The Commercial Products of the Vegetable Kingdom eBook

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INTRODUCTORY.

The want of a practical work treating of the cultivation and manufacture of the chief Agricultural Productions of the Tropics and Foreign Countries, has long been felt, for not even separate essays are to be met with on very many of the important subjects treated of in this volume.

The requirements of several friends proceeding to settle in the Colonies, and wishing to devote themselves to Cotton culture, Coffee planting, the raising of Tobacco, Indigo, and other agricultural staples, first called my attention to the consideration of this fertile and extensive field of investigation.

Professor Solly, in one of the series of Lectures on the results of the Great Exhibition, delivered before the Society of Arts, early last year, made some practical remarks bearing on the subject:—

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“If (he said) you were to place before any manufacturer specimens of all the substances which could be employed in his particular manufacture, and if you could tell him from whence each could be procured, its cost, the quantities in which he might obtain it, and its physical and chemical properties, he would soon be able to select for himself the one best suited for his purposes. This, however, has never happened in relation to any one art; in every case manufacturers have had to make the best of the materials which chance or accident has brought before them. It is strange and startling, but nevertheless perfectly true, that even at the present time there are many excellent and abundant productions of nature with which not only our manufacturers, but, in some instances, even our men of science, are wholly unacquainted. *There is not a single book published which gives even tolerably complete information on any one of the different classes of vegetable raw produce at present under our consideration*. The truth of these remarks will be felt strongly by any one who takes the trouble to examine any of these great divisions of raw materials. He will obtain tolerably complete information respecting most of those substances which are known in trade and commerce; but of the greater number of those not known to the broker, he will learn little or nothing. Men of science, for the most part, look down upon such knowledge. The practical uses of any substances, the wants and difficulties of the manufacturer, are regarded as mere trade questions, vulgar and low—simple questions of money. On the other hand, mere men of business do not feel the want of such knowledge, because, in the first place, they are ignorant of its existence, and secondly, because they do not see how it could aid them or their business; and if it should happen that an enterprising manufacturer desires to learn something of the cultivation and production of the raw material with which he works, he generally finds it quite impossible to obtain any really sound and useful information. In such cases, if he is a man of energy and of capital, he often is at the cost of sending out a perfectly qualified person to some distant part of the globe, to learn for him those practical details which he desires to know. This is no uncommon thing; and many cases might be stated, showing the great advantages which have arisen to those who have thus gained a march upon their neighbours.”

The Society of Arts, appreciating the importance of from time to time encouraging the introduction of new and improved products from our Indian and Colonial Possessions, has offered many gold medals as premiums for a great variety of staples from abroad.

The Great Exhibition of the Industry of all Nations brought together an immense variety of productions from tropical regions, of which the English public were comparatively ignorant. Attracting public attention, as these necessarily did, information on the best modes of cultivating and manufacturing them will be peculiarly valuable to the colonists, and is as eagerly sought after by many brokers, merchants and manufacturers at home.

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In consequence of the recent liberal policy of Great Britain, the competition of foreign countries, the want of cheap and abundant labor, and other causes, those chief staples, Sugar and Coffee, which for a series of years formed the principal and almost exclusive articles of production in our colonies, and which had met with a ready and remunerative sale in the British markets, have either fallen off to an alarming extent, or become so reduced in price as scarcely to repay the cost of cultivation. The partial abandonment of the cultivation of these staples in our colonies has had the effect of crippling the agricultural and commercial enterprise of several of our most valuable foreign possessions, and throwing out of employment a number of persons: it behoves us, therefore, to direct attention to some of the many minor articles in demand;—to those indigenous or exotic products of the soil in tropical regions, which, being inexpensive in cultivation and manufacture, might be undertaken with a moderate outlay of labor and capital, and the certainty of a ready and remunerative sale in the European markets; and could moreover be attended to without neglecting or at all interfering with the cultivation of the leading staples.

It is evident that the export wealth of tropical regions must be chiefly agricultural, the soil and climate being peculiarly fitted for the culture of fruits, trees and plants yielding oils, gums, starch, spices, and other valuable products, which no art can raise cheaply in more temperate latitudes. The large and continued emigration of farmers and other enterprising persons from Britain and the Continent to Natal, the Cape Colony, Northern Australia, Ceylon, the East India Company’s Possessions and the Straits Settlements, Brazil, New Granada, and the Central American Republics, Texas, the Southern States of North America, and other tropical and sub-tropical countries, renders information as to the agriculture and productions of those regions highly desirable. Even to the settlers in our West Indian possessions, most of whom have too long pursued the old beaten track of culture and manufacture, comparatively regardless of modern improvements and the results of chemical, scientific, and practical investigation, recent information on all these subjects, and a comparison of the practices of different countries, cannot fail to be useful.

There is much valuable information to be met with in detached papers and essays in the scientific periodicals of the day, and in colonial and other publications; such as the Transactions and Journals of the different agricultural and horticultural societies of the East and West Indies, the United States, Australia, &c., but none readily accessible for easy reference, and which the new settler, proceeding out to try his fortune in those fair and productive regions of the globe, can turn to as a hand book. I have had much experience in Tropical Agriculture, and for many years my attention has been mainly directed to this important subject, for which purpose I have kept up a large and extended correspondence with numerous agricultural, scientific and other societies abroad; with experienced practical men, and have also received the leading journals of all the tropical Colonies.

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No one person could be expected to be thoroughly familiar with all the different modes of culture and preparation of every one of the numerous products to be described in this volume; but where my own agricultural experience (of several years in the West Indies and South America) was at fault, I have availed myself of the practical knowledge of those of my colonial friends and correspondents best informed on the subject, and am particularly fortunate in having many valuable essays on Tropical Agriculture scattered through the different volumes of my “Colonial Magazine.”

The discussion of the best modes of culture, properties, manufacture, consumption, uses, and value of the commercial products of the vegetable kingdom cannot be without its value, and the attention of merchants and planters may be usefully directed to various articles, which will be profitable both in an agricultural and commercial point of view; many of which are already sources of wealth to other countries.

The introduction of new objects of industry into the colonial dependencies of the British Empire, is no longer considered a mere subject of speculation, but one well worthy the attention of the eye of science; and the fostering hand of care is beginning to be held out to productions of nature and art, which, if not all equally necessary to the welfare of man, yet certainly merit the attention of the cultivator and capitalist, and have great claims on the scientific observer, and on those interested in raising the manufactures of our country to a higher standard.

Few who have not investigated this subject are aware of the immense number of countries lying in the equatorial and tropical ranges of the torrid zone, many of which, from the value and importance of their indigenous productions, have already attracted considerable notice, and to which still more attention will be directed by European nations as the value of their various products becomes more extensively known.

The homeward commerce which we carry on with our numerous Colonies, with our Indian Possessions, and with foreign countries, is principally in articles furnished by the vegetable kingdom, such as the cereal grains, wheat, rice, maize, &c.; vegetables used in preparing dietetic drinks and distilled liquors, as tea, coffee, cacao, and the sugar cane, grapes, &c.; spices and condiments; drugs; dyes and tanning substances, obtained from the bark, leaves, fruit, and roots of various herbs and trees; the expressed or distilled oils of different plants; fruits in the green, dried, or preserved state; starches obtained from the roots or trunks of many farinaceous plants; fibrous substances used for cordage, matting, and clothing, as cotton, Indian hemp, flax, coco-nut coir, plantain and pine-apple fibre; timber and fancy woods. These substances, in the aggregate, form at least nine-tenths in value of the whole imports of this country. There are also several products of the animal kingdom dependent

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on vegetable culture, which might be brought into this category, such as silk and cochineal. Very few of these products of the vegetable kingdom come to us in any other than an unmanufactured state; they are shipped to this country as the chief emporium and factory of the world, either for re-export or to be prepared for consumption by the millions to whom they furnish employment, sustenance, and articles of clothing.

It is a wise ordination of Providence, that the different nations of the earth are as it were mutually dependent on each other for many of the necessaries and luxuries of life, and the means of progress and civilization. Commerce is thus extended, the various arts and manufactures improved by comparison and competition; and the acres yet untilled in distant lands hold out strong inducements for immigration, their climate and products affording health, freedom, and independence to the over-tasked and heavily taxed artisan and agriculturist of Europe. Although the systems of tropical agriculture, generally pursued, are peculiar and effective, yet there is no doubt that much improvement remains to be carried out in the practices adopted, in the implements employed, and the machinery used for preparing the crops for shipment. In the British Isles our insulated position, limited extent of country, unsettled climate, and numerous population, aggregated in dense masses, have compelled us to investigate and avail ourselves of every improvement in agriculture, arts and manufactures, which experience, ingenuity, and a comparison with the customs of other countries, have placed at our disposal.

If we except sandy deserts, and some of the interior portions of the polar regions, it will be found that there is scarcely any country but what is capable of improvement. Indeed, so extensive are the resources of agriculture, that further improvements may be most easily effected.

Let us then examine and ascertain what new objects may be improved upon, and if by our speculations only one single article, either for food or use, is added to those already in use, or those that are already cultivated be improved upon, it is equivalent to an increase of our wealth.

An eminent writer has truly remarked that “Agriculture is the parent of Manufactures, seeing that the productions of nature are the materials of art.”

In the economy of Providence every fragment of creation seems to unfold, as man progresses in the arts of life, unbounded capabilities of adaptation to his every want. We have, indeed, daily illustration of the truth of that trite and homely adage, that “nothing is made in vain.”

That quaint old English poet, Herbert, who flourished in the fifteenth century, in a short poem on “Providence,” has graphically described, in his unique vein, the sentiment which forces itself upon us in view of the numerous discoveries of the age in which we live:—

“All countries have enough to serve their need.

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* * * * *

——The Indian nut alone
Is clothing, meat and trencher, drink and can,
Boat, cable, sail, and needle, all in one."

"The addition (it has been well observed) of even a single flower, or an ornamental shrub, to those which we already possess, is not to be regarded as a matter below the care of industry and science. The more we extend our researches into the productions of nature, the more are our minds elevated by contemplating the variety as well as the exceeding beauty and excellence of the works of the Creator."

The mode of arrangement of the various subjects treated of involved some consideration; two or three plans were open for adoption. 1st. To describe the several products in the order of their agricultural importance or commercial value. 2nd. An alphabetical reference, in the style of a Dictionary or Encyclopaedia; and 3rd. Classifying them under subdivisions, according to their particular or chief uses. The last seemed to me the most desirable and efficient mode, although open to some objections, from the variety of uses to which different parts of many plants were applied. Some, as cotton, indigo, sugar, coffee, tea, &c., would readily fall into their proper division, but others, as the coco-nut, plantain, &c., from the variety of their products, would come under several heads. I have, however, endeavoured to meet this difficulty by placing each plant or tree under the section to which its most valuable production seemed naturally to refer it.

There are very many plants and substances which have been passed over altogether, it being impossible, within the limits of a moderate sized volume, to bring under notice even a tithe of the valuable grasses, timber trees, cabinet woods, fruits, &c.; and I have confined myself in a great measure to those which either already are, or might easily be rendered, articles of commerce, of some importance. I have shown their present value by quoting the current prices, and brought down, as far as possible, the statistics of each article to the close of last year, thus rendering the work valuable by commercial references which could not be found collectively elsewhere.

There are some articles of commerce which could not properly be treated of in a work intended as a guide on agriculture and husbandry, for the tropical planter and cultivator, who purposes devoting his attention to the raising of useful crops and plants on his estate. The forests and jungles of the tropics abound in products of an useful character, the luxurious and spontaneous growth of nature, such as ebony, sandal wood, &c.; but these must be sought for by a different class of settlers; and the mahogany cutter of Honduras, the teak-feller of India, the gatherer of elastic gums, can scarcely be ranked with the cultivators of the soil.

I had originally intended to confine my remarks to staples of tropical growth, but I have been induced to depart from my prescribed plan by the importance of some of the commercial products of temperate regions, such as maple and beet-root sugar, wheat, the grain crops, and potatoes.

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The system of agriculture, and modes of tillage, &c., of separate countries in the Eastern and Western hemisphere, notwithstanding their similarity of climate, are as opposite as if each country belonged to a different zone; and yet much may be learned by one of the other.

The only essentially useful division of seasons in countries within the tropics is into a wet and dry season, the former being the period of germination, the latter that of fructification.

The implements of agriculture required are for the most part few and simple, for no high tillage is necessary, the luxuriance of vegetation being so great that most of the products of the soil will grow indiscriminately throughout the year, and the only care of the husbandman, after the first preparation of the soil, is to keep down the vast growth of weeds, which might stifle the crops.

In tropical regions there is less demand for manures than in temperate climates, but still there are many additions to the soil that may profitably be made.

Firstly, that most important principle, which has only recently been practically inculcated, is in too many quarters entirely neglected, namely, returning to the soil the component parts taken off by various crops, and which is so generally practised in all good agricultural districts, by a careful rotation of crops. Liebig has well pointed out this: “It must be admitted (he says), as a principle of agriculture, that those substances which have been removed from a soil must be completely restored to it; and whether this restoration be effected by means of excrements, ashes, or bones, is in a great measure a matter of indifference.” Again he remarks, “We could keep our fields in a constant state of fertility by replacing every year as much as we remove from them in the form of produce; but an increase of fertility, and consequent increase of crop, can only be obtained when we add more to them than we take away.” Of all natural manures, therefore, the best for each description of plant is its own refuse, or ashes; enough of these can seldom, however, be obtained. But, as far as they can be restored, this principle is beginning to be acted upon by the sugar planters of the West Indies, who employ the waste leaves and ashes of the expressed stalk of the cane, after it has been used as fuel, to manure their cane-fields. The vine growers of Germany and the Cape also bury the cuttings of their vines around the roots of the plants. The cinnamon grower of the East returns the waste bark and cuttings of the shoots to the soil. And in the coco-nut groves of Ceylon, the roots of the trees are best manured with the husks of the nuts and decomposed poonac, or the refuse cake, after the oil has been expressed from the pulp. Analysis of soils is, perhaps, not so essential in countries where virgin land is usually in abundance, and the luxuriance of vegetation furnishes itself, by decomposition, abundant materials for replenishing the fertility of the soil. But there are some substances, such as muriate of soda, gypsum, phosphate, and other compounds of lime, which may be advantageously applied. Guano and expensive artificial manures, are seldom required, and, indeed, will not repay the planters for importing.

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An experienced cultivator can generally judge by a superficial examination, aided by the situation, locality, and appearance of the soil, whether a certain portion of land is fitted for the profitable growth of any particular plant. Depth of soil, and facilities for deepening it, with the nature of the subsoil, so as to know whether it retains or parts with water, are also important considerations, because tap-rooted plants require free scope for penetrating deep into the ground.

A due supply of water is of vital importance to most crops—and therefore the extent and periods of the fall of rain are essential to be known, as it is not always possible to resort to irrigation. The quantity of labor required for previous tillage, cultivation, and harvesting of different crops, and the available supply, are primary essentials to be considered before entering upon the culture of any staple product, however remunerative it may appear in prospective. Facility and cost of transport to the nearest market or shipping port are the next desiderata to be ascertained, as well as a careful estimate of the cost of plant or machinery necessary.

It may be desirable at the outset to make a brief enumeration of the countries lying within the different zones, and the agricultural products of which come, therefore, more especially under the notice of the tropical planter.

Meyen, in his division of the horizontal range of vegetation into zones, extends—

1. The equatorial zone to fifteen degrees on both sides of the equator. In this division we shall find the Cape Verd Islands, Sierra Leone, Ascension, and St. Helena, the Republic of Liberia, the European and native settlements in the Gulf of Guinea, and on the western Coast of Africa, Abyssinnia, Zanzibar on the East Coast, Mocha and Aden in the Red Sea, the northern portion of Madagascar, the Seychelles, the Madras Presidency, Northern India, Ceylon and the Nicobar Islands, Sumatra, Siam, Malacca, Singapore and the Straits Settlements, Cochin China, the Phillippine Islands, Borneo, Celebes and the Moluccas, Java and Madura, Banca, the Johore Archipelago, Timor and the eastern group of Islands, with New Guinea, a large portion of Northern Australia, the Marquesas, Society's and other oceanic islands. In South America the Republics of Peru, Bolivia, Ecuador, New Granada, and Venezuela, British, French and Dutch Guiana, and a large portion of the empire of Brazil; Trinidad, Barbados, and most of the islands in the Carribean Sea.

This zone has a mean temperature of 781/2 to 821/2 Fahrenheit.

2. The tropical zone reaches from the 15th deg. on each side of the equator to the tropics in 23 lat. The mean temperature is 731/2 to 783/4 deg. Summer temperature 801/2 to 86 deg.; winter temperature in the eastern coast districts, 59 deg.

In this region is comprised the following countries:—Sandwich Isles, Canton, in province of China, Burmah, Calcutta, and a portion of the Bengal Presidency, the Bombay

Presidency, Madagascar, Mauritius and Bourbon; the southern portion of Brazil, Cuba, St. Domingo, Mexico, and Central America.

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3. The sub-tropical zone extends from the tropics 23 to 34 deg. of latitude. There are a number of tropical fruits in this region. The winters are mild and vegetation is green throughout the year. In the northern division of the zone palms and bananas grow on the plains. In this region is comprised all the extreme northern portions of Africa, coasting the Mediterranean, comprising Algiers and the Barbary States, Egypt, part of Persia, Cabool and the Punjab; the greater portion of China, Lower California, Texas, the South-Western States of America, the Bermudas, the Cape Colony and Natal, New South Wales, Southern and Western Australia—the Government settlements in the Northern Island of New Zealand, the largest portion of Chile, Paraguay, Uruguay and the Argentine Republics, the Provinces of Brazil from St. Paul to Rio Grande, Madeira and the Canary Isles.

To define accurately the conditions of temperature which a plant requires to maintain it in a flourishing condition we must ascertain within what limits its period of vegetation, may vary, and what quantity of heat it requires. This most remarkable circumstance was first observed by Boussingault, but unfortunately we do not as yet possess sufficiently accurate accounts of the conditions of culture in the various regions of the earth, to enable us to follow out this ingenious view in all its details. His theory is, that the time required by a plant to arrive at maturity is as the inverse ratio of the temperature; therefore, knowing the mean temperature of any place, and the number of days which a plant takes to ripen, the time required at any other point more or less elevated, can easily be ascertained. Peter Purry, a native of Switzerland, who settled in Charleston in the eighteenth century, in a memorial to the Duke of Newcastle, then Secretary of State, sets out with this postulate, that “there is a certain latitude on our globe, so happily tempered between the extremes of heat and cold, as to be more particularly adapted than any other for certain rich productions of the earth; among which are silk, cotton, indigo,” &c.—and he fixes on the latitude of 33 deg., whether north or south, as the one of that peculiar character.

The following Table, showing the climate, duration and production of certain plants cultivated in tropical America, is from the proceedings of the Agricultural Society of Grenada. The second, column gives the altitude in English yards above the level of the sea. The third, the mean temperature by Fahrenheit’s thermometer. The fourth, the average time required to commence bearing. The fifth, the number of plants in a Spanish “fanegada” of 170 varras, about 153 square yards. The sixth, the average duration of each plant. The seventh, the average produce of each plant in the year:—

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-----------------+-----------+---------+--------+------
+------+--------
|    2    |    3    |    4   |  5   |  6   |    7
|Level of   |Mn.  Temp.|  Time  |No. of|      |Average
|the Sea, to|Deg.  Min.|Required|plants|Years |produce
-----------------+-----------+---------+--------+------+---
--+--------
Cacao           |          }|81.17    |61/2      | 1,156|  40  |11/4 lb
(Theobroma      |587 yds.  }|46.00    |yrs      |      |      |per tree
Cacao)          |          }|         |         |      |      |
+-----------+---------+--------+------+------+-------
Plantain       {|630 yds. to|81.17    | 9 mths.| 3,613|  30  |50
(Musa          {|1077       |46.00    |91/2   " |      |      |plantains
Paradisiaca)   {|           |40.61    |11   "  |      |      |
+-----------+---------+--------+------+------+--------
Indian Corn    {|1077       |81.17    | 90 days|28,900|Annual|238 for
(Zea Mays)     {|1260 to    |40.61    |110  "  |      |      |every
{|  1890     |36to37.80|120  "  |      |      |seed
{|2880       |25.20to27|180  "  |      |      |
+-----------+---------+--------+------+------+-------
Manioc or      {|1077       |81.17    |10 mths |28,900|Bicen-|One
Cassava        {|1195       |40.61    |12   "  |      |nial  |cassava
{|          |43.00    |120 days|      |      |weighing
{|          |         |        |      |      |3/4 lb.
{|          |         |        |      |      |1/4 oz.
{|          |         |        |      |      |starch
+-----------+---------+--------+------+------+-------
Coco nut        | 630       |81.17    |5 yrs.  |   452|  60  |4 bottles
(Cocos          |           |46.00    |6  "    |      |      |oil per
nucifera)       |           |         |        |      |      |tree
+-----------+---------+--------+------+------+-------
Tobacco        {| 630       |81.17    |150 days|28,900|Annual|1/2 lb.
(Nicotiana     {|1077       |46.00    |170  "  |      |      |_dried_
tabacum)       {|1980       |40.61    |180  "  |      |      |to each
{|          |33.30    |225  " |      |      |5 plants
+-----------+---------+--------+------+------+-------
Cotton         {| 630       |81.17    |61/2  mth |28,900|31/2    |1/2 lb.
(Gossypium)    {|1077       |46.00    |7    "  |      |      |nett
{|1415       |40.61    |71/2"     |      |      |per
{|          |34.61    |9    "  |      |      |plant
+-----------+---------+--------+------+------+-------
Coffee         {| 230       |47       |24 mths | 5,300|  45  |11/2
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(*Coffea*   {| 630 |46 |25 " | | |lb.
Arabica)   {|1077to 2250|37.80 to |28 " | | |per
{|2453 |39.60 |36 " | | |tree
{| |33.30 | | | |
+-----------+---------+--------+------+------+--------
Sugar cane   {| 630 |84.17 |11 mths.|28,900| 5 |10 percnt
(*Saccharum*   {|1080 |46.00 |12 " | | |sugar
officinarum) {| |41.40 |14 " | | |upon the

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						weight
						of the
						raw cane
Indigo	90	48.60	21/2 "	57,800	11/2	70 plants
(*Indigofera*	630	46.00	3 "			produce
tinctoria)	1077	40.61	31/2 "			1 lb.
						coloring
						matter
Potato	1080	38.70	140 days	116,600		41/2
(*Solanum*	1980	33.30	165 "		Annual	lb each
tuberosum)	2700	27.00	210 "			plant
Wheat	567	42.30	80 "	57,800	Annual	37 for
(*Triticum*	1170	38.70	100 "			every
aestivum)	2520	32.99	120 "			seed
						planted

The plantain bears at 1,529 yards, in a temperature of 61 deg. Fahrenheit, and requires fifteen months, but its cultivation is of little benefit in so high a latitude. It is the same with the cassava root. The cane at 1,160 altitude, in a temperature of 66 deg., gives no sugar; and indigo at 1,620 affords no coloring matter.

SECTION I.

DRIED LEAVES, SEEDS, AND OTHER SUBSTANCES USED IN THE PREPARATION OF POPULAR DIETETIC BEVERAGES.

No substances are so essentially necessary to mankind, or form such important articles of commerce, as those which we come first to consider, the dietetic products—cacao, coffee, tea, and sugar. The consumption of these in all civilized countries is immense, notwithstanding that in many they have been fettered with heavy fiscal duties. The investigation of the culture of the plants from which they are obtained, and the manufacture of the products, is a very curious object of research.

CACAO OR COCOA.

The chocolate nuts or seeds, termed cacao, are the fruit of species of *Theobroma*, an evergreen tree, native of the Western Continent. That commonly grown is *T. cacao*; but Lindley enumerates two other species, *T. bicolor*, a native of New Granada; and *T. Guianensis*, with yellow flowers, a native of Guiana. The seeds being nourishing and agreeable to most people, are kept in the majority of houses in America, as a part of the provisions of the family. By pressure they yield fatty oil, called butter of cacao. They also contain a crystalline principle analogous to caffeine, called theobromine. The common cacao of the shops consists generally of

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the roasted beans, and sometimes of the roasted integuments of the beans, ground to powder. The consumption of cacao in the United Kingdom is about three millions of pounds annually, yielding a revenue of L15,500. Few tropical products are more valuable or more useful as food to man than cacao. It is without any exception the cheapest food that we can conceive, and were it more generally employed, so that the berries should not be more than two, three, or, at most, six months old, from the time of gathering (for, if kept longer, they lose their nutritive properties), even a smaller quantity than that usually taken in a cup would suffice: in fact, cacao cannot be *too* new. The cacao beans lie in a fruit somewhat like a cucumber, about five inches long and three-and-a-half inches thick, which contains from twenty to thirty beans, arranged in five regular rows with partitions between, and which are surrounded with a rose-colored spongy substance, like that of water melons. There are fruits, however, so large as to contain from forty to fifty beans. Those grown in the West India islands, as well as Berbice and Demerara, are much smaller, and have only from six to fifteen; their development being less perfect than other parts of South America. After the maturation of the fruit, when their green colour has changed to a dark yellow, they are plucked, opened, their beans cleared of the marrowy substance, and spread out to dry in the air. In the West Indies they are immediately packed up for the market when they are dried; but in Caraccas they are subjected to a species of slight fermentation, by putting them into tubs or chests, covering them with boards or stones, and turning them over every morning to equalize the operation. They emit a good deal of moisture, and lose the natural bitterness and acrimony of their taste by this process, as well as some of their weight. Instead of wooden tubs, pits or trenches dug in the ground are sometimes had recourse to for curing the beans; an operation called earthing. They are, lastly, exposed to the sun and dried. According to Lampadius, the kernels of the West India cacao beans contain in 100 parts, besides water, 53.1 of fat or oil, 16.7 of an albuminous brown matter, which contains all the aroma of the bean; 10.91 of starch, 73/4 of gum or mucilage, 0.9 of lignine, and 2.01 of a reddish dye-stuff, somewhat akin to the pigment of cochineal. The husks form 12 per cent, of the weight of the beans. The fatty matter is of the consistence of tallow, white, of a mild agreeable taste, and not apt to turn rancid by keeping. It melts only at 112 degrees Fahr., and should, therefore, make tolerable candles. It is obtained by exposing the beans to strong pressure in canvas bags, after they have been steamed or soaked in boiling water for some time. From five to six ounces of butter may be thus obtained from a pound of cacao. It has a reddish tinge when first expressed, but it becomes white by boiling with water.

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The beans, being freed from all spoiled and mouldy portions, are to be gently roasted over a fire in an iron cylinder, with holes in its ends for allowing the vapors to escape, the apparatus being similar to a coffee-roaster. When the aroma begins to be well developed, the roasting is known to be finished, and the beans must be turned out, cooled, and freed by fanning and sifting from their husks. The kernels are then to be converted into a paste, either by trituration in a mortar heated to 130 degrees Fahr., or by a powerful mill.[1] The cacao tree resembles our dwarf apple tree both in body and branches, but the leaf, which is of a dark green, is considerably broader and larger. The nuts are of the color and about the size of an almond, and hang eighteen to thirty together by a slender stringy film, enclosed in a pod. A ripe pod is of a beautiful yellow, intermixed with crimson streaks; when dried, it shrivels up and changes to a deep brown; the juice squeezed from the mucilaginous pulp contained in the husks of these nuts appears like cream, and has a very grateful taste of a cordial quality. The nuts have a light pleasant smell, and an unctuous, bitterish, roughish (not ungrateful) taste. Those of Nicaragua and Caracas are the most agreeable and are the largest; those of the French Antilles, and our own West India islands, are the most unctuous.

The Mexicans, in preparing the chocolate paste, add some long pepper, a little annatto, and lastly vanilla; some add cinnamon, cloves and anise, and those who love perfumes, musk and ambergris.

The finest American cacao is said to be that of Soconusco, but the principal imports are from Caracas and Guayaquil, which is of a very good quality. The province of Barcelona, adjoining Caracas exports annually from 200,000 to 300,000 cwt.

The very large shipments from Guayaquil are shown by the following return. Of this quantity Spain takes the largest portion, Mexico the next, and England receives but a very small quantity.

Cacao exported from Guayaquil:—

lbs.	
1833	6,605,786
1834	10,999,853
1835	13,800,851
1836	10,918,565
1837	8,520,121
1838	7,199,057
1839	12,169,787
1840	14,266,942

The exports of cacao from the port of La Guayra, has been as follows in the years ending December 31.

Fanegas.	
1850	40,181
1851	47,951
1852	54,083

Five fanegas are equal to one English quarter. The price of cacao was, at the close of 1852, sixteen dollars the fanega.

The province of Caracas, according to Humboldt, at the end of the last century, produced annually 150,000 fanegas of cacao, of which two-thirds were exported to Spain, and the remainder locally consumed. The shipments from the port of La Guayra alone averaged 80,000 to 100,000, or nearly double the present shipments. In the early part of the present century the captain-generalship of Caracas produced nearly 200,000 fanegas, of which about 145,000 were sent direct to Europe. The province of Caracas then produced 150,000 fanegas; Maracaibo, 20,000; Cumana, 18,000, and New Barcelona, 5,000.

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The vallies of Aragua, in the province of Caracas, those of Cariaco, Campano, of Rio Caribe and the banks of the river Caroni, in Spanish Guiana, produce excellent cacao in abundance.

The tree there bears fruit in four years after it has been planted, the following year still more, and increases in fecundity until the ninth or tenth year, when it is in full bearing.

The banks of the Magdalena, in the vicinity of Santa Martha and Carthagena, are famed for the excellent cacao they produce. “This tree,” says Bonnycastle (Spanish America, vol. 1, p. 257), “is indigenous, seldom exceeds the diameter of seven inches, and is extremely beautiful when laden with its fruit, which are disposed on short stalks over the stem and round the great branches, resembling citrons, from their yellow color, and warty appearance. The leaves are attenuate, stalked, drooping, about a foot long and three inches broad, elliptic, oblong, pointed, slightly wavy, entire, and very smooth on both sides; with one mid-rib and many transverse ones, connected by innumerable veins. The petals of the flower are yellow, the calyx of a light rose-color, and the flowers themselves are small and placed on tufts on the sides of the branches, with single foot-stalks, about an inch long. Its fruit is red, or a mixture of red and yellow, and about three inches in diameter, with a fleshy rind half-an-inch thick; the pulp is whitish and of the consistence of butter, containing the seed; these seeds are generally twenty-five in number in each fruit, and when first gathered are of a flesh color, and form a nice preserve if taken just before they are ripe. Each tree yields about two or three pounds of fruit annually, and comes to maturity the third year after planting from the seed; it also bears leaves, flowers, or fruit all the year round, the usual seasons for gathering being June and December. The excellence of the Magdalena chocolate may be attributed to the moist nature of the soil, as the plant never thrives where the ground is hard and dry, or cannot be irrigated.”

Mode of cultivation in the Colombian Republics—Plantations of cacao were speedily multiplied in Colombia, and the soil so admirably seconded the labors of the planter, that in the produce abundance was united to excellence. The cacao of this quarter ranks next to that of Soconusco. It is well known that the best commercial recommendation of cacao is that of coming from Caracas. But even in these provinces the quality varies. The cacao of Orituco is superior to that of other places, and a quantity of equal bulk weighs twenty per cent. more. The cacao of the coast comes next, and obtains a preference over that of the interior.

The plantations of cacao are all to the north of the chain of mountains which coast the sea, and in the interior country. The former extend from Cumana to the mouth of the Tocaygo; the latter are situate in the vallies of Tuy, Orituco, Ocumare, Cura, Marrin, Tare, Santa Theresa, Santa Lucia, Zuapira, Santa Philippo, Barquisimeto, Valencia, Gruige and Cariaco.

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All kinds of soil are not equally adapted to the culture of cacao, still less are all exposures; but an analysis of the soil destined to this culture never furnishes indications on which reliance can be placed. No regard should be had to color or composition; it is only requisite that it should be friable to a certain depth, which is ascertained by the size of the trees with which it is covered; this sign determines the land proper for cacao.

A suitable situation is not so easily found. It should be exposed as little as possible to the north, and be on the borders of a river, which may communicate moisture to the soil in dry seasons, and receive its drainings in times of rain. A preference is particularly to be given to land which can receive from the river the benefits of irrigation without being exposed to injury from its overflow.

After having chosen the land, it should be cleared of all trees, shrubs, and other plants. This operation is performed in various ways. It is customary in Colombia to commence felling the trees immediately after the rains, that is, about the month of November; the wood, after being cut, is left to dry, then collected in heaps and burnt.

As soon as the new plantation is cleared, it is crossed with small ditches, in directions according to the declivity of the soil. These serve to drain the stagnant waters, to carry off the rains, and to irrigate or water the soil whenever necessary. The *alignement* is then laid out, in which the cacao trees are to be arranged. They are planted in triangles or squares. In either case, there is always in the centre an alley, bordered by cacao trees, and running from east to west. When they are planted in squares, this alley is crossed by another running from north to south. The cacao plants should be placed at fifteen or sixteen feet (French measure) from each other, in good soil; and about thirteen or fourteen feet in soil of inferior quality.

This is almost the only tree in nature to which the enlivening beams of the sun are obnoxious. It requires to be sheltered from their ardour; and the mode of combining this protection with the principles of fertility, forms a very essential part of the skill which its cultivation demands. The cacao tree is mingled with other trees, which guard it from the rays of the sun, without depriving it of the benefit of their heat. The *Erythrina* and the banana are employed for this purpose. The latter, by the rapidity of its growth, and the magnitude of its leaves, protect it for the first year. The erythrina endures at least as long as the cacao; it is not every soil, however, that agrees with it. It perishes after a while in sandy and clayey ground, but it flourishes in such as combine those two ingredients.

In the Antilles this protection cannot be given to cacao, as it would expose the plantation to destruction by every hurricane. Besides, the cacao succeeds but indifferently there, and is much less oily than in other parts.

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The quality of the soil, and the species of the erythrina, should determine the distance at which they ought to be placed. That kind which the Spaniards call *bucare anaveo*, is planted in a fertile soil, at the distance of two alleys, that is to say, at each second range of cacao trees. That which they call *bucare peonio*, is placed at three alleys in good soils (about forty-eight French feet).

The former species of erythrina is that which elevates itself the highest. The second species has many thorns, the upper surface of the leaf is darker and the lower whiter. Both kinds should be cut in the wane of the moon, and remain in the shade until its increase, at which time they should be planted. It is much preferable, however, to take them from a nursery.

In one range of cacao trees a banana is placed between two cacaos, and an erythrina between the two following. In the other range a banana is placed between each cacao tree, and no erythrinas, so that the latter are at the distance of two alleys. The banana and the erythrina are first planted, and when a shelter from the sun is thus provided, the hole for the cacao is made, around which are planted four stalks of the yucca plant, at the distance of two feet from each other. At the end of two months the cacao is planted. The smaller the plant is, the better. There are, nevertheless, soils subject to worms where the small plants do not thrive; but, excepting in this particular, the small plants are preferable, because the large require more labor for their transportation and planting; many of them die, and those which survive bud and shoot forth, but are never of any value.

The cacao plant should not exceed thirty-six inches in size when transplanted; if larger, it succeeds with difficulty, as will be shown.

The nurseries of cacao demand an excellent soil, well prepared, where the water does not remain. They should be well sheltered from the sun. Small knolls of earth are formed, in each of which are put two seeds of cacao, in such a manner that they are parallel with the level of the ground. During the first twenty days the seeds are covered with two layers of banana or other leaves. If necessary, the ground is watered; but the water is not suffered to remain. The most suitable time for sowing is in November.

Where there is not a facility for watering, the planting of the cacao should take place in the rainy season; but when the former is practicable, it is best to plant in dry weather and assist nature by irrigation, since it is then in the power of the cultivator to give the exact quantity of moisture necessary. But, in all cases, care should be taken that the plants are not wet in the interval between their being taken out of the ground and replanted.

When the bananas grow old, they should be carefully felled, lest the cacaos should be injured by their accidental fall. They are totally removed as soon as the erythrina yields sufficient shade; this operation gives more air to the trees of the plantation, and encourages their growth.

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Until the cacao attains four feet in height, it is trimmed to the stem. If it shoots forth several branches, they are reduced to three, at equal distances; and, in proportion as the plant increases, the leaves which appear on the three branches are stripped off. If they bend much, and incline towards the earth, they are tied in bunches, so that the tree may not remain crooked. The branches, which are trimmed, are cut at the distance of two fingers from the tree. The suckers which spring from the tree are also removed, as they only live at its expense.

Enemies of the tree.—The cacao trees should, as already stated, have sufficient shade to prevent their being burned by the sun. If they are much exposed to its rays, their branches are scattered, crack, and the tree dies. They are also infested with worms, which gnaw the bark all around, then attack the interior and destroy them. The only remedy which has hitherto been found, is to employ people to kill these worms, which are deposited by a small, scaly winged insect, which gnaws the tree; as soon as it hears the approach of its destroyers, it lets itself fall, and trusts to its wings for safety.

The color of this insect is a mixture of ash color and white. If pressed, it emits a sound something similar to the noise of water thrown on a very hot substance. It has two small horns on its head, the points of which are directed upwards. It is so lively that, even when the head is separated from the body, it is a long time in dying. To deposit its progeny it makes small holes in the tree.

At the commencement of the winter, or rainy season, another worm makes its appearance, which devours the leaves of the young cacao plant. This species of worm is called *goaseme*, and they are in some years so abundant, that all the people of the plantation are solely employed in destroying them. This worm is four inches in length, and of the thickness of a finger. It is sometimes called *angaripola*, or Indian, on account of the vivacity of its colors. It is believed that these worms are mediately produced by other large worms in the earth, from which are engendered butterflies, who lay their eggs on the leaves of the cacao. These eggs are full of small worms, which feed on the leaves of the cacao, and appear in clusters of the size of a shilling. They are sought and destroyed with great attention, as they occasion considerable damage. Those which escape lodge themselves in the earth, and in the succeeding year are changed into butterflies. At the time when the worm makes its appearance, it is necessary to make fires, which should not be so large as to injure the cacao, yet sufficient to attract and burn the butterfly.

The plantations of cacao in the valley of Tuy, the quarters of Marrin, Cuba, Sabana, Ocumare, San Francis, &c., are subject to another species of worm called *rasquilla*. It multiplies in the dry seasons.

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There are small insects, called by the Spaniards *accerredores*, of the same figure with those which eat the bark of the cacao, but larger and of a blackish colour. They feed on the branches of the tree; are always found upon those branches which they have cut; and the evil can only be obviated by killing them.

The worms called *vachacos* occasion also much damage. They eat the leaf and the flower. To destroy them it is necessary to seek them in their nests in the earth. Water is thrown on the spot, and stirred, as in making mortar. By this means their young are crushed, and the evil is diminished, if it be not entirely removed.

A parasitical plant often attaches itself to a branch of the cacao tree which it covers over and causes to wither, by nourishing itself with the substance of the plant. The only remedy is to remove it.

When the cacao trees are in a bearing state, they are subject to a disease called *tache*. This is a black taint, or stain, which attacks the trees, encircling them below, and kills them. The mode of preservation is to make, in the beginning, a slight notch that shall pierce the bark. But if the taint is extensive, it is necessary to cut all the affected part. It then exudes a liquid and is healed. The bark remains of a violet color in the part that has been tainted.

The other enemies of the cacao are the agouti, stag, squirrel, monkey, &c. The agouti produces most havoc. It often destroys in one night all the hopes of the proprietor.

Birds are not less injurious to the cacao. The whole class of parrots, in particular the great Ara, which destroys for the pleasure of destroying, and, the parroquets, which come in numerous flocks, conspire also to ruin the plantations of cacao.

Means of preserving a plantation.—It is necessary that a cacao plantation should have always shade and irrigation; the branches of the plant should be cleared of the lichens that form on them; the worms destroyed; and no large herbs or shrubs and mosses permitted to grow near, since the least disadvantage resulting therefrom would be the loss of all the fruit that should fall into these thickets. But it is most essential to deepen the trenches which carry off the water, in proportion as the plant increases in size, and as the roots of course pierce deeper; for if the trenches are left at a depth of three feet, while the roots are six feet in the earth, it follows that the lower part of the cacao plant is in a situation of too great humidity, and rots at the level of the water. This precaution contributes not only to make the plantation more durable, but also to render the crop more productive. It is necessary, also, to abstain from cutting any branch from cacao plants that are already bearing. Such an operation might occasion the subsequent crop to be stronger; but the plants become enervated, and often perish, according to the quality of the soil and the number of branches cut off.

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If the earth of the plantations be pressed and trampled down by animals, the duration of the plant is diminished. Irrigation, made with judgment, maintains them long in a state of produce.

Withering of the fruit.—The fruit of the cacao withers on the tree from three causes:—

First.—When the plantation is, during a long time, inundated with water. I have seen plantations of cacao, which had only been covered with water thirty hours, and of which the fruit was totally withered.

Second.—From abundant rains, particularly in very damp valleys. This is only to be remedied by keeping the plantation well drained, that the water may not remain on it.

Third.—A want of necessary irrigation, and the watering of the plantation under an ardent sun. The vapor from the earth kills the fruit. If the rains are deficient for a time, and an excessive rain succeeds, the fruit of the cacao also withers.

This dessication or withering takes place everywhere; but in some places the surplus of fruit, which the tree is unable to nourish, is alone subject to it. In others, as Araquita and Caucagua, it withers in proportion to the northerly rains. An unsuitable soil occasions another kind of decay. The pods become stinted, containing some good and some bad seeds. The Spaniards call this *cocosearse*, which means defective.

Harvest of the cacao.—The tree yields two principal crops in a year, one about St. John’s day, the other towards the end of December. The cacao however ripens and is gathered during the whole year. But in all seasons the planters of the Central American republics make it a point, so far as possible, to collect their crops only at the decline of the moon; because experience proves that this precaution renders the cacao more solid, and less liable to spoil.

To collect the fruit, those negroes and Indians are employed who have the sharpest sight, that only the ripe fruit may be gathered. The most robust and active are chosen to carry it to the places where the beans are to be shaken out. The aged and maimed are employed to do this. The operation is performed on a floor well swept, and covered with green leaves, on which they place the cacao. Some open the pod, and others strike out the beans with a small piece of wood, which must not be sharp, lest it should injure them.

The good and bad beans must not be mingled together. There are four sorts of cacao in every crop; the ripe and in good condition, the green but sound, the worm-eaten, and the rotten. The first quality is best, the second is not bad; but the two others should be rejected.

As soon as that which is not fully ripe begins to show specks, it must be separated. As to the pods which are not perfectly ripe, they should remain in heaps during three days under green banana leaves, that they may ripen before they are hulled. When the cacao is stored, great care is necessary not to leave amongst it pieces of the pod or leaves, or any other excrementitious particles. This care must be repeated every time that it is removed from the store, or replaced in it.

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The cacao must always be exposed to the sun on the fourth day after it has been gathered, and this exposure should be daily repeated until it is perfectly dry. When that is the case, the beans burst on being squeezed, their shell resounds when struck, and they no longer become heated when placed in heaps; the latter is the best proof that the moisture injurious to their preservation is dissipated. If the cacao is not sufficiently exposed to the sun, it becomes mouldy; if too much, it withers, and easily pulverises—in either case it soon rots.

When the quantity of cacao gathered is considerable, it is placed in the sunshine by a hundred quintals at a time, unless the cultivator has a sufficient number of persons employed to expose a greater quantity. This operation is indispensable, to prevent it from becoming mouldy. If the rains prevent this exposure to the sun, it is necessary, as soon as it is sufficiently cleaned or purified, to spread it in apartments, galleries, or halls, with which the plantation must be provided; this operation cannot be delayed without danger of losing the crop.

It is to be wished that stoves were employed to dry the cacao when the sun fails, but this expedient, so simple and important, is generally unknown.

It is almost universally believed that the most essential precautions for preserving the cacao consists in gathering it at the decline of the moon. I believe that they may more seriously calculate on the care of depositing it in apartments so hermetically closed that the air cannot penetrate; it would be advisable to make these apartments of wood, for the more perfect exclusion of moisture. The floor should be elevated two feet; under the floor a pan of coals is placed, covered with a funnel, the point of which enters into the heap of cacao and then diffuses the vapor. In the apartment which contains the cacao, some persons place bottles of vinegar, slightly stopped with paper, to prevent the formation of worms.

The beans which begin to show specks, may be preserved from entire corruption by a slight application of brine. This occasions a small degree of fermentation, which is sufficient to destroy the worms, and to preserve the cacao during a considerable time from new attacks. Why is not this preservative also employed after the cacao is dried, and when placed in the store, where it awaits the purchaser?

At St. Philip they make use of smoke to preserve the cacao; it is also ascertained that fine salt, thrown in small quantities on the cacao, protects it from worms.

Much has been done for the cacao when it has been cleared of all green or dead beans, and extraneous substances; when it has received no bruise or injury in the operation of drying, and when it has been subsequently kept in a place that is dry and not exposed to the air; yet, even with all these precautions, cacao of the best quality is seldom found marketable at the end of a year.

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These circumstances sufficiently prove that the culture of cacao requires attention more than science, vigilance rather than genius, and assiduity in preference to theory. Choice of ground, distribution and draining of the waters, position of the trees destined to shade the cacao, are almost the only points which require more than common intelligence. Less expense is also required for an establishment of this kind than for any other of equal revenue. One able hand, as I have already said, is sufficient for the preservation and harvest of a thousand plants, each of which should yield at least one pound of cacao, in ground of moderate quality, and a pound and a half in the best soil. By an averaged calculation of twenty ounces to each plant, the thousand plants must produce twelve hundred and fifty pounds, which, at the ordinary price of 31s. 6d. per cwt., would produce about L17 10s. per annum for each laborer. The expenses of the plantation, including those of utensils, machines, and buildings, are also less considerable for cacao than for any other produce. The delay of the first crop, and the accidents peculiar to cacao, can alone diminish the number of planters attached to its culture, and induce a preference to other commodities.

The cacao plant is not in a state of prolific produce till the eighth year in the interior, and the ninth in plantations on the coast. Yet, by a singularity which situation alone can explain, the crops of cacao commence in the ninth year in the valley of Goapa, and at the east of the mouth of the Tuy. In the vicinity of the line, and on the banks of Rio-Negro, the plantations are in full produce on the fourth, or at most the fifth year.

The cacao tree continues productive to the age of fifty years on the coast, and thirty years in the interior of the country.

In general the culture and preparation of cacao receives more attention in the eastern parts of Venezuela than in other places, and even than in the French colonies. It is true that the suitability of the soil contributes much to the quality of the article; but without the assistance derived from art, it would be far from possessing that superiority awarded to it by commerce over the cacao of every other country.

Stevenson ("Travels in South America”) speaks of another kind of cacao tree, called moracumba, which is larger than the ordinary species, and grows wild in the woods. The beans under the brown husk are composed of a white, solid matter, almost like a lump of hard tallow. The natives take a quantity of these, and pass a piece of slender cane through them, and roast them, when they have the delicate flavour of the cacao.

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There are several cacao plantations in Surinam. The trees are left to grow their natural height, which is about that of a cherry-tree; their leaves resemble those of the broad-leaved laurel, and are of a dark green colour. The fruit in shape resembles a lemon, but is rather more oval; it is at first green, and, when ripe, yellow. It is said that there are some trees which produce above two hundred, each containing about twenty beans or nuts. The fruit not only proceeds from the branches, but even from the stem; and though there is always ripe and unripe fruit, it is only gathered twice a year. The chocolate is in that colony in general of an inferior quality, known by its dark brown color and rough taste, but the superiority of the cacao depends principally on the soil where the trees are planted.—(Baron Von Sack’s “Surinam.”)

My friend, Sir R. Schomburgk, in his “Description of British Guiana,” says—“While we crossed from the river Berbice to the Essequibo, we met a number of chocolate nut trees, near the abandoned Caribi settlement of Primoss. It is not to be doubted that the trees were originally planted by the Indians, but from their number and the distance from the river, I judged they were propagated by nature. Though they were overshadowed by larger trees, and had for many years been neglected, they had reached nevertheless a height of from thirty to forty feet, and the luxuriant growth and the abundance of fruit, proved that the plant was satisfied with the soil. The forests at the banks of the Rio Branco, in the vicinity of Santa Maria and Carno, abound in wild cacao trees, the fruits of which are collected by the scanty population of that district for their own use.”

The cultivation of cacao will be most suitable to the less wealthy individual, as it demands so little labor and outlay. Baron Humboldt observes, in alluding to Spanish America, that cacao plantations are occupied by persons of humble condition, who prepare for themselves and their children a slow but certain fortune; a single laborer is sufficient to aid them in their plantations, and 30,000 trees, once established, assure competence for a generation and a half.

The following have been the total imports of Cacao into the United Kingdom from Mexico and Central America, &c.:—

	lbs.
1832	85,642
1834	16,171
1835	211
1836	861,531
1837	564,992
1838	1,681,965
1839	508,307
1840	1,058,015
1841	1,802,547
1842	441,084

1843	1,229,515

(Parl. Paper, No. 426, Sess. 1844.)

Only a few hundred pounds of this is entered annually for home consumption, the great bulk being re-exported.

In 1850 we imported 1,204,572 lbs. from Mexico; 1,231,773 lbs. from Chile; 4,438 lbs. from Venezuela, and 23,538 lbs. from Hayti.

BRAZIL.—A great deal of cacao is raised in different parts of this empire. From the province of Para alone 35,000 bags, valued at L35,000, were exported in the year 1845. Mr. Edwards, in his "Voyage up the River Amazon," gives an interesting account:—

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“We were now (he says) in the great cacao region, which, for an extent of several hundred square miles, borders the river. The cacao trees are low, not rising above fifteen or twenty feet, and are distinguishable from a distance by the yellowish green of their leaves, so different from aught else around them. They are planted at intervals of about twelve feet, and, at first, are protected from the sun’s fierceness by banana trees, which, with their broad leaves, form a complete shelter. Three years after planting the trees yield, and therefore require little attention, or, rather, receive not any. From an idea that the sun is injurious to the berry, the tree-tops are suffered to mat together until the whole becomes dense as thatch-work. The sun never penetrates this, and the ground below is constantly wet. The trunk of the tree grows irregularly, without beauty, although perhaps by careful training it might be made as graceful as an apple tree. The leaf is thin, much resembling our beech, excepting that it is smooth-edged. The flower is very small, and the berry grows direct from the trunk or branches. It is eight inches in length, five in diameter, and shaped much like a rounded double cone. When ripe, it turns from light green to a deep yellow, and at that time ornaments the tree finely. Within the berry is a white acid pulp, and embedded in this are from thirty to forty seeds, an inch in length, narrow and flat. These seeds are the cacao of commerce. When the berries are ripe, they are collected into great piles near the house, are cut open with a tresado, and the seeds, squeezed carelessly from the pulp, are spread upon mats to dry in the sun. Before being half dried they are loaded into canoes in bulk, and transmitted to Para. Some of these vessels will carry four thousand arrobas, of thirty-two pounds weight each, and, as if such a bulk of damp produce would not sufficiently spoil itself by its own steaming during a twenty days’ voyage, the captains are in the habit of throwing upon it great quantities of water, to prevent its loss of weight. As might be expected, when they arrive at Para it is little more than a heap of mould, and it is then little wonder that Para cacao is considered the most inferior in foreign markets. Cacao is very little drunk throughout the province, and in the city we never saw it except at the cafes. It is a delicious drink when properly prepared, and one soon loses relish for that nasty compound known in the States as chocolate, whose main ingredients are damaged rice and soap fat. The cacao trees yield two crops annually, and, excepting in harvest time, the proprietors have nothing to do but lounge in their hammocks. Most of these people are in debt to traders in Santarem, who trust them to an unlimited extent, taking a lien upon their crops. Sometimes the plantations are of vast extent, and one can walk for miles along the river, from one to another, as freely as through an orchard. No doubt a scientific cultivator might make the raising of cacao very profitable, and elevate its quality to that of Guyaquil.”

Cacao shipped from Brazil to the United Kingdom, for nine years, ending 1835:—

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lbs.	
1827	3,992,449
1828	1,174,168
1829	2,442,456
1830	1,308,694
1831	1,716,614
1832	2,198,709
1833	2,402,803
1834	1,591,600
1835	1,678,769

Cultivation in the West India Islands.—The only English colonies where this nutritious and wholesome substance is now cultivated to any extent, are Trinidad, St. Lucia, Grenada, and St. Vincent.

In Jamaica and British Guiana it has given place to the production of sugar, and though it forms such an important article in the imports and consumption of the United Kingdom, the quantity introduced from British plantations is barely equal to the demand. The imports from Jamaica in 1831 were 6,684 lbs., and in 1838, 16,564 lbs.; while the imports since have been merely nominal. Of 5,014,681 lbs. imported in 1841, 2,920,298 lbs. were furnished by the British West Indian colonies, 1,802,547 lbs. came from the Colombian republics, and 269,794 lbs. were brought from Brazil. Trinidad furnishes by far the largest proportion of the West Indian supplies, the imports from thence in 1841 having been 2,500,000 lbs., while the imports from all the other islands were but 427,000 lbs. In 1850, 4,750,000 lbs. were shipped from Trinidad, whilst in 1851 the quantity was nearly as much.

Trinidad.—Although this tree is indigenous to many, if not most of the tropical parts of America, it was first extensively cultivated in Mexico; and it is remarkable that the words cacao and chocolate are both of Mexican origin. From Mexico the variety called Creole cacao it is supposed was transplanted to the West India colonies; that variety called Forastero (stranger) came from the Brazils. The latter tree is the most productive, but the former gives the best fruit, insomuch that few persons now plant the Forastero cacao. There are two or three indigenous species found growing wild in the forests of Trinidad, *viz*., *T. Sylvestris cacao*, *T. Guianensis*, and another sort.

There are few, perhaps no agricultural or horticultural pursuits, so delightful (observes Mr. Joseph, in his “History of Trinidad,”) as that of the cultivation of the cacao. It is planted in rows, intersecting each other at right angles, at the distance of from twelve to fifteen feet, according to the nature of the soil. The tree is not suffered to grow higher than about fifteen feet, and its broad rich foliage, the hues of which vary from a light green to a dark red, loaded with yellow and dark red pods, which contain the chocolate bean, are beautiful objects; these alleys are shaded by rows of magnificent trees, called *Bois Immortel* by the French and English, by the Spaniards the Madre de Cacao. It is the *Erythrina umbrosa* or *arborea* of Linnaeus. Like the Bignonia or Pouie, this tree, at particular seasons, throws off its foliage and is covered with blossoms; those of the Erythrina are of a brilliant red color, justifying its Greek appellation. In this state they are literally dazzling to behold—no object in the vegetable world looks more striking than the alleys of a cacao walk shaded by a forest above them of the Bois Immortel.

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I have been obligingly furnished by Mr. W. Purdie, the able Government botanist of Trinidad, with a short essay upon the cultivation of the cacao tree, with which many of the valleys of that island are so beautifully adorned, and which, at one time, poured into that now unfortunate colony so large a stream of wealth. Fortunately the cacao planter of the island has managed to survive the many years of depression under which—like sugar now—the cacao cultivations lingered and sunk, and which brought the once wealthy planter down to poverty and misery. His prospects, however, are gradually improving.

The opinions put forth by Mr. Purdie, on the subject of which he treats, will be found to run counter to the long-established practice hitherto pursued in the treatment of cacao plantations; but it must not be forgotten that these are the opinions of a person with whom the study of trees, their physiology and functions, has been not merely an amusing science, but an adopted employment, and whose acquirements in this respect, previous to his arrival in the colony, recommended him for selection as the agent to extend through South America (the great cacao region) the investigations of one of the most noted botanical gardens in Europe.

Mr. Purdie says:—

“In the present depressed times, it behoves us to look well into the resources of our fertile island, particularly as far as any improvement can be suggested capable of averting, at least, a part of the misery and ruin that is hovering over us, and which is too eagerly borne on the lips of all classes of the community, instead of using our efforts to do what we can to meet the difficulty; but few seem to inquire whether we make the most of our present means or not, whilst every one rather joins in the cry that sugar fetches little or nothing, and it is no uncommon thing to hear the complaint transferred from sugar to cacao.It is but too true that the markets are at present lamentably against the most important branch of our industry, under the present manner of sugar cultivation and manufacture in this island. But it can hardly be admitted that the same is the case in that of cacao—also a very important branch of our agriculture.My attention has been lately directed to the average produce per tree, which will, I hope, throw some light on its cultivation. From fifteen cacao trees, which are all there are at St. Ann’s, I have this year gathered 115 lbs. of cacoa (dried), and at present there is at least 50 lbs. more ripe on the same trees. This gives 165 lbs. of cacao from fifteen trees, or 11 lbs. per tree. These cannot be considered fine trees; on the contrary, they are what would be considered ordinary ones; therefore the average in this case is fair, and differs materially from selecting the produce of fifteen trees from a large plantation, and giving the average return of what might be obtained from cacao cultivation.

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Last year these trees did not average more than 2 lbs. per tree, and I attribute the increase of crop to the thinning out of both the cacao and shade trees.In a former letter to the cacao-planters of Trinidad, I recommended twenty-four to thirty feet from tree to tree as the proper distance; but so as to meet the feelings of those who, unfortunately for themselves, consider every cacao tree cut down a sacrifice, I propose that the trees be thinned out to twenty-four feet, and that, at intervals of twenty rows at most, avenues of fifty feet in both directions should be left. After this, it will be better seen what may be necessary to be done to each individual tree; neither should the shade trees be forgotten; as a general rule, they are prejudicially thick.By attending to this, I am quite satisfied that a very material increase in the produce will be seen; indeed, I may say that on this depends the chief difference of 11/4 lb. and 11 lbs. per tree; for I consider it a very fair inference, that the average obtained here can be realised in any other place in this island, and to any extent, under the same circumstances of light and air, unless on very poor soil, of which we fortunately have but little.At twenty-four feet apart there would be seventy-five trees per acre, or 250 per quarree. This, at 11 lbs. per tree, gives 2,750 lbs. of dried cacao per quarree, at 5 dollars per 100 lbs., gives 137 dollars 50 cents gross; deducting 80 dollars per quarree expenses, leaves 57 dollars 60 cents net profit. Thus an estate of 120 acres, or 36 quarrees, would contain 9,000 trees, at 11 lbs. per tree will give 33,000 lbs. of cacao, at 5 dollars gives 4,350 dollars gross per annum; deducting 80 dollars per quarree (a much more liberal sum than is at present laid out), leaves a net balance of 1,950 dollars, or 16 dollars 25 cents per acre.Now this, it must be remembered, would be the produce from 9,000 trees, and from an estate containing only 36 quarrees of land (which cannot be considered a large one); what, then, might be expected from estates containing 40,000 trees?I have been recently favoured with the following average return of cacao in this island, which I have no doubt will be considered a fair one. I insert it in full, and, from the very low return, it shows a lamentable deficiency in the cultivation of this most grateful tree:—

’The average number of cacoa trees in a quarree of land is 868.

’1st. The estates throughout the island are generally planted at a distance of 12 feet by 12, and 131/2 feet by 131/2. Those planted at 12 by 12 contain 969 trees in the quarree, and those at 131/2 by 131/2 contain 767 trees, the area of the quarree being taken at 139,697 superficial feet. There may be in the island about 60 quarrees in all, planted at 15 by 15 feet.

’2nd. The actual annual value of a quarree of land planted in cacoa
is ten fanegas, or 11/4 lb. to a tree.

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’It is to be observed that this is the general return from each tree as estates are now cultivated, but if planters had the means of keeping their estates in high cultivation, each cacoa tree would produce 2 lbs. on an average.’3rd. The annual average cost of cultivating a quarree in cacao, and manufacturing the produce therefrom, is 35 dollars, in the imperfect manner it is carried on at present, thereby giving only 10 fanegas per quarree.’I believe there are many estates in the island where the average distance is less than 12 by 12; however, to give the present mode the full benefit of the return, I will adopt, for comparison’s sake, the maximum number of trees; so that 960 trees per quarree, at l1/4 lb. per tree, gives 1,211 lbs. of cacao, at 5 dollars per 100 lbs. is worth 60 dollars,[2] gross return per quarree; deducting 36 dollars, not 80 dollars, for expenses, which leaves 24 dollars per quarree net, or about 7 dollars 75 cents per acre.This is a startling account from lands among the most fertile in the world, and from a plant, under fair treatment, next to the sugar cane, perhaps the most grateful for the care bestowed, more especially when we consider that more than ten times that quantity might be obtained with a comparatively insignificant *outlay of money*.If such, then, be the case, as stated in the above report (and it is to be regretted that it is too near the truth), apathy on the part of those whose interests are so much concerned is unwarrantable. It is not enough to say that our fathers must have known the proper way to plant cacao; this is but a lame excuse, and not sufficient to dispense with any exertions of the present generation, beyond merely collecting whatever fruit may come, as it were, fortuitously. Moreover, at the time the present cacao plantations were established in this island, its cultivation was comparatively little known; it is therefore likely that they might have erred, as they undoubtedly did, in cramming them so close together; but notwithstanding this, by a proper system of thinning, the evils might have been easily obviated, and large crops ensured.A few mornings ago, a cacao planter from Santa Cruz called on me, and in conversation stated that the only place where he had anything like a crop of cacao at present, was where the hurricane of the 11th of October had devastated his estate most severely, and which he at that time considered a ruinous visitation. I hope the lesson will not be lost on him.In Jamaica it is found necessary to prune the coffee trees yearly, which is done with as much care as gooseberry or currant bushes in England; but, notwithstanding this, I remember a friend of mine in Jamaica telling me of the extraordinary difference on his coffee plantation under the management of a person who understood and attended more particularly

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to the pruning of his trees.Lunan, in his ‘Hortus Jamaicensis,’ published in 1814, gives a very elaborate article on the cacao, although its cultivation was almost extinct in his day in that island. He, however, appears to have derived his information chiefly from Blume, who wrote a short account of Jamaica, in 1672, at which time cacao was the chief export of the island. Lunan attributes its downfall to heavy ministerial exaction, which was then, he says, upwards of 480 per cent. on its marketable value. Speaking of the average weight of cacao per tree, he has the following:—’The produce of one tree is generally estimated at about 20 lbs. of nuts. The produce per acre in Jamaica has been rated at 1,000 lbs. weight per annum, allowing for bad years. In poor soils, and under bad management, the produce of the tree rarely exceeds 8 lbs. weight.’ He also says—’When the cacao plants are six months old, the planter from this period must not be too fond of cleaning the plantation from grass and herbage, because they keep the ground cool; but all creeping, climbing plants, and such weeds as grow high enough to overtop the cacao, should be destroyed.’ He gives the distance from tree to tree at 18 feet. I have long since been of opinion that it is of less consequence to clean the ground beneath the trees than to attend to the top-pruning of the shade trees, as well as to the cacao (although the former is very desirable, it is nevertheless a subordinate consideration). Under the present mode of cultivation the ground-cleaning is the only one at all attended to, and that badly.A very important economy might also be made in the curing of the cacao, by which much time would be saved, and consequently expense, by adopting the same method as is used in Jamaica for drying coffee, namely, floorings of cement, or, as they are called, barbecues. At convenient distances in the centre of these floorings (which are inclined planes) a slightly-raised circular ridge is formed with cement, leaving an aperture at the lower side to allow the escape of any water that may have lodged in them. The cacao is easily brought together in these places in the event of rain, and at night covered with portable wooden frames, which are readily removed by two men. In this way the cacao would be dried in a fifth of the time much more effectually, and of a brighter colour.Any experiments tending to bring about a proper system of cultivation and manufacture of cacao, must be beneficial to the island, as well as to individuals; for it cannot be denied that the cultivation of cacoa will still prove advantageous in proportion to the care bestowed on it. Indeed its cultivation is at present languishing, not so much from inadequate prices, as from a want of proper attention to its cultivation.”

In 1796, there were sixty plantations in Trinidad, which produced 96,000 lbs. In 1802 the plantations were reduced to fifty-seven, the yield being about the same. In 1807, 355,000 lbs. of cacao were grown. In 1831, there were 2,972 quarrees (each three acres and one-fifth English) under cultivation in Trinidad with cacao, on which were 2,464,426 trees, which produced a crop of 1,479,568 lbs. In 1841 there were 6,910 acres planted with cacao.

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The following have been the exports from this island from 1821 to 1844:—

	lbs.
1821	1,214,093
1822	1,780,379
1823	2,424,703
1824	2,661,628
1825	2,760,603
1826	2,951,171
1827	3,696,144
1828	2,582,323
1829	2,756,603
1830	1,646,531
1831	1,888,852
1832	1,530,990
1833	3,090,526
1834	3,363,630
1835	2,744,643
1836	3,188,870
1837	2,507,483
1838	2,571,915
1839	2,914,068
1840	2,007,494
1841	2,493,302
1842	2,163,798
1843	1,099,975

(Mill's Trinidad Almanac).

In a lecture delivered by Dr. Lindley before the Society of Arts, alluding to the colonial products shown, at the Great Exhibition, he said:—

"There was one sample which ought to be mentioned most especially; namely, the cocoa of admirable quality which comes, or which may come, from Trinidad. Cocoa—-cacao, as we should call it—is an article of very large consumption. Enormous quantities of it are now used in the navy; and every one knows how much it is employed daily in private life. It is, moreover, the basis of chocolate. But we have the evidence of one of the most skilful brokers in London, who has had forty years experience to enable him to speak to the fact—that we never get good cocoa in this country. The consequence is, that all the best chocolate is made in Spain, in France, and the countries where the fine description of cocoa goes. We get here cocoa which is unripe, flinty, and bitter, having undergone changes that cause it to bear a very low price in the market. But it comes from British possessions, and is, therefore, sold here subject to a duty of only 18s. 8d. per cwt., whereas if it came from a foreign country it would pay 56s.[3] The differential duty drives the best cocoa out of the English market. Still it appears that we might supply, from our own colonies, this very cocoa; because, as I have said, there was exhibited, from Trinidad, a very beautiful sample, quite equal to anything produced in the best markets of the Magdalena, of Soconusco, or of other places on the Spanish main. It had no bitterness, no flintiness, no damaged grain in it; but all were plump and ripe, as if they had been picked. The cocoa from the Spanish main goes into other countries, for the preparation of that delicious chocolate which we buy of them. It is thrown out of our market by the differential duty. But it is their own fault if our own colonies do not produce fine cocoa, as Trinidad has conclusively proved."

The exports of cacao from St. Lucia, where there are now 300 acres under cultivation, have been as follows:[4]—I have also added the produce of St. Vincent and Grenada imported here:—

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Grenada. St. Lucia. St. Vincent.
lbs. lbs. lbs.
1828 75,275 17,384 1829 300,051 93,793 12,216 1830 337,901 153,340 9,989 1831 368,882 98,090 7,861 1832 196,195 51,925 538 1833 312,446 91,048 1,005 1834 349,367 60,620 2,197 1835 276,359 49,218 5,876 1836 307,236 47,950 7,721 1837 351,613 48,591 2,525 1838 426,626 38,590 6,588 1839 327,497 54,639 760 1840 269,680 82,293 3,956 1841 372,008 78,225 3,874 1842 280,679 55,175 7,268 1843 296,269 48,279 55,867 1844 544,253 65,667 8,304 1845 342,092 31,000 6,450 1850 609,911 1,372 8,642 1852 604,299 9,428 5,287

A little cacao is now grown in Antigua, about 19,000 lbs. having been exported from that island in 1843, and 2,000 in 1846.

Dominica and British Guiana produce small quantities; our imports from these quarters having been as follows:—

	Dominica.	Demerara.
	lbs.	lbs.
1833	8,808	2,051
1834	4,767	86
1835	685	126
1836	279	1,121
1837	1,896	522
1838	1,054	
1839	1,127	58
1840	2,366	2,376
1841	4,014	129
1842	667	98
1843	4,614	4,178
1844	1,746	10,209
1845	5,444	

The cultivation of cacao in Cuba is of comparatively recent introduction, but it is expected to increase, and, in some degree, to supply the place of coffee, which is evidently on the decline there. In 1827, the gross produce of Cuba amounted to 23,806 arrobas, and the exports to 19,053. In the same year, 15,3013/4 arrobas were imported, so that at that period the production was not adequate to the consumption. The expectation of a great increase of production seems not to have been realized, as the exports of cacao in 1837 were only 5871/4 arrobas, while the imports amounted to 40,8371/2 arrobas.

There are now about sixty-nine cacao plantations in that island, almost exclusively situate in the central and oriental departments, which produced, in 1849, 3,836 arrobas, valued at 19,180 dollars.

Hayti exported, in 1801, 648,518 lbs. of cacao; in 1826, 457,592 lbs., and in 1836, 550,484 lbs.

The French island of Martinique produces a considerable quantity of cacao. In 1763, there were stated to be 103,870 trees in bearing. The produce exported in 1769 was 11,731 quintals. In 1770 there were 871,043 trees. In 1820 there were 412 square acres under cultivation with cacao, producing 449,492 lbs.; and in 1835, 492 hectares, which yielded 155,300 kilogrammes. I have no later returns at hand.

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The beverage generally called *cocoa* is merely the berries of *Theobroma Cacao*, pounded and drank either with water or milk, or with both. *Chocolate* (of which I shall speak by and bye) is a compound drink, and is manufactured chiefly from the kernels of this plant, whose natural habitat would seem to be Guayaquil, in South America, though it flourishes in great perfection in the West Indies. It grows also spontaneously and luxuriantly on the banks of the Magdalena, in South America; but the fruit of those trees that are found in the district of Carthagena is preferred to all others, probably from a superior mode of cultivation. Sir R. Schomburgk, in his expedition into the interior of British Guiana, found the country abounding in cacao, “which the Indians were most anxious to secure, as the pulpy arillus surrounding the seed has an agreeable vinous taste.” Singular to say, however, they appeared perfectly ignorant of the qualities of the seed, which possesses the most delightful aroma. Sir Robert adds, they evinced the greatest astonishment when they beheld him and Mr. Goodall collecting these seeds and using them as chocolate, which was the most delicious they had ever tasted. These indigenous cacao trees were met with in innumerable quantities on the 5th of June, 1843, and the following day; and thus inexhaustible stores of a highly-prized luxury are here reaped solely by the wild hog, the agouti, monkeys, and the rats of the interior.—(Simmonds’s Col. Mag. vol. i., p. 41.)

The height of the cacao shrub is generally from eighteen to twenty feet; the leaf is between four and six inches long, and its breadth three or four, very smooth, and terminating in a point like that of the orange tree, but differing from it in color; of a dull green, without gloss, and not so thickly set upon the branches. The blossom is first white, then reddish, and contains the rudiments of the kernels or berries. When fully developed, the pericarp or seed-vessel is a pod, which grows not only from the branches, but the stem of the tree, and is from six to seven inches in length, and shaped like a cucumber. Its color is green when growing, like that of the leaf; but when ripe, is yellow, smooth, clear, and thin. When arrived at its full growth, and before it is ripe, it is gathered and eaten like any other fruit, the taste being subacid. If allowed to ripen, the kernels become hard; and, when taken out of the seed-vessel, are preserved in skins, or, more frequently, laid on the vijahua leaves, and placed in the air to dry. When fully dry, they are put in leathern bags, and sent to market: this is the Spanish mode of taking in the crop. A somewhat different method is followed in Trinidad and Jamaica (in the latter island it can scarcely be said to be cultivated now); but it differs in no essential degree from the principle of gradual exsiccation, and protection from moisture.

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Chocolate, properly so called, and so prized both in the Spanish continent and in the West Indies, never reaches Great Britain except as a contraband article, being, like nearly all colonial manufactured articles, prohibited by the Custom-house laws. What is generally drank under that name is simply the cacao boiled in milk, gruel, or even water, and is as much like the Spanish or West India chocolate as vinegar is to Burgundy. It is, without any exception, of all domestic drinks the most alimentary; and the Spaniards esteem it so necessary to the health and support of the body, that it is considered the severest punishment to withhold it, even from criminals; nay, to be unable to procure chocolate, is deemed the greatest misfortune in life! Yet, notwithstanding this estimation in which it is held, the quantity made in the neighbourhood of Carthagena is insufficient for the demands of the population, and is so highly priced that none is exported but as presents! The manner in which the Spaniards first manufactured this veritable Theobroma—this food for gods (from *Theos*, God, and *broma*, food)—was very simple. They employed the cacao, maize, Indian corn (*Zea Mays*), and raw cane-juice, and coloured it with arnatto, which they called *achiotti* or *rocou*, but which was known in Europe at that time by the name of *Terra Orellana*. These four substances were levigated between two stones, and afterwards, in certain proportions, mixed together in one mass, which mass was subsequently divided into little cakes, and used as required, both in the solid and fluid form.

The Indians used one pound of the wasted nuts, half a pound of sugar, and half a pound of ground corn (maize) each, and then added rose-water to make it palatable. This the Mexicans called chocolate, from two words in their language, signifying the noise made by the instruments used to mill and prepare it in the water. Many other ingredients were subsequently added; but with the exception of Vanilla, in the opinions of most persons, they spoil, rather than improve it. Chocolate, as used in Mexico, is thus prepared: —- The kernels are roasted in an iron pot pierced with holes; they are then pounded in a mortar, and afterwards ground between two stones, generally of marble, till it is brought to a paste, to which sugar is added, according to the taste of the manufacturer. From time to time, as the paste assumes consistency, they add long pepper, arnatto, and lastly, vanilla. Some manufacturers vary these ingredients, and substitute cinnamon, cloves, or aniseed, and sometimes musk and ambergris—the two latter on account of their aphrodisiac qualities. The following is the formula given by a late writer:—To six pounds of the nut add three-and-a-half pounds of sugar, seven pods of vanilla, one-and-a-half pounds of corn meal (maize ground), half-a-pound of cinnamon, six cloves, one drachm of capsicums (bird pepper), and as much

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of the rocou or arnatto as is sufficient to color it, together with ambergris or musk, to enforce (as he says) the flavor, but in reality to stimulate the system. There is another chocolate made of filberts and almonds, but this is not considered genuine. In old Spain it is somewhat differently made; two or three kinds of flowers, also the pods of Campeche, almonds, and hazel-nuts, being mixed up with it, while the paste is worked with orange-water.

With regard to the manner in which chocolate is prepared in England nothing need be said, as it is too well known to require description. That which has appeared to me the best is "*Fry's Chocolate*," which requires only to be rubbed up with a little boiling water, and scalded milk added to it with sugar, according to the taste of the drinker; there is a flavour, however, in this chocolate sometimes of *suet*, which is probably added to give it a richness which the cacao employed may not possess of itself. In the West Indies they rarely add anything to cacoa but arnatto (sometimes a little fresh butter), though it is often scented and sweetened, and sold in little rolls at five-pence and ten-pence each, currency. It is always boiled with milk, which, though very indigestible when boiled and taken alone, seems to lose this quality when taken with chocolate. Chocolate thus made is much drank, when cold, in the middle of the day, and is considered, both by the negroes and the old settlers, as a most nutritive and salutary beverage.

The signs by which *good chocolate* or cacao is known are these:—It should dissolve entirely in water, and be without sediment; it should be oily, and yet melt in the mouth; and if genuine, and carefully prepared, should deposit no grits or grounds. That made in the West Indies, and in some parts of Cuba, is dark; but that manufactured in Jamaica is of a bright brick colour, owing to the greater quantity of arnatto which is used in the preparation, and which, I think, gives it a richer and more agreeable flavor.

In an economical point of view, chocolate is a very important article of diet, as it may be literally termed meat and drink; and were our half-starved artisans, over-wrought factory children, and ricketty millinery girls, induced to drink it instead of the innutritious beverage called "tea," its nutritive qualities would soon develop themselves in their improved looks and more robust constitution. The price, too, is in its favour, cacao being eight-pence per pound; while the cheapest black tea, such as even the Chinese beggar would despise, drank by milliners, washerwomen, and the poorer class in the metropolis, is three shillings a pound, or three hundred and fifty per cent, dearer, while it is decidedly injurious to health.

The heads of the naval and military medical departments in England have been so impressed with the wholesomeness and superior nutriment of cocao, that they have judiciously directed that it shall be served out twice or thrice a week to regiments of the line, and daily to the seamen on board Her Majesty's ships, and this wise regulation has evinced its salutary effects in the improved health and condition of the men. Indeed, this has been most satisfactorily established in Jamaica among the troops; and the same may be asserted of the seamen in men of war on the coast.

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But the excellent qualities of chocolate were known not only to the Mexicans and Peruvians, from whom, as a matter of course, the Spaniards acquired a knowledge of its properties; but European nations also acknowledged its virtues. The Portuguese, French, Germans, and Dutch, considered it an exceedingly valuable article of diet, and Hoffman looked upon it both as a food and a medicine. In his monograph, entitled *Potus Chocolati*, he recommends it in all diseases of general weakness, macies, low spirits, and in hypochondrial complaints, and what since his time have been termed nervous diseases. As one example of the good effects of cacao, he adduces the case of Cardinal Richelieu, who was cured of eramacausis, or a general wasting away of the body, by drinking chocolate.[5] And Edwards informs us that Colonel Montague James—the first white person born in Jamaica after the occupation of the island by the English—lived to the great age of 104; and for the last thirty years of his life took scarcely any other food but chocolate. It is also certain that those who indulge in excesses find their vigor more speedily restored by the alternate use of chocolate and coffee than by any other ingesta; and pigs, goats, and horses, which are fed even on the spoiled berries, are observed to become very speedily fat, and in good condition.

But cacao has not only the property of rapidly restoring the invalid to health, strength, and condition, but a very inconsiderable quantity of it will sustain life for a long period. The South American Indians perform extraordinary journeys, subsisting, daring these prolonged travels, on an incredibly small quantity of chocolate—so small, indeed, as to render the accounts of travellers upon the subject almost marvellous. In this respect it resembles coffee, which also possesses the estimable property of sustaining the powers of life, while it modifies and restrains the passion of hunger.

It is a curious fact, and how far this condition may be connected with its powers of sustenance is worthy of inquiry, that chocolate recently boiled, if the operation be performed in a tin pan, is highly electrical; and this property may be frequently manifested by repeating the process.

Cacao, according to Bridges, “was the favourite staple of the Spanish commerce, trifling as that commerce was; and when the English took possession of the island of Jamaica, it was that which first engaged their attention. The extensive plantations left by their predecessors, who had made it their principal food and only support, soon, however, began to fail. They were renewed; but whether it might be from the want of attention, or of information in the new colonists, the plants never succeeded under their management; so that, disgusted with the troublesome and unprofitable cultivation, they soon substituted indigo.” Yet forests of cacao trees grow wild in Guiana, the Isthmus of Darien, Yucatan, Honduras, Guatemala, Chiapa, and Nicaragua; while in Cuba, St. Domingo, and Jamaica, it was once an indigenous plant.

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The following were the expenses of a cacao plantation in Jamaica during the early period of British possession:—

L stg
Letters patent of five hundred acres of land 10
Six negroes 120
Four white persons, their passage and maintenance 80
Maintenance of six slaves for six months 18
Working implements 5
——
L233

In four to five years the produce of one hundred acres would usually sell for L4,240 sterling. This was a monstrous and most unlooked-for return; but then, what was it to the profits of sugar, which, owing to the prodigious increase of the slave trade, was fast coming into active operation, and eating up and destroying all other sources and springs of industry? How dearly have the West Indians paid for the short-lived affluence which the sugar cane conferred!

Blome, in his brief account of Jamaica, published in 1672, speaks of cacao as being one of the chief articles of export. He states that there were sixty cacao-walks or plantations, and many more planting; but, for many years, no cacao plantation has existed in Jamaica, all the chocolate used being made from imported berries, or the chance growth of a munificent climate and redundant soil! A few scattered trees, Edwards says (and as I my self know), here and there, are all that remain of those flourishing and beautiful groves, which were once the pride and boast of the country. They have withered with the indigo manufactory, under the heavy hand of ministerial exaction. *The excise on cacao, when made into cakes, rose to no less than L12 12s. per cwt., exclusive of 11s. 111/2d. paid at the Custom-house, amounting together to upwards of L840 per cent. on its marketable value!*

The mode of cultivating the cacao is given at some length by Edwards; it is that of the Spaniards, a process strictly followed in Trinidad, where, of all the West India islands, it constitutes a considerable item of exports. It is thus described:—“A spot of level land being chosen—preference is always given to a deep black mould, sheltered by a hedge or thicket, so as to be screened by the wind, especially the north, and cleared of all weeds and stumps of trees—a number of holes are dug, at ten or twelve feet distance from each other, each hole being about a foot in length, and six or eight inches deep. A very important matter is the selection of the seeds for planting, and this is done in the following manner: the finest and largest pods of the cacao are selected when full ripe, and the grains taken out and placed in a vessel of water. Those which swim are rejected; those chosen are washed clean from the pulp, skinned, and then replaced in the water till they begin to sprout; Banana (*Musa paradisiaca*), or some other large leaves, those of the sea-side grape (*Coccoloba uvifera*), for instance, are then taken, and each hole is lined with

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one of them, leaving, however, the sides of the leaves some inches above ground; after which the mould is rubbed in gently till the hole is filled; three nuts are then selected for each hole, and they are set triangularly in the earth, by making a small opening with the finger about two inches deep, into which the nuts are put, with that end downwards from which the sprout issues.” They are then covered lightly with mould, the leaf folded over, and a small stone placed on the top, to prevent its opening; in eight or ten days the young shoots appear above the ground; the leaves are then opened to give them light and air, and a shelter from the sun, either in the shape of plantain or banana leaves, is not forgotten; but the coco-nut and other species of palm, on account of their fibrous structure and great durability, are always preferred. This artificial shelter is continued for five or six months. But, as a further security to the young plants, for they are very delicate, other trees or shrubs are planted to the south-west of the plants, that they may grow up with and shelter them, for young cacao will grow and flourish only in the shade. For this purpose the coral bean-tree (*Erythrina Corallodendrum*) is chosen. I should presume there are other trees and plants equally eligible for this purpose, and more useful; but my experience does not enable me to speak positively upon the subject. Should the three seeds placed in each hole spring up, it is thought necessary, when the plants are fifteen or twenty inches high, to cut one of them down. The two others, if they devaricate, are sometimes suffered to remain, but it does not always happen that even *one* of the three springs above the earth; consequently this additional labor is not invariably requisite.

On the fourth or fifth year the tree begins to bear, and attains perfection by the eighth, continuing to produce two crops of fruit per annum, yielding at each crop from 10 lbs. to 20 lbs., according to the nature of the soil. It will continue bearing for twenty years; but, as it is a delicate plant, it suffers from drought, and is liable to blight. In these respects, however, it does not differ from many other plants, which are even more subject to disease, though not half so valuable. Besides, a proper system of irrigation, such as could be had recourse to in many parts of Jamaica, would obviate and prevent these evils.

The whole quantity imported into the United Kingdom from the West Indies and British Guiana during the last thirteen years, has been as follows:—

	lbs.
1831	1,491,947
1832	618,090
1833	2,125,641
1834	1,360,325
1835	439,440
1836	1,611,104

1837	1,847,125
1838	2,147,816
1839	969,428
1840	2,374,233
1841	2,919,105
1842	2,490,693
1843	1,496,554
1844	3,119,555
1845	3,351,602
1846	1,738,848
1847	3,026,381
1848	2,602,309
1849	3,159,086

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1850	1,987,717
1851	4,347,195
1852	3,933,863

Cacao is cultivated in the highlands as well as on the coasts of the north-eastern peninsula of the large and rich island of Celebes, which has within the last year or two been thrown open to foreign trade. The plantations of it are even now considerable, and this branch of industry only requires not to be impeded by any obstacles in order to be still further extended. It forms a large ingredient in the local trade, and furnishes many petty traders with their daily bread, not to speak of the landowners, for whom the cultivation of the cacao affords the only subsistence. The preparation of the product differs from that adopted in the West Indies, but we have not been able to ascertain the practice. We may reckon that 1,200 to 2,000 piculs of 133 lbs. are yearly produced; the prices vary much, being from 50 to 75 florins per picul.—("Journal of the Indian Archipelago," vol. ii., p. 829.)

Bourbon now produces 15,000 to 20,000 kilogrammes of cacao annually. Cacao is grown to a small extent in some of the settlements of Western Africa, but as yet only a few puncheons have been exported, all the produce being required for local consumption.

The following figures give the imports and consumption of cacao into the United Kingdom in the last five years:—

	Imports.	Consumption.
	lbs.	lbs.
1848	6,442,986	
1849	7,769,234	3,233,135
1850	4,478,252	3,103,926
1851	6,773,960	3,024,338
1852	6,268,525	3,382,944

The home consumption is very steady at about 3,000,000 lbs., yielding to the revenue L15,000 to L16,000 for duty. The produce of British colonies pays 1d. per lb. duty, that from foreign countries 2d; cocoa husks and shells half these amounts; when manufactured into chocolate or cocoa paste the duty is 2d. per lb. from British possessions, and 6d. from other parts. The quantity imported in this form is to the extent of about 14,000 lbs. weight.

COFFEE.

The next staple I proceed to speak of is coffee—second only in importance as a popular beverage to that universal commodity, tea. I shall proceed, in the first instance, to take a retrospect of the progress of the coffee trade, and glance at the present condition and future prospects of produce and consumption. It will be seen, by reference to the following figures, that the consumption of coffee in the United Kingdom shows a successive decrease, from 1847 to 1850, of 6,414,533 lbs., and a loss to the revenue of L179,614.

HOME CONSUMPTION AND REVENUE OF COFFEE FOR THE

Years	lbs.	L
1824	8,262,943	420,988
1825	11,082,970	315,809
1828	17,127,633	440,245
1835	23,295,046	652,124
1839	26,789,945	779,115
1840	28,723,735	921,551
1844	31,394,225	681,610
1845	34,318,095	717,871
1846	36,793,061	756,838
1847	37,441,373	746,436
1848	37,106,292	710,270
1849	34,431,074	643,210
1850	31,226,840	566,822
1851	32,564,164	445,739
1852	35,044,376	438,084

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I estimated, in a little treatise on coffee and its adulterations, which I published in 1850, that not less than 18,000,000 lbs. of vegetable matter of various kinds were sold annually under the deceptive name of coffee. Three-fourths of these 18,000,000 lbs. of pretended coffee were composed of chicory, and the remaining fourth of other ingredients prejudicial to health, as well as a fraud upon the revenue. The various substances used in adulterating both chicory and coffee, when sold in the powdered state, have been specifically pointed out and set forth from time to time in memorials from the trade and the coffee-growers. Mr. M'Culloch and other competent judges set down the actual consumption of chicory in the United Kingdom at 12,500 tons per annum. When we consider the vast difference of price between chicory and coffee, as purchased by the wholesale dealer, the temptation to its fraudulent use was obviously great, and there was no penal restriction against it.

It will be interesting and useful to trace the history of the trade in chicory from its first introduction.

The substitution of chicory for coffee occasioned a loss to the revenue of three hundred thousand pounds sterling a-year, besides its mischievous effect in adulterating and debasing a popular beverage when used in such large and undue proportions for admixture, and sold at the price of coffee.

Since the prohibition of the admixture of chicory with coffee, when sold to the public, and the compulsory sale by Treasury minute of the two articles in separate packages, a large and rapid increase in the consumption of coffee has taken place, and the trade is now placed in a healthy position. Whilst the increase in the consumption of coffee from the 1st of January, to 5th September, 1852, was but 142,267 lbs. as compared with the same period of 1851; the increase in the remaining four months of the year was to the amazing extent of 2,350,368 lbs. This increased consumption is likely to continue, and our colonial possessions are furnishing us with larger proportionate supplies, as may be seen by the following figures:—

TOTAL IMPORTS OF COFFEE IN

	1848	1849	1850	1851	1852
Produce of British Possessions	lbs. 35,970,507	lbs. 40,339,245	lbs. 36,814,036	lbs. 35,972,163	lbs. 42,519,297
Ditto foreign countries	21,082,943	22,976,542	13,989,116	17,138,497	11,857,957
Total	57,053,450	63,315,787	50,803,152	53,110,660	54,377,254

In the year 1832 chicory was first imported into England, subject to a duty equivalent to that levied upon colonial coffee, and permitted to be sold by grocers *separately* as chicory; but notices were at the same time issued, that the legal penalties would be rigidly enforced, if discovered mixed with coffee.

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In 1840, in consequence of memorials from the grocers and dealers in chicory, and also from the circumstance of exceedingly high rates then ruling for coffee, together with the disruption of our commercial relations with China, simultaneously advancing the price of tea (thus rendering both these popular beverages excessively dear to the consumer), an order was issued from the Treasury to the Excise Board, authorizing the admixture of chicory with coffee; a duty, however, being still maintained on the former of L20 per ton on the kiln-dried, and 6d. per lb. on the powdered root, when imported from abroad.

In the year 1845, the cultivation of chicory was introduced upon British soil, and, being a home-grown commodity, was exempt from duty, but nevertheless, by virtue of the said Treasury Order, was permitted to enter into competition with a staple production of our own colonies, contributing on its import a tax of 60 to 80 per cent. to the revenue of the State.

The result, as might have been foreseen, necessarily created and stimulated a demoralizing system of fraud, unjust and destructive to the interests of the coffee planter, and prejudicial to the national revenue.

The effects of so baneful a system being equally manifest upon both consumption and revenue, they are here separately illustrated.

In 1824, according to the following high scale of duties, *viz*., 1s. on West India, 1s. 6d. on East India, and 2s. 6d. on foreign, the Customs derived from coffee was L420,988; in the following year the rates were reduced one-half, and in the short space of three years the amount yielded had advanced to L440,245, an increase which steadily progressed (partly aided by the admission of the produce of British India at the low duty) until it reached L921,551 in 1840. These satisfactory results justified a further reduction of the duties in 1842 to 4d. on colonial and 8d. (and in the subsequent year to 6d.) on foreign, under which the revenue declined in 1844 to L681,616. In 1846 it had again reached to L756,838, and was gradually recovering itself, when this system of adulteration first began to extend itself generally, and since that time the revenue has rapidly declined under the *same scale of duties* to L566,822 in 1850.

In 1824 the quantity retained for home consumption was 8,262,943 lbs., which was augmented to 11,082,970 lbs. in the first year of the reduction of duty, and continued to exhibit an increase at a rate rather exceeding two million pounds per annum until 1830, when coffee would appear to have reached its limit of consumption without further stimulus, and remained stationary until the modification of duties allowing the admission of foreign coffee, *via* the Cape, at the colonial rate, when it advanced from 23,295,046 lbs. in 1835, to 28,723,735 lbs. in 1840; and consequent upon a further reduction of duties in 1842, the elasticity of the trade experienced a still wider development, and an increase of nine million pounds is exhibited in the next five years. From that period, however, the general use of chicory has not only checked the progressive increase of this healthy demand, but an annual decline is observable to the extent of above six million pounds in 1850, as compared with 1847.

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On the 15th of April, 1851, with the view of partly remedying the grievance of the colonists on this head, the duties were equalized and reduced to 3d. The results are, however, far from satisfactory, either in a fiscal or commercial point of view. It is true that an increase in consumption, of one-and-a-quarter million pounds has taken place, but at the sacrifice of L121,000 of revenue. But this increase, it will be seen, has not exceeded 41/4 per cent., whilst there has been a diminution of 211/2 per cent. in the revenue receipts. Upon investigation, moreover, it will be found that, notwithstanding the *total* increase exhibited, there has been an actual falling off of 894,778 lbs. of colonial coffee in 1851; the items for last year are, however, much more favorable and encouraging for the planters.

No reasonable cause can be assigned for this rapid and serious diminution in the consumption of coffee, except the notorious substitution of chicory and other substances.

The arguments advanced to account for the falling off in the consumption of coffee, by adducing the increase of tea and cacao for a similar period are fallacious, and contrary to the commercial experience of many years, which convincingly proves these kindred articles to have always simultaneously increased, or diminished, in ratio with the general prosperity of the kingdom, and the prevalence of temperate habits among the community.

I shall now proceed to trace the fluctuations in the consumption of coffee.

At the close of the last century the consumption of coffee was under one million pounds yearly; the only descriptions then known in the London market were Grenada, Jamaica, and Mocha—the two former averaging about L5 per cwt., and the latter L20 per cwt. Grenada coffee is now unknown, and Ceylon and Brazil are the largest producers. In 1760, the total quantity of coffee consumed in the United Kingdom was 262,000 lbs., or three quarters of an ounce to each person in the population. In 1833 the quantity was 20,691,000 lbs., or 11/2 lb. to each person. When first introduced into England, about the middle of the 17th century, coffee was sold in a liquid state, and paid a duty of 4d. per gallon; afterwards, until the year 1733, the duty was 2s. per lb.; it was then reduced to 1s. 6d., since which it has paid various rates of duty; in the year 1824 it was settled at 6d. per lb. All descriptions of coffee now pay but 3d. per lb.

The consumption of coffee in the United Kingdom, for several years previous to 1825, varied from seven millions and a half to eight millions and a half pounds in round numbers, the duty being 1s. per lb. on British plantation, 1s. 6d. per lb. on East India, and 2s. 6d. per lb. on foreign. From the 5th of April of that year those rates were each reduced to one half, and the immediate consequence was a steady increase of the consumption until 1831, when it amounted to 23,000,000 lbs. The consumption continued, without

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any material variation, at this rate, or to advance by very slow degrees, until 1836, when the duty on East India coffee was reduced to 6d. per lb.; and this change had precisely the same effect as the previous one, for the consumption again advanced to upwards of 26,000,000 lbs., which was then considered, in a memorial of the London trade, to be as much as our colonies were capable of producing! We now find, however, one small island, Ceylon, producing a fourth more than this amount annually.

The Belgians, a population of 4,500,000, consume more than 33,000,000 lbs. of coffee annually; quite as much as is used by the whole 35,000,000 French. The duty on 100 lbs. of coffee in France is more than the common original cost—the Belgian duty not a tenth part; so that the French do not use 1 lb. of coffee per head, while the Belgians consume 7 lbs. each per annum. The proportion in England is not more than 11/2 lb. per head to the population. The United States are the largest consumers of coffee, as it is admitted into their ports free of duty, and can therefore be sold for nearly the price per pound which the British Government levies on it for revenue. The entire consumption of the United States and British North America, calling their population 23,000,000 and ours 30,000,000, exceeds ours, on an estimate of population, by sixfold. Thus the average consumption of coffee by each American, annually, is about 81/2 lbs., while the quantity used by each person in the European States is less than 11/2 lb.

The changes in the sources of supply, within the last fifteen or sixteen years, have been very remarkable. The British possessions in the East have taken the place which our islands of the West formerly occupied. The British West Indies have fallen off in their produce of coffee from 30,000,000 to 4,000,000 lbs. Ceylon which, fifteen years ago, had scarcely turned attention to coffee, now exports nearly 35,000,000 lbs. San Domingo, Cuba, and the French West India colonies are gradually giving up coffee-cultivation in favor of other staples; and it is only Brazil, Java, and some of the Central American Republics that are able to render coffee a profitable crop. The export crop of Brazil (the greatest coffee-producing country), grown in 1850, for the supply of the year ending July, 1851, amounted to no less than 302,000,000 lbs., of this a large quantity remained in the interior to supply the deficiency of the current year.

It is scarcely thirty years ago that the coffee-plant was first introduced into Bengal by two refugees from Manilla; and the British possessions in the East Indies now yield 42,000,000 lbs. Sufficient extent has not yet been given to enable it to be decided in what district of *Continental* India it may be most advantageously cultivated. It is in the fine island of Ceylon, however, that coffee-culture has made the most rapid progress.

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It is an important fact that the supply of coffee from Ceylon, even at the present moment, and irrespective of land already planted but not yet come into full bearing, is in excess of the whole consumption of Great Britain, and the planter is thus compelled to carry the surplus to continental markets. The exports of coffee from Ceylon have been rather stationary the past three years, averaging about 300,000 cwt. In the sixteen years ending with 1851, Ceylon had exported 130,083 tons of coffee!

The present *produce* of the various coffee-growing countries in the world, may be set down at the following figures:

SOUTH AND CENTRAL AMERICA.

Millions of lbs.	
Costa Rica	9
La Guayra and Porto Cabello	35
Brazil	302
British West Indies	8
French and Dutch West Indies	7
Cuba and Porto Rico	30
St. Domingo	331/2

ASIA AND THE EAST.

Java 140
The Philippine Isles 3
Celebes 11/2
Sumatra 5
Ceylon 34
Malabar and Mysore 5
Arabia (Mocha) 3
—–
616 = 275,000 tons.

This I have computed as accurately as possible from the most recent returns, but it falls much below the actual capabilities of production, even with the trees at bearing, and land already under cultivation; and also, in a great measure, excludes the local consumption in the producing countries. In many quarters there has been a considerable falling off in the production. The British West Indies, as we have seen, formerly exported 30,000,000 lbs., the French and Dutch West Indies 17,000,000, Cuba and Porto Rico 56,000,000, and St. Domingo, in the last century, 76,000,000. The growth of coffee has been transferred from the West to the East Indies, and to the South American Continent, where labor is more abundant, certain, and cheap. In the East the increase in production has been enormous and progressive, with, perhaps, the exception of Sumatra, which has fallen off from 15,000,000 lbs. to somewhere about one-third of that quantity.

The following statement may be taken as an approximate estimate of the actual *consumption* of coffee at the present time:—

	Millions of lbs.
Great Britain	32
Holland and Belgium	125
France	33
German Customs Union	95
Other German Countries not included in the Union, and Austria	46

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Switzerland	13
Mediterranean Countries	20
Russia	12
Sweden and Denmark	20
Spain and Portugal	15
Cape of Good Hope and Australia	6
United States and British America	170
	587

A calculation made in the *Economist*, a year or two ago, gave the following as the probable consumption:—

	Millions of lbs.
Holland and Netherlands	108
Germany and North Europe	175
France and South of Europe	105
Great Britain	37
United States and British America	175
Total	600

But this estimate is too high in some of the figures. Great Britain we know, from the official tables only, consumes 34,000,000 lbs. annually; the United States and British America not so much as set down by several millions; for the official returns of the imports of coffee into the United States show an average for the three years ending June, 1850, of less than 154,000,000 lbs.; although a writer in a recent number of "Hunt's Merchant's Magazine," New York, (usually a well-informed periodical,) assumes a consumption of 200,000,000 lbs., for the North American States and Provinces.

The quantity of coffee produced being greater than the consumption thereof, the growth of it becomes less remunerative, and consequently we may look for a decrease in the supply. Ceylon, as well as the West Indies generally, British and foreign, are likely to direct their attention to some more profitable staple. A diminished production may further be expected in Brazil, consequent on the extermination of the slave-trade and the more sparing exertion of the labour of the slaves. In Cuba the want of labour is so much felt that large engagements have been entered into for the importation of Chinese; and there are many reasons for expecting a diminished production in Java, the next largest coffee-producing country. The necessary consequence of this expected decrease in the quantity of coffee produced will be, to bring the produce as much below the wants of the consumers as it is now above, and this must again result in an enhancement of prices in process of time.

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If it were thought desirable to extend the production of coffee, there are many new quarters, besides the existing countries in which it is largely cultivated, where it could be extensively grown. We may instance Liberia and the western coast of Africa generally, the interior ranges of Natal, the mountain-ranges on the northern coast of Australia, from Moreton Bay to Torres Straits, &c., &c. But the present production is more than equal to the demand; and unless a very largely increased consumption takes place in the European countries, the present plantations (colonial and foreign) are amply sufficient to supply, for many years to come, all the demands that can be made upon their trees, a large proportion of which have yet to come into full bearing.

The coffee tree would grow to the height of fifteen or twenty feet if permitted, but it is bad policy to let it grow higher than four or five feet. It comes to maturity in five years, but does not thrive beyond the twenty-fifth, and is useless generally after thirty years. Although the tree affords no profit to the planter for nearly five years; yet after that time, with very little labor bestowed upon it, it yields a large return.

Mr. Churchill, Jamaica, found that 1,000 grains of the wood, leaves, and twigs of the coffee tree, yielded 33 grains of ashes, or 3.300 per cent. The ashes consist of potass, lime, alumina, and iron in the state of carbonates, sulphates, muriates, and phosphates, and a small portion of silica. According to Liebig's classification of plants, the coffee tree falls under the description of those noted for their preponderance of lime. Thus the proportions in the coffee tree are—

Lime salts 77
Potass salts 20
Silica 3
——
100

I shall now proceed to describe the cultivation of the tree and preparation of the berry, as carried on in different countries.

Cultivation of Mocha—In Arabia Felix, the culture is principally carried on in the kingdom of Yemen, towards the cantons of Aden and Mocha. Although these countries are very hot in the plains, they possess mountains where the air is mild. The coffee is generally grown half way up on their slopes. When cultivated on the lower grounds it is always surrounded by large trees, which shelter it from the torrid sun, and prevent its fruit from withering before their maturity. The harvest is gathered at three periods; the most considerable occurs in May, when the reapers begin by spreading cloths under the trees, then shaking the branches strongly, so as to make the fruit drop, which they collect and expose upon mats to dry. They then pass over the dried berries a heavy roller, to break the envelopes, which are afterwards winnowed away with a fan. The interior bean is again dried before being laid up in store.

The principal coffee districts are Henjersia, Tarzia, Oudein, Aneizah, Bazil, and Weesaf. The nearest coffee plantations are three-and-a-half days journey (about 80 miles) from Aden.

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The following information is derived from Capt. S.B. Haines of the Indian Navy, and our political agent at Aden. A camel load is about 400 lbs = 25 frazlas or bales.

G.C. Commassees.
The price of ditto inland 31 41
At Mocha, duty to Dewla uncertain
Bake fee one butsha on each frazla 25
Weighing and clerk's fee 20
Packing 40
Camel hire to the coast 12 50
Cost from Sana to Mocha 44 15

Coffee is brought into the Sana market in December and January from the surrounding districts.

The varieties are—

1. Sherzee, best—price 1 G.C. frazla 25 butsha. 2. Ouceaime. 3. Muttanee. 4. Sharrazee. 5. Hubbal from Aniss. 6. Sherissee from ditto—price per frazla 1 G.C. 15 B.

The nearest place to Sana where the coffee tree grows, is at Arfish, half a day distant. Attempts have been made to introduce the shrub in the garden of the Imaum at Sana, but without success, ascribed to cold. Kesher is more prized at Sana; the best is Anissea, and is sold at a higher price than other coffee, namely, g.c. 12 per 100 lbs.; inferior, at from 4, 5, and 6.

Rain falls in Sana three times in the year. 1st. In January, in small quantities. 2nd. Beginning of June, when it falls for eight or ten days. By this time the seed is sown, and the cultivators look forward to the season with anxiety. 3rd. In July, when it falls in abundance. A few farmers defer sowing till this period, but it is unusual when they expect rain in June.

The coffee plant is mostly found growing near the sides of mountains, valleys, and other sheltered situations, the soil of which has been gradually washed down from the surrounding heights, being that which forms its source of support. This is afforded by the decomposition of a species of claystone (slightly phosphoritic) which is found irregularly disposed in company with a few pieces of trap-rocks, amongst which, on approaching Sana from the southward, basalt is found to preponderate. The clay stone is only found in the more elevated districts, but the debris finds a ready way into the lower country by the numerous and steep gorges which are conspicuous in every direction. As it is thrown upon one side of the valley, it is carefully protected by means of stone walls, so as to present to the traveller the appearance of terraces. The plant requires a moist soil, though much rain does not appear necessary. It is always found in greater luxuriance at places where there is no spring. The tree at times looks languid, and half withered; an abundant supply of water to the root of the plant seems necessary for the full growth and perfection of its bean.

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Progress of Cultivation in India.—There are said to be ten varieties of the coffee, but only one is found indigenous to India, and it is questionable if this is not the Mocha species introduced from Arabia. The cultivation of this important crop is spreading fast throughout the east, and has been adopted in many parts of Hindostan. In the Tenasserim provinces, on the table land of Mysore, in Penang, and especially in the islands of Bourbon and Ceylon, it is becoming more and more an object of attention. It is known to have given good produce in Sangar and the Nerbudda; also in Mirzapore, as well as Dacca, and other parts of Bengal; Chota Najpore, Malabar, and Travancore. From three to four million pounds of coffee are now exported from the Indian presidencies annually. The highest quantity was four and a quarter million pounds in 1845, but the progress of culture, judging from the export, has been small.

On the hilly districts on the east coast of the Gulf of Siam, the cultivation is carried on on a limited scale. The annual produce is not much more than about 400 cwt., although it is understood to be increasing. The quality of the berry is reckoned to be nearly equal to Mocha, and it commands a high price in the English market.

The soil recommended in India is a good rich garden land, the situation high and not liable to inundation, and well sheltered to the north-west, or in such other direction as the prevailing storms are found to come from.

A plantation, or a hill affording the shrubs shade, has been found beneficial in all tropical climates, because, if grown fully exposed to the sun, the berries have been found to be ripened prematurely.

The spot should be well dug to a depth of two feet before the trees are planted out, and the earth pulverised and cleared from the roots of rank weeds, but particularly from the coarse woody grasses with which all parts of India abound.

The best manure is found in the decayed leaves that fall from the trees themselves, to which may be added the weeds produced in the plantation, dried and burnt. These, then, dug in, are the only manure that will be required. Cow-dung is the best manure for the seed-beds.

The seed reserved for sowing must be put into the ground quite fresh, as it soon loses its power of germination. Clean, well-formed berries, free from injury by insects, or the decay of the pulp, should be selected.

These berries must be sown in a nursery, either in small, well-manured beds, or in pots in a sheltered spot, not too close, as it is well to leave them where sown until they acquire a good growth; indeed, it is better if they are removed at once from the bed where they are sown, to the plantation. Here they should be planted as soon as they have attained two years of age, for, be it remembered, that if they are left too long in the nursery, they become unproductive and never recover. The distance at which they should be put out in the plantation need not exceed eight feet apart in the rows, between which, also, there should be eight feet distance. The seedlings appear in about a month after the seed is sown.

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The culture requisite is, in the first instance, to afford shade to the young plants; many consider that this shelter should be continued during the whole period of their culture; but this is somewhat doubtful, as it has been found that plants so protected are not such good bearers as those which are exposed. The best plants for this purpose are tall, wide-branching trees or shrubs, without much underwood. The other culture requisite is only to keep the ground tolerably clean from weeds, for which one cooly on from five to ten biggahs is sufficient. He should also prune off decayed or dead branches. This treatment must be continued until the fourth year, when the trees will first begin bearing, and, after the gathering of each crop, the trees will require to be thinned out from the superabundant branches, their extremities stopped, and the tops reduced to prevent their growing above seven or eight feet in height; the stems, also, should be kept free from shoots or suckers for the height of at least one foot, as well as clear from weeds.

Irrigation must be frequent during the first year that the plants are removed to the plantation, and may be afterwards advantageously continued at intervals during the dry and hot weather, as a very hot season is found unfavorable to the plant, drying up and destroying the top branches and the extremities of the side shoots; whilst, on the other hand, a very long rain destroys the fruit by swelling it out and rotting it before it can be ripened: hence it is necessary to attend to a good drainage of the plantation, that no water be anywhere allowed to lodge, as certain loss will ensue, not only of the crop of the current year, but most frequently of the trees also, as their roots require to be rather dry than otherwise.

The crop will be ready to gather from October to January, when the ripe berries should be carefully picked from the trees by hand every morning, and dried in the shade, the sun being apt to make them too brittle; they must be carefully turned to prevent fermentation, and when sufficiently dry the husks must be removed, and the clean coffee separated from the broken berries. After being picked out and put aside, and then again dried, it is fit to pack. The first year’s crop will be less than the succeeding ones, in which the produce will range from 1/2 a lb. to 1 lb. in each year.—(Simmonds’s “Colonial Magazine,” vol. xv.)

Ceylon.—Coffee is stated to have been introduced into this island from Java, somewhere about the year 1730. It was extensively diffused over the country by the agency of birds and jackalls. In 1821 its cultivation may be said to have partially commenced, and in 1836, it had become widely extended through the Kandyan provinces.

In 1839 not a tree had been felled on the wide range of the Himasgaria mountains. In 1840 a small plantation was, for the first time, formed. In 1846 there were fifty estates, then averaging, each, 200 acres of planted land, and yielding an average crop of 80,000 cwt. of coffee. Every acre is now purchased in that locality, and in large tracts, or there would have been twice the number of estates in cultivation. In 1848, the Galgawatte estate, situate in this range, at an elevation of 4,000 feet, containing 246 acres, of which 72 were planted, was purchased by Mr. R.D. Gerard, for L1,600.

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The quantity of land which had been brought under cultivation with coffee in this island in the ten years previous to the last reduction of duty in 1844, was, in round numbers, 25,000 acres; but so rapid was the subsequent increase, that in the succeeding three years, that extent of land was doubled; so that, in 1847, there were upwards of 60,000 acres of land under cultivation with coffee, giving employment to 40,000 immigrant coolies from the continent of India, and upwards of two millions of capital were invested in the cultivation of this staple.

The quantity of land under culture with coffee by Europeans, was about 55,000 acres in 1851. Allowing 20,000 acres to produce the quantity of native coffee exported, and 5,000 for that consumed in the island, the total extent of coffee cultivation in Ceylon, European and native, will be 80,000 acres.

The produce exported in 1849 was 373,593 cwt., while in the year 1836, when attention was first directed to this island as a coffee-producing country, the crop was not more than 60,330 cwt. Large profits were made by the first planters, more capital was introduced, until, between the years 1840 and 1842, the influx of capitalists, to undertake this species of cultivation, completely changed the face of the colony, and enlarged its trade, and the produce of coffee in sixteen years has increased sixfold.

The general culture resembles the practice in Java. Of the Ceylon coffee, that grown about Ramboddi fetches the highest price, from the superiority of the make, shape, and boldness of the berry. The weight per bushel, clean, averages 56 lbs.; 571/2 lbs. is about the greatest weight of Ceylon coffee. The lowest in the scale of Ceylon plantation coffee is the Doombera, which averages 541/2 lbs., clear, per bushel. The following have been the prices of good ordinary Ceylon coffee in the port of London for the last eight years in the month of January, 1853, 46s. to 48s.; 1852, 40s. to 42s.; 1851, 38s. 6d. to 40s. 6d.; 1850, 56s. 6d. to 57s. 6d.; 1849, 31s. to 32s. 6d.; 1848, 31s. 6d. to 33s.; 1847, 39s. 6d. to 41s. 6d.; 1846, 49s. to 50s.

Forest lands are those usually planted in Ceylon, and the expense attendant on clearing and reclaiming them from a state of nature, and converting them into plantations, is estimated to average L8 per acre. The lowest upset price of crown lands in the colony is L1 per acre.

Coffee planting has failed over a considerable portion of the southern province of the island, where the experiment was tried. The temperature was found to be too equable, not descending sufficiently low at any time to invigorate the plant; which, though growing luxuriantly at first, soon became weak and delicate. Nurseries are established for young plants. The districts in which the coffee is principally cultivated, extend over nearly the whole of the hilly region, which is the medium and connecting link between the mountainous zone and the level districts of the coast.

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The mania for coffee planting has recently subsided, in consequence of the barely remunerative returns at which that article has been sold, ascribable partly to over-production, and in some measure, perhaps, to the temporary glut of foreign coffee thrown on the British market by the reduction of the duty. As regards the yield, some estates in Ceylon have produced upwards of 15 cwt. per acre, but it is a good estate that will average seven, and many do not give more than 4 cwt. the acre.

The shipments from Colombo for five years, are stated below, with the class of coffee:—

	Plantation.	Native.	Total.
	cwt.	cwt.	cwt.
1845	75,002	112,889	187,891
1846	91,240	70,991	162,231
1847	106,198	143,457	249,655
1848	191,464	88,422	279,886
1849	243,926	118,756	362,682
1850	198,997	56,692	255,689
1851	220,471	97,091	317,562

While, in 1839, the total value of the exports from Ceylon was only L330,000, in 1850 the value of the single staple of coffee was no less than L609,262, and in 1851 had still further increased.

I append a memorandum of the quantities of coffee exported from Ceylon since 1836:—

	Quantity.	Value.
	cwt.	L
1836	60,329	
1837	34,164	
1838	49,541	
1839	41,863	
1840	68,206	
1841	80,584	196,048
1842	119,805	269,763
1843	94,847	192,891
1844	133,957	267,663
1845	178,603	363,259
1846	173,892	328,781
1847	293,221	456,624

1848	280,010	387,150
1849	373,593	545,322
1850	278,473	609,262
1851	339,744	

Total in 16 years 2,600,832

Average 162,552 (Ceylon Almanac for 1853.)

The local export duty of two-and-a-half per cent., was abolished from 1st September, 1848.

From these figures it appears that, in a period of sixteen years, Ceylon exported two and a half millions of cwts. of coffee. The consumption of coffee, although for a long time stationary in Britain, now that adulteration is no longer legalised, is likely to increase as rapidly as in other parts of the world; and it appears pretty evident that, so long as anything like remunerative prices can be obtained, Ceylon will do her part in supplying the world with an article which occupies the position of a necessary to the poor as well as a luxury to the rich. The exports of coffee from this colony have, within a few thousands of hundredweights, been nearly quadrupled since 1843, when only 94,000 cwts. were sent away.

Dr. Rudolph Gygax, in a paper submitted to the Ceylon Branch of the Royal Asiatic Society, offered remarks on some analyses, of the coffee of Ceylon, with suggestions for the applications of manures.

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“Having had,” he observes, “my attention drawn to an account of an analysis of the Jamaica coffee berry, made by Mr. Herapath, the Liverpool chemist, I have paid some little attention to the subject of the coffee plant of this island, forming, as it does, so very important a feature in the resources of this colony. The desire that I thus felt for obtaining some information regarding the constituent parts of the Ceylon tree and its fruit, was heightened by a knowledge of the fact, that not a few of those coffee estates, which once gave good promise of success, are now in a very precarious state of production.I much regret that the means at my disposal have not allowed me to carry out any *quantative* analysis, but the result of my labours are sufficiently accurate for my present purpose. I have analysed the wood and fruit of trees from two different localities, as well as the ashes of some plants sent me from the Rajawella estate near Kandy, and they all tend to bear out the result of Mr. Herapath’s inquiries. Placing the substances traced in the coffee plant in the order in which they occur in the greatest quantity, they will stand thus:—

> Lime, potash, magnesia, phosphoric acid, other acids.
>
> Of these lime is by far the most prominent, forming about 60 per cent. of the whole.

I cannot help, therefore, arriving at the conclusion that, to cultivate coffee with any degree of success, the first-named substance must be present in the soil; or, if not present, must be supplied to it by some process.Now it is a singular fact that the rocks and soils of Ceylon are greatly deficient in alkaline matter; and, taking this view of the case, one no longer wonders that many estates cease to produce coffee. That all, or nearly all the plantations did, in their first year or two of bearing, produce liberally in fruit, may readily be accounted for by the fact that the alkaline poverty of the soil was enriched by the burning of the vast quantities of timber which lay felled on all sides. Whilst this temporary supply lasted, all was well with the planter. Heavy rains, and frequent scrapings of the land with the mamotie, or hoe, soon dissipated this scanty supply, and short crops are now the consequence.But nature, ever bountiful, ever ready to compensate for all deficiencies, has provided to our hands a ready means of remedying this evil of the soil, by scattering throughout most parts of the interior supplies of dolomitic limestone. The dolomite of Ceylon is not pure, far from it, being mixed freely with apatite or phosphate of lime. Even in this very accidental circumstance the coffee planter is aided; for the phosphoric acid thus combined with the limestone is the very substance required in addition. Some of the finest properties in the island are situated on a limestone bottom, and these no doubt will continue to yield abundant crops for a very long period.It has been urged against this opinion that in some districts where coffee planting has proved a complete failure, dolomite is found most abundantly; but I have very little doubt that the dolomite here alluded to is only *magnesian* limestone, and which is most inimical to the coffee bush.I am aware that already several manures have been tried on coffee with varying degrees of success. Guano has, I believe, quite failed, and is besides very costly. Cattle manure is said to be effective, and no doubt it is, but it is a costly and troublesome affair. Bones, ground fine, are now being tried, though they cannot but prove most expensive, especially when imported.

A ton of bone dust contains of animal matter, 746 lbs,; phosphates
of lime, &c., 1,245 lbs.; carbonates of lime, &c., 249 lbs.

The virtue of bones lies in the phosphates far more than in the animal matter, and thus their action on soils is felt for many years after their application. The Singalese cultivators of paddy about Colombo and Galle, appear to have been long aware of the fertilizing effects of this kind of manure, and import the article in dhonies from many parts of the coast: they bruise them coarsely before applying them.The partially decomposed husks of the coffee berry have been tried for some years, and successfully, but they are difficult of collection, and bulky to remove from one part of the estate to another.In Europe it would appear that little is yet known as to the causes of the fertilising effects of oil cake: some suppose them to arise mainly from the oil left by the crushing process, but this is not at all clear. I do not, however, see that we must look for much assistance from Poonac as a manure for coffee: for the cocoanut tree it is doubtless most valuable, but we have yet to learn that, beyond supplying so much more vegetable matter, it helps the action of the soil on the roots of the coffee bush, which, after all, is what is really required.For the proper application of the dolomite to land as manure, it should be freely burnt in a kiln, with a good quantity of wood, the ashes of which should be afterwards mixed with the burnt lime, and the whole exposed for several days to the action of the air, sheltered of course from the weather. The mixture should be applied just before the setting in of the monsoon rains: if the land be tolerably level, the lime may be scattered broadcast on the surface, though not quite near the plants. When the estate to be manured is steep, then the substance to be applied should be placed in ridges cut crossways to the descent of the slopes.About one cwt. to the acre would be ample for most lands; some may, however, require more. The contents of the husk pits might advantageously be mixed up with the burnt lime, when a sufficiency of it has been saved.

A planter in Ambagamoe states that he has tried the following remedy for that destructive scourge, the coffee-bug, with great success.

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He applies saltpetre in a finely-powdered state, dusted over the tree when wet with rain or dew. The operation is inexpensive, as a very small quantity suffices, one cwt. being sufficient for nine or ten acres. It can be applied through a bamboo-joint covered with a perforated top, or any equally simple contrivance.

Messrs. Worms' are reported to have found coco-nut oil an effectual remedy.

To sum up the question of manures:—

Poonac, the marc or cake, after the coco-nut oil is expressed, is represented to be a stimulating manure; but is not durable. Lime is an useful application, especially to stiff soils, as the coffee tree contains 60 parts of lime. Bone-dust is an excellent fertiliser, but in Ceylon it is found that it cannot be applied at a less expense than L5 per acre. Cattle manure is the cheapest and most available. Guano does not seem suitable.

Peeling, pulping, and winnowing.—The coffee-peeler, used for separating the bean from the pellicle, was formerly a large wheel revolving in a trough, the disadvantage of which was the flattening more or less of the bean when not thoroughly dry. A new machine has been recently introduced, the invention of Mr. Nelson, C.E., of the Ceylon iron works, by which this evil is obviated; its principle being not weight, but simple friction, of sufficient force to break the parchment at first, and, when continued, to polish the bean free from the husk. A very simple winnowing machine for cleaning the coffee as it comes out of the peeler, is attached. From the winnowing machine it runs into the separating machine, which sorts it into sizes, and equalizes the samples, by which a vast amount of time and manual labour are saved. The same principle is intended to be applied by Mr. Nelson to pulping, which will obviate the injury now inflicted by the grater upon the fresh berry. In spite of the greatest care numbers of the beans in a sample, on close examination, will be found scratched or pecked; and when the closest attention is not paid, or the person superintending the process is devoid of mechanical skill, the injury is proportionate.

The ordinary pulping-mill in use, consists of a cylinder of wood or iron, covered with sheet brass or copper, and punctured similarly to a nutmeg grater. This cylinder, technically called the barrel, runs upon a spindle, which turns a brass pick on each side of a frame. Immediately in a line with the centre upon which it turns, and placed vertical to each other, are two pieces of wood, frequently shod with iron of copper, called "the chops," placed about half an inch apart, or sufficient to allow the passage of "parchment" coffee between them. The lower chop is placed so close to the barrel, yet without contact, that all coffee must be stopped by it and thrown outwards. The upper chop is adjusted to that distance only which will permit the cherry coffee to come into contact with the barrel; but will

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not allow the berries to pass on till they have been denuded of their red epidermis by a gentle squeeze against its rough surface. The far greater portion of the pulps are separated by being carried past the lower chops upon the sharp points of the copper, and thrown out behind, and a few are left with the parchment coffee. As from the different sizes of the berries, and their crowding for precedence as they descend from the hopper above to the gentle embrace of the barrel and upper chop, some pass unpulped, the coffee as it comes from the lower chop is made to fall upon a riddle, which separates the unpulped cherries. These are put back again, and passed through a pulper with the upper chop set closer. The secret of working-appears to be the proper setting of the chops, and many have been the schemes proposed for reducing this to a certainty. Perhaps, after all, few plans are better than the old wedges, by tightening or loosening of which the chop is kept in the required position. Within the last few years, the machine has been considerably improved by being formed entirely of iron, cog-wheels being substituted in the place of straps and drums to move the riddle, and the riddle itself is now formed of two sieves, by which the chance of unpulped berries reaching the parchment is lessened. On some estates, water-wheels have been put up to drive several pulpers at one time, which otherwise would require from two to four men each to work them, but from the costly buildings and appurtenances which such machinery renders necessary, they are rare.

Although the operation of pulping is so simple, it is one which requires the machine to be set in such a way that the greatest quantity of work may be done, or, in other words, the smallest quantity of unpulped berries be allowed to pass through. On the other hand, the berries must not be subjected to injury from the barrel; for if the parchment skin is pricked through, the berry will appear, when cured, with an unsightly brown mark upon it. Several new coverings for barrels, instead of punctured copper, have been tried; among others, coir-cloth and wire net, but the old material is not as yet superseded. After pulping, the coffee in parchment is received into cisterns, in which it is, by washing, deprived of the mucilaginous matter that still adheres to it. Without this most necessary operation, the mucilage would ferment and expose the berry to injury, from its highly corrosive qualities.

As some portion of pulp finds its way with the coffee to the cistern, which, if suffered to remain would, by its long retention of moisture, lengthen the subsequent drying process, various methods have been adopted to remove it. One mode is to pass the coffee a second time through a sieve worked by two men; another to pick it off the surfaces of the cistern, to which it naturally rises.

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In August, 1846, premiums were awarded by the Ceylon Agricultural Society to Messrs. Clerihew and Josias Lambert for the improvements they had introduced into coffee-pulpers, which, by their exertions, had been brought to great perfection. The first improved complete cast-iron pulper received in the island, was made for Mr. Jolly, from drawings sent home by Mr. Lambert to Messrs. B. Hick and Son, engineers. This pulper is one of the most perfect in every respect that has yet been brought into use, the disadvantages belonging to the old machine having been entirely remedied. The sieve crank has a double eccentric action. The chops are regulated by set screws, and the sieve suspended in a novel and secure manner, the whole combining strength and efficacy, together with an elegance of form, which will likewise be appreciated.

Mr. W. Clerihew, of Ceylon, submitted to the Great Exhibition a model of his approved apparatus for drying coffee (which has been patented in the name of Robert R. Banks, Great George Street, Westminster), and received the Isis gold medal for the same. The intention is to dry the vegetable and aqueous moisture of the berry. Before this is required, the coffee has previously undergone the process of pulping, or removal from the soft fleshy husk. Here let Mr. Clerihew describe the advantages for himself—

“When the coffee berry is picked from the tree it bears a closer resemblance to a ripe cherry, both in size and appearance; and several processes have to be gone through before the article known in commerce as coffee is produced. In the first place, the pulpy exterior of the cherry has to be removed by the process of pulping, which separates the seed and its thin covering called the parchment, from the husk. When the pulping process is completed, we have the parchment coffee by itself in a cistern, and the next process consists in getting rid of the mucilage with which it is covered.”

Having become assured, both by experiment and by Liebig’s reasoning, that the successive stages of decomposition were wholly ascribable to the action of the stagnant air which occupies the interstices between the beans, and taking into account that a mass of coffee presented a medium pervious to air, it occurred to Mr. Clerihew that it was possible, by means of fanners, working on the exhausting principle, so to withdraw air from an enclosed space as to establish a current of air through masses of coffee spread on perforated floors forming the top and bottom of that space. The plan he carried into execution at Rathgoongodde plantation in 1849. No sooner was the plan put in operation than, instead of stagnant air occupying the interstices of the beans and gradually acting on them, a stream of air was established and flowing through the mass of coffee, each bean of it became surrounded by a constantly renewed atmosphere of fresh air.

Java.—When Arabia enjoyed the exclusive monopoly of coffee, it could not be foreseen that one day the island of Java would furnish for the consumption of the world from 125 to 130 millions of pounds per annum. The cultivation was introduced by M. Zwaendenkroom, the Governor-General of Batavia, who obtained seeds from Mocha, in 1723. According to official statements the following are the exports.

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In 1839 there were exported 46,781,729 kilogrammes, valued at 48 million florins. Eight years labor, 1833 to 1841, brought its produce of coffee from 12 million kilogrammes annually, up to 55 millions.

In 1846, the exports were 916,876 piculs, but, in 1850 they were only 14,801 piculs. The total coffee crop of Java was in 1850, 1,280,702 lbs.; in 1851, 1,436,171 lbs.; in 1852, 1,229,349 lbs.

&nb
sp;

	1840	1841
Residences in which this produce has been cultivated in 1840 and 1841	20	20
Number of families destined for the labor	470,673	453,289
Trees which have yielded a crop	916,193,894	216,085,600
Trees which have produced the average quantity of a picul of 125 lbs. Dutch	280	248
Quantity of coffee furnished to the godowns in piculs	706,258	877,444
Trees according to the reckoning made in the month of March, 1841 and 1842	336,922,460	329,898,936

The comparative result of this table shows—1st. That, in the year 1841, coffee had been gathered from 20,000,000 more trees than the number in 1840, and that the crop had increased by 171,000 piculs.

2nd. That, in the month of March, 1842, there were above 7 millions less of coffee trees than in 1840. This diminution is merely nominal, seeing that these trees have served to replace those which by their small produce have to be suppressed in the lowlands of the residency of Baylen. On the contrary, the increase of trees, planted from 1839 to 1840, amount to very nearly the same number, of 7 millions.

3rd. That, in the season of 1842, there was planted nearly 20 millions of plants; of which 12 millions are to serve to replace the old trees, and 8 millions are destined to extend this culture. It is calculated that this island will very soon be in a condition to produce a million of piculs or 125 millions more of Dutch pounds of coffee. Previous to 1830, Java scarcely exported as much as 40 millions of pounds.

Cultivation and Preparation of Coffee in Java.—For the following valuable details I am indebted to M. de Munnick, the inspector of the agricultural department, Batavia, as contributed to my "Colonial Magazine" (vol. xi. p. 46).

Soil and Situation.—Elevated lands are found to be those best suited for the growth of coffee in Java. Land situated between 1,000 and 4,000 feet above the level of the sea may be generally said to be adapted to the cultivation of coffee. It must not be taken for granted that all ground of less elevation is unsuited. Suitable ground is to be found lower down, but the cultivation on it is more difficult; the tree gives less fruit, and the plant is less durable. Valleys lying between high mountains are more especially fit for coffee plantations, because the soil which is washed down from the heights affords fresh food continually to the lowlands; the valleys themselves are moist, since the hills surrounding them attract the rain; and they are shut out from severe winds by the same protecting enclosure. The soils best suited to the successful growth of coffee may be classed as follows:—

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Firstly. Cleared forest lands, especially those in which the black leafy, or vegetable mould is found to considerable depth. These are the richest grounds, and will support the coffee plant for many years, and they are also cultivated with the least trouble.

Secondly. Dark brown soils, approaching to black, which, without having much clay in them, appear to the eye to have a mixture of coral. The greater the depth of this coral-like stratum, and of the reddish or deep yellowish soil, the better is the ground for coffee. This kind of land also has sufficient strength and substance to afford nourishment for many years to the plant; but it entails more trouble than the before mentioned soils, because the young plant does not so speedily strike root into it, and sometimes dies, so that provision has to be made against failures.

Thirdly. Reddish and loose ground, such as is generally found in the neighbourhood of volcanic lands. This kind is frequently found well adapted for coffee; it flourishes on such land luxuriantly, but does not last long, as the ground possesses less strength and nourishing substance.[6] By digging in different places we become better acquainted with the nature of the ground, but we may take it as a rule, that rich old forest land on which many larger trees are found, and plains covered with heavy underwood, most frequently offer eligible sites for coffee plantations.

Grounds in which loam is found, and stony soils, are unfit for coffee. But I do not mean by “stony soils” land on which many stones are lying, for on that very account it may be most suitable; but I mean land which shows a pebbly stratum just below the surface, or such as is of a porous, stony nature. In the choice of situation care must be taken to select that which is as much as possible protected against the south-east wind, because its dry influence is very injurious to the coffee plant, and also prevents the growth of the *Erythrina* (known here locally as the Dadap tree) which is so necessary for its shade. Flat grounds, or gentle declivities, are better than steep slopes; yet the latter can be well employed if proper care is taken.

Cultivation.—After the ground has been cleared in the dry season—that is, after the bushes have been rooted out, the undergrowth burnt off, and the thickets removed—-ploughing is commenced in September. When the ground has twice been deeply ploughed, the weeds and roots must be brought together with the rake and carefully burnt. The depth of the ploughing must be regulated by the nature of the ground. In all kinds of cultivation, deep ploughing is recommended, but in Java we ought not to plough deeper than the stratum of fertile soil, as a kind of subsoil may be wrought uppermost injurious to plants, and which, before it can become fertile, must for a year at least have been exposed to the atmosphere.

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The ground having been turned up, should be left exposed for some days to throw off the vapor arising from it; and must then be again ploughed and cleared with the rake. After waiting for some days, it should be ploughed for the fourth and last time, and made as clean and friable as possible. In small plantations this is to be done with the spade, but on large estates the roller must be used. This roller consists of a heavy piece of round wood, eight or ten feet long, to which a pole is fastened in the middle to have oxen harnessed to it. It is drawn slowly over the ploughed land, and presses the clods to earth. To give it greater force, the driver sits or stands upon it.

Before the field has been properly ploughed and rolled in the above way, the middle of October will have arrived, and we then begin to open a path through the plantation from the highest to the lowest point, about two roods broad, and the whole of the land is then divided into separate parcels. Portioning off the estates into divisions of equal size is a system to be much recommended. By this means labor may be equally divided, superintended and inspected. Order and regularity, which are necessary in all things, are most especially required in cultivation on a large scale.

The size of these parcels is regulated by the nature of the estate. On flat or gently declining land they may be greater than on steep grounds, because, in order to prevent the washing away of the soil on precipitous land, the water must be led off by trenches, which of themselves make the divisions of land smaller. On flat ground the divisions may be each 625 square roods, each of which may contain, if planted—

		Trees.
12 feet by 12		625
10 "	10	900
8 "	8	1406
6 "	6	2500

The distance between the coffee bushes cannot be definitely laid down, as it depends on the nature of the soil. On the most fertile forest lands twelve feet by twelve is a good distance. Only on low and meagre grounds, where the tree grows less luxuriantly and strong, can six feet by six be reckoned a proper distance.

Between the divisions a path should be left, one rood in breadth. Along the middle paths and by the side of the divisions drains must be cut, the former two feet in breath and depth, the latter one foot. The drains along the divisions must be cut in such a way as to conduct the rain-water to the larger drains which flank the middle paths. On precipitous ground, when the coffee is planted, small ridges should be raised between the rows, to prevent the rich earth from washing down in the heavy rains. The steeper the land is, the closer these ridges should be; and care should be taken to incline them, so as to break the descent, the direction of which they should in some degree follow.

The first ridges may be made with the branches of the trees which have been felled, or with the rubbish cleared from the ground on the first raking of it.

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Placing the pickets.—When the ground has been worked and divided in the above manner, the pickets are placed. These are slips of bamboo one-and-a-half to two feet long. First—two long canes (which do not stretch like string), each one hundred feet long, are marked off in feet according to the distance at which the planting is to take place; heavy stakes are made fast to each end of them, by which they can be well secured on the ground. At the places where they are marked off in feet, strings are fastened so tightly that they cannot be displaced; and then the canes are laid down and well fixed in the ground, one in the length and the other in the breadth.

Picketing does not give much trouble; it ensures regular planting, and makes the daily inspection simple. The planting thus takes place in straight lines, which give an ornamental appearance, and afterwards renders the view over the whole plantation easy. At every place where a string has been tied, a picket is stuck in the ground; then the cane is removed to another place, and so on till all the estate is marked out by pickets. After the picketing, a hole is made with the spade at every mark; it should be a good foot broad and deep, and the earth inside should be made very fine and clear. The earth is now ready to receive the coffee plant, and the time has only to be waited for when the first rains fully begin.

Nurseries.—In the month of October, or earlier, if coffee trees are near at hand, nurseries must be prepared in the neighbourhood of the land about to be planted. This can be done in the ravines, or, if they are too far from the spot where the plants are wanted, pieces of ground most convenient can be selected. If the ravines are preferred, places must be chosen which are shaded by trees not prejudicial to the coffee plants. On ground where there is no trees, the nurseries may be covered, at the height of four feet, with leaves of jack (*Artocarpus integrifolia*), areca, or other palm trees, in a manner to admit the air.

The ground made loose and fine, coffee plants newly opening, or seeds only, are planted or sown at a distance of four inches square; 500 square roods will in this way furnish 648,000 plants, which are sufficient for an estate of 300,000 trees. Transplanting from nurseries is absolutely necessary in coffee cultivation, and the trouble it costs is always doubly repaid. Having a choice of plants, a person can be convinced he has taken none but healthy trees, and he proceeds therefore with a confidence of success. After the first year, all failures having been nearly replaced, the estate is fully planted, the trees are of regular growth, and no useless clearing is required—a thing which is always necessary in irregular plantations. It is easy also to pick the berries from the trees which are planted with regularity; the work goes on smoothly; and, when the estate has lived its time, it may be abandoned altogether, without leaving patches of living trees here and there, which renders superintendence so very difficult.

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There should always be a plentiful supply of plants, to give an ample choice and to make up for failures. When plants are placed in the nurseries, they should not have more than two offshoots, or leaves, above each other; and when the ball plants are transplanted, they should not be higher than a foot, as large plants always give meagre trees.

At the end of November or beginning of December, if the nurseries are kept free from weeds, and, if necessary, occasionally watered, the plants will be about a foot high, and will have put forth 4 or 5 leaves; they are then just fit to be transplanted. Then, the ground is cloven with the spade, at a distance of an inch and a half round the stem of the plant, to about three inches deep; the plant, with the ball of earth adhering to it, is carefully lifted out of the ground, and the ball is wrapped in a jack, plantain, or other leaf, and tied to prevent the earth falling off; but, before the plants are thus taken from the ground, it must be moistened to make the earth adhesive.

Planting the coffee trees.—The plants, which, after the above operation are called "ball plants," are then placed in a bamboo wicker frame, and are carefully carried by two men to the place where they are to be put into the ground. They are then taken out of the frame and placed in the holes next to the pickets. The pickets are removed, and the plant is fixed upright; the leaf surrounding the ball is made loose, but not taken away; the planter presses the plant down with his hand and fills up the hole with fine loose earth, and the business of planting the coffee tree is finished.

Planting the Dadap tree.—This is a species of Erythrina, probably *E. indica*, or *E. arborescens*; that used for the purpose in the West Indies is *E. Corallodendrum*. In Java, as soon as the coffee is planted, the operation of planting the dadap tree is commenced. The best sort of dadap comes from Serp or Mienyak; it is smooth and broad-leaved, and shoots up quickly. Thick young stems are chosen, about three feet long, and the lower part is pointed off. If the dadap is moist or juicy, it should be cut twenty-four hours before it is planted. The dadap is planted uniformly by measuring the cane in the same way as the coffee itself. Between every two rows of coffee one of dadap is planted, not on a line with the coffee plants, but alternately with them; thus, if the coffee is eight feet by eight, the dadap is sixteen by sixteen. The dadap is planted to the depth of a foot, with somewhat of a westerly inclination, in order that the morning sun may fall on a larger surface of the stick. The ground must be stiffly trodden round the bottom of the stem, and the upper part of it should have some kind of leaf tightly bound around it to prevent the sap from escaping. When the coffee and dadap plants have thus been put out, every fifth day the young plantation should be carefully inspected, and a picket placed wherever there is a failure, as a mark to the planter that a new plant is there required. This operation of replacing failures is carried on all through the wet season, and the dadaps which have not succeeded are at the same time changed.

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Keeping up the estate.—In the first six months after planting, the estate should be cleaned each fortnight with the hoe; the ground being well moved and the weeds taken out. Those weeds which are too close to the plants to be removed in this manner, must be pulled out with the hand. When the plantation is thus wholly or partially cleaned, the earth must be taken off the weeds, and they must be collected and thrown on the pathways.

The weeding in this manner gives at first a great deal of trouble, but it is most advantageous in the long run, as the weeds are thus easily kept down.

Great care must be taken to do away with an old custom of burying the weeds in large holes on the estates. It conduces to bad and slovenly habits, such as cutting off the tops of the weeds by wholesale, and thus giving the plantation an appearance of cleanliness, whilst it, in fact, is as dirty as ever. This is soon discovered by the weeds showing themselves again above ground in a very few days, and even if they rot under ground, they breed insects which are very hurtful to the bushes, and the seeds vegetate.

After the first six months, this weeding will be sufficient if it takes places once a month, but this must be persevered in till the third year, when there may be a much greater interval between the weeding. When the trees are coming to full growth, the hoe should be less frequently used in cleaning; the hand must be used to the full extent to which the branches reach, as the roots of the tree spread to a like distance, and if they are injured the growth of the tree is prejudiced.

The well-being of an estate chiefly depends on frequent cleaning of the plantation in the beginning. The idea of some persons that cleaning in the dry season is of little consequence, must be given up, as it is principally at that very time that it is extremely profitable to remove and clear the ground round the trees in their growth. In the first place, this destroys the weeds which take the nourishment away from the trees; secondly, the ground is rendered more open to receive the slight showers and dews which moisten it, and to benefit by the influence of the air; the roots are thus considerably refreshed. The dew falling on ground which has been recently moved, penetrates at once into it, and does good to the plant; but if it falls on the weeds, the first rays of the sun absorb it, and deprive the tree of this source of refreshment.

The dadap is to be taken care of whilst clearing goes on; it must be cropped so as to cause it to grow upright, and to throw as much shade as possible on the coffee without pressing upon it.

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In warm fertile ground, where the coffee plant grows rapidly, the trees should be topped in the third year; but this should be done sparingly, and as a general measure it is not to be recommended; it should be resorted to only as a means to prevent the too rapid growth of the tree, or its running up to a point. Topping and taking off suckers are both necessary on meagre soils, where the trees run much to wood; and it prevents the trees being injured in the picking season, which often occurs without this precaution. The top or middle stem is broken off at a height of six or seven feet, but care must be taken not to tear the tree; when the top shoots out again it must be cropped a second time, and it is seldom necessary to do this more than twice. The cropping causes the tree to shoot out in breadth, and to push forth a greater number of sprigs, and good strong ones.

Picking coffee.—When the estate becomes productive, it must in the picking season, just before the work begins, be kept exceedingly clear of weeds, and be even swept clean with brooms, in order that the berries which fall off may be gathered up.

The picking should take place under proper superintendence, the trees be picked row by row, and care taken that each berry is plucked off separately, and not a heap together, by which the trees are torn and the first offshoots prevented. In picking high trees, light ladders should be used, made out of two or three bamboos tied together.

Customary preparation of the berry in the pulp.—When the coffee is picked and brought into the village, it is piled up in a heap in the open air, and left in that manner for twenty-four hours. Thus heaped up it gets warm, and this creates a certain fermentation of the juice which is in the berry. That fermentation promotes the drying and loosens the silvery pellicle which is attached to the bean inside the parchment, and which cannot be entirely got rid of in any other way. Coffee which still retains that pellicle is called in trade “grey coffee,” and is lower priced than good clean sorts. After the fermentation, the coffee is spread out in rather thick layers, and turned over twice a day. If it rains during this first spreading out, the coffee does not require to be sheltered, as the washing causes the juicy substance to evaporate, and this accelerates the drying afterwards.

In proportion as the coffee becomes dryer, the thickness of the layer must be reduced, and the turning over must be more frequent till the coffee is quite dry outside and the pulp has become hard.

Then the coffee is laid out on drying floors, which can be easily and speedily covered in rainy or damp weather, and is dried by the powerful heat of the sun.

This system of drying in the pulp requires six weeks or two months, as it is advisable not to be over hasty with drying.

When the coffee is entirely dry, it is either at once pounded or placed in the stores to await that operation. In order to know if the coffee be sufficiently dry, take a handful of it and shut your hand close; shake it to your ear, and listen if the beans rattle freely in the pulp. Or try them by biting the berry, and see if the bean and pulp are both brittle and crisp, which shows that the fruit is dry enough.

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Preparation of the coffee in the parchment, or the West India system.—Only sound and fully ripe beans can be prepared in the West India manner. In picking, therefore, all unripe, green, or unsound beans must be taken away to dry in the pulp. As soon as the coffee is brought in, it must be pulped. This operation is performed by means of small peeling mills. These mills consist of two horizontal wooden cylinders rubbing on a plank; they are covered with hoop-iron, and set in motion by a water-wheel. The coffee is driven under the cylinder, and kept constantly moist; by being turned through the mill, the pulp is so bruised that the bean in the parchment falls from it into the bamboo open frame, which is placed in front of the mill. The coffee is then pressed with the hand, and falls through the frame into a basket. The pulp, and beans not rid of the pulp, remain on the frame; the first is cleared away, the rest passes a second time into the mill, and this operation is continued till all the coffee is stripped of the pulp, and the parchment beans are in the basket. When the parchment coffee is thus separated from the outer skin, it is thrown into the washing troughs, and remains there for twenty-four hours; this drains from it the slimy substance adhering to it. After being thus steeped, it is washed with pure water two or three times in the basket, so that it becomes quite free from slimy matter. The parchment coffee is then spread out on drying frames, and exposed for six or eight days to the heat of the sun, till the outside is perfectly dry. To do this equally it must be stirred about every hour. These frames, which serve also to dry the coffee in the pulp, are made as follows:—A bamboo roof is set up, resting on four wooden pillars, and sloping considerably; it is covered closely with reeds; its length is ten feet, its breadth six feet; the pillars are from nine to ten feet high; a wooden framework is attached to this, about thirty feet long, or three times the length of the space covered by the roof. On this frame are brought out three platforms, one above the other, which are pushed out by means of little rollers under them; they are ten feet long by six broad, and six inches deep. The borders are of wood, and the bottom of platted bamboo. In rainy weather, or when the drying cannot go on, the three platforms are pushed under the covered space. These drying places are set up near the overseer’s dwelling, where they stand free, and are not shaded by trees or buildings. After this first drying on platforms, the parchment coffee is again dried inside the house, and bamboo huts are for this purpose erected on each side of the outhouse of the planters. These huts have trays, divided into two or three compartments, one above the other, to keep the coffee separate, according to the time of its having been picked. The parchment coffee is spread out as thin as possible, and turned over with a small wooden rake every hour.

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In proportion to the dryness of the weather, from one to two months are required to dry the coffee fully. In drying inside the houses, the greatest care must be taken to prevent heating the coffee; this is the great object of the West Indian system, as such heating is very prejudicial. On this account the huts in which the platforms are placed must be very airy, so that the wind may have good play among the trays, on which the coffee must be thinly spread and frequently turned.

Pounding.—Coffee in the pulp, as well as that in the parchment, must, before being pounded, be exposed for some hours to the sun to make it crisp and hard; but it must be allowed to cool again before the pounding begins, or the beans will be liable to be broken.

The pounding is done in small baskets of a conical form, two feet high, at the top eighteen inches in diameter, and at the bottom one foot. These baskets are, up to one-third of their height, thickly woven round with coir, and fastened on the ground between four thick bamboo poles, and with the bottom half an inch in the ground itself. The coffee is pounded by small quantities at a time with light, wooden pestles; the baskets must not be more than half full. When the coffee is sufficiently pounded, the basket is lifted from between the poles and the beans are thrown into sieves, on which it is cleaned from skin, and white, black, or broken beans. According to the West Indian system, the coffee must now be instantly put in bags, to preserve its greenish colour, which is very peculiar. If the green coffee is not instantly sent to the packing stores to be bagged, it must be put up in a very dry place, and be turned over once every day, to prevent heating, which damps and discolors the berry.

Coffee is grown to some extent in Celebes—the average crop being from 10,000 to 12,000 piculs of 133 English pounds. The production has rather fallen off than increased during the last few years. The whole of the coffee grown must be delivered by the inhabitants to the government exclusively, at twelve copper florins per picul. It is much prized in the Netherlands, and maintains a higher price in the market than the best Java coffee. As the treatment of the product in Java differs wholly from that which is in vogue in Celebes, and this, in our eyes, is much inferior, I know not whether the higher price is ascribable to the name, or to an intrinsic superiority in quality. It is certain that this cultivation is susceptible of much improvement, and might be advanced to a much higher condition.

From tables given by M. Spreeuwenberg ("Journal of the Indian Archipelago," vol. ii. p. 829) of the quantity of coffee delivered from each district of this island, for the years 1838 to 1842, it appears that the average annual delivery of coffee was 1,288,118 lbs.

Of the production of Sumatra I have no details, but a very fair proportion is grown there—about five million pounds.

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Production of America and the West Indies.—The cultivation of the coffee plant is largely carried on in South and Central America and the West India Islands.

Its culture has greatly increased within the last few years in Venezuela, particularly in the valleys and on the sides of the hills. The exports from La Guayra, in 1833, were about twelve millions of pounds, being nearly double the quantity exported in 1830. The price there is about ten dollars the 100 lbs., which is still too high to enable it to enter into competition with the produce of Brazil or Cuba.

The total produce of coffee in Venezuela in 1839 was 254,567 quintals. The quintal is about 10 lbs. less than the English cwt.

La Guayra.—The exports of coffee from this port in 1796, were 283 quintals.

	Quintals.
1843	164,066
1844	141,934
1845	134,585
1846	175,346
1847	130,671
1850	179,537

The exports of coffee from La Guayra have been declining within the past few years; the shipments were but 153,901 quintals in 1851, and only 124,623 in 1852.

Caracas coffee ranks in our market with good ordinary St. Domingo.

The decline in the produce of coffee in the British West India possessions has been very great. In 1838, we imported from the West India Islands and British Guiana 171/2 million pounds of coffee, in 1850 we only received 41/4 million pounds from thence. The shipments from Jamaica have decreased from about 15 million pounds in 1836, to 4 million pounds in 1850; Berbice and Demerara, from 5 million pounds in 1837, to about 8,000 pounds in 1850.

Production of coffee in the Brazils.—Forty-two years ago the annual crop of coffee in Brazil did not exceed 30,000 bags, and even in 1820 it only reached 100,000 bags. About that time the high price of coffee in England, superadded to the diminished production in Cuba, stimulated the Brazilian planters to extend its cultivation, and in 1830 they sent to market 400,000 bags, or 64,090,000 lbs., and in 1847, the enormous quantity of 300,000,000 lbs.

It would seem from the annexed figures that the production of coffee in Brazil doubled every five years, up to 1840, since when it has increased eighty per cent. The increase since 1835 has been upwards of two hundred millions of pounds, and of that increase the United States have taken one half.

	lbs.
1820	15,312,000
1825	29,201,600
1830	62,685,600
1835	100,346,400
1840	170,208,800
1850	303,556,960

The sources from whence the United States derives its supplies of coffee are shown in the following table:—

Years. Brazil. Cuba. St. Domingo. Java. Total 1835 35,774,876 29,373,675 19,276,290 4,728,890 103,199,577 1840 47,412,756 25,331,888 9,153,524 4,343,254 94,996,095 1845 78,553,616 1,157,794 13,090,359 3,925,716 108,133,369 1850 90,319,511 3,740,803 19,440,985 5,146,961 144,986,895 1851 107,578,257 3,009,084 13,205,766 2,423,968 152,453,617

Coffee, up to 1830, paid a duty in the United States of five cents a pound. Since 1832 it has been free.

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The population of the United States in 1840 was, in round numbers, seventeen millions; the average consumption of coffee for the three years ending 1841, 981/2 millions of pounds, which gave a consumption of 53/4 lbs. per head. The average for the three years ending 1850, was 143 millions of pounds, and the population was twenty-three millions, which gave a consumption of 61/4 lbs. per head. In 1830 the consumption was only 3 lbs. per head; but the price ruled nearly double what it was in the three years preceding 1850.

In 1821 the consumption per head, to the inhabitants of the United States, was 1 lb. 4 oz. In 1830, the proportion had increased to 3 lbs. per head, the foreign price having fallen fifty per cent. The importation in the year 1831 doubled, in consequence of the reduced duty; and the consumption per head for the four years ending with 1842, averaged 6 lb. per head, having quadrupled to each inhabitant since 1821. From 1820 to 1840, the Brazilian product increased 1,100 per cent, or 155 million pounds. In the same time the consumption in the United States increased 137 million pounds; leaving an increase of eighteen million pounds of Rio coffee, besides the enhanced products of all countries, to supply the increased consumption of England and Europe.

The consequence of the duty in England is, that while the United States, with a population of seventeen millions, consumed, in 1844, 149,711,820 lbs. of coffee, Great Britain, with a population of twenty-seven millions, consumed 31,934,000 lbs. only, or less than one-fourth the consumption of the United States. In 1851 the figures remained nearly the same, *viz*., 148,920,000 lbs. in the United States, and 32,564,000 lbs. for Great Britain.

The cultivation of coffee forms the present riches of Costa Rica, and has raised it to a state of prosperity unknown in any other part of Central America. It was begun about fifteen years ago; a few plants having been brought from New Granada, and the first trial being successful, it has rapidly extended. All the coffee is grown in the plain of San Jose, where the three principal towns are situated—about two-thirds being produced in the environs of the capital, a fourth in those of Hindia, and the remainder at Alhajuela, and its vicinity. The land which has been found by experience to be best suited to coffee is a black loam, and the next best, a dark-red earth—soils of a brown and dull yellow color being quite unsuitable. The plain of San Jose is mostly of the first class, being, like all the soils of Central America, formed with a large admixture of volcanic materials. Contrary to the experience of Java and Arabia Felix, coffee is here found to thrive much better, and produce a more healthy and equal berry on plain land, than upon hills, or undulating slopes, which doubtless arises from the former retaining its moisture better, and generally containing a larger deposit of loam.

I am inclined, in a great measure, to attribute the practice of sowing coffee in sloping land in Java to this fact, that the plains are usually occupied by the more profitable cultivation of sugar-canes. In Arabia, the plains are generally of a sandy nature (being lands which have, apparently, at no very distant geological period, formed the bed of the sea), which may account for the plantations existing only upon the low hills and slopes.

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A coffee plantation in Costa Rica produces a crop the third year after it is planted, and is in perfection the fifth year. The coffee trees are planted in rows, with a space of about three yards between each and one between each plant, resembling in appearance hedges of the laurel bay. The weeds are cut down, and the earth slightly turned with a hoe, three or four times in the year; and the plant is not allowed to increase above the height of six feet, for the facility of gathering the fruit. The coffee tree here begins to flower in the months of March and April, and the berry ripens in the plains of San Jose in the months of November and December, strongly resembling a wild cherry in form and appearance, being covered with a similar sweet pulp.

As soon as the crimson color assumed by the ripe fruit indicates the time for cropping, numbers of men, women, and children are sent to gather the berry, which is piled in large heaps, to soften the pulp, for forty-eight hours, and then placed in tanks, through which a stream of water passes, when it is continually stirred, to free it from the outer pulp; after which it is spread out on a platform, with which every coffee estate is furnished, to dry in the sun; but there still exists an inner husk, which, when perfectly dry, is, in the smaller estates, removed by treading the berry under the feet of oxen; and in the larger, by water-mills, which bruise the berry slightly to break the husk, and afterwards separate it by fanners. The entire cost of producing a quintal (101 1-5 lbs. British) of coffee, including the keeping of the estate in order, cleaning and fanning the plants, and gathering and preparing the berries, is, at the present rate of wages (two rials, or about a shilling per day), calculated at two and a half dollars (equal to ten shillings); but the laborers are now hardly sufficient for working all the estates which are planted, so that the price may probably rise a little, though the present rate of payment enables the natives to live much better than has been their wont.

The coffee tree bears flowers only the second year, and its blossoms last only 24 hours. The returns of the third year are very abundant; at an average, each plant yielding a pound and a-half or two pounds of coffee.

The price of coffee in San Jose during the months of February, March and April, after which none can generally be met with, was, in 1846, about 5 dollars cash per quintal, the duty (which is collected for the repairs of the road) one rial more, so that the speculator makes at least ten rials, or about 20 per cent., by purchasing and sending the coffee to the port, on his outlay and charges; but it is often bartered for manufactured goods, and is also purchased before-hand, half being paid in imports and half in cash to the grower.

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The largest coffee estates of Costa Rica are possessed by the family of Montealegre and Don Juan Moira. The principal of these I have examined. They appear to be very carefully and judiciously managed, possessing good mills for cleaning and husking the coffee, worked by water power; and annually producing 500 tons. The entire produce of the year 1836, amounted to about 3,000 tons, and the crop of 1847 exceeded 4,000 tons, near which quantity it will probably continue, till the population gradually increases, the laborers, as already mentioned, being barely sufficient for the present cultivation. As the value at the present average price in the English market of 50s. a cwt., will give L200,000, the produce of the district will appear pretty considerable for a petty American State, possessing only 80,000 inhabitants, and just emerging from a half-savage condition.—(Dunlop's "Central America.")

The cultivation of coffee on the plains of San Jose, in Costa Rica, according to Stephens, has increased rapidly within a few years. Seven years before, the whole crop was not more than 500 quintals, and in 1844 it amounted to 90,000.

Don Mariano Montealegre is one of the largest proprietors there, and had three plantations in that neighbourhood. One, which Mr. Stephens visited, contained 27,000 trees, and he was preparing to make great additions the next year. He had expended a large sum of money in buildings and machinery; and though his countrymen said he would ruin himself, every year he planted more trees. His wife, La Senora, was busily engaged in husking and drying the berries. In San Jose, by the way (he adds), all the ladies were what might be called good business-men, kept stores, bought and sold goods, looked out for bargains, and were particularly knowing in the article of coffee.

The coffee at Surinam is suffered to grow in three stems from the root, and when one of them does not produce plenty of berries, it is cast away, and the best shoot in appearance next the root is allowed to grow in its room. The trees are not permitted to rise higher than about five feet, so that the negroes can very easily pluck the berries, for gathering which there are two seasons, the one in May, or the beginning of June, and the other in October or the beginning of November. The berries are often plucked of unequal ripeness, which must greatly injure the quality of the coffee. It is true when the coffee is washed, the berries which float on the water are separated from the others; but they are only those of the worst quality, or broken pieces, while the half-ripe beans remain at the bottom with the rest. Now, in the description I have given of the method of gathering coffee in Arabia, it is seen that the tree is suffered to grow to its natural height, and the berries are gathered by shaking the tree, and making them fall on mats placed for them. By this way the Arabians harvest only the beans perfectly ripe at the time,

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and which must give the coffee a more delicate flavor. A tree will yield each time on an average from 1 lb. to 11/2 lb. of coffee, when pulped and perfectly dried. An acre of land planted with coffee, when favored by the weather, becomes more profitable than when it is planted with sugar canes; but its crops are always very precarious, as the blossoms, and even the berries, are sometimes damaged by the heavy rains, which are much less injurious to sugar canes; wherefore a planter feels himself best secured in his revenue, as soon as he can cultivate them both.

Nothing can exceed the beauty of the walks planted with coffee trees, from their pyramidical shape and from their glossy dark green leaves, shining with great brightness, amongst which are hanging the scarlet-coloured berries. Mr. Baird, in his “Impressions of the West Indies,” thus speaks of a coffee plantation:—

“Anything in the way of cultivation more beautiful, or more fragrant, than a coffee plantation, I had not conceived; and oft did I say to myself, that if ever I became, from health and otherwise, a cultivator of the soil within the tropics, I would cultivate the coffee plant, even though I did so irrespective altogether of the profit that might be derived from so doing. Much has been written, and not without justice, of the rich fragrance of an orange grove; and at home we ofttimes hear of the sweet odors of a bean-field. I have, too, often enjoyed in the Carse of Stirling, and elsewhere in Scotland, the balmy breezes as they swept over the latter, particularly when the sun had burst out, with unusual strength, after a shower of rain. I have likewise, in Martinique, Santa Cruz, Jamaica, and Cuba, inhaled the gales wafted from the orangeries; but not for a moment would I compare either with the exquisite aromatic odors from a coffee plantation in full blow, when the hill-side—covered over with regular rows of the tree-like shrub, with their millions of jessamine-like flowers—showers down upon you, as you ride up between the plants, a perfume of the most delicately delicious description. ’Tis worth going to the West Indies to see the sight and inhale the perfume.”

The decline in the quantities of coffee drawn from the “West Indies to supply the great demand, is manifest in the following summary of imports from those islands:—

lbs.
In 1828 they exported about 30,000,000
1831 the imports from British West Indies were 20,017,623
1841 Ditto Ditto 9,904,230
1850, the last year in which distinct accounts 4,262,225
were kept

Decrease from 1831 15,755,398

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Jamaica.—The coffee plant was first introduced into Jamaica by Sir Nicholas Lawes, in 1728, when it was cultivated on an estate called Temple Hall, in Liguanea, not far from Kingston. In 1752 there were exported 60,000 lbs.; and in 1775, 44,000 lbs. Until 1788 little attention was paid to this product. In the four years ending 30th September, 1794, the average exportation of coffee was 1,603,000 lbs.; in 1804 it amounted to 22,000,000 lbs.; and during the three years ending 30th September, 1807, the average annual exportation was more than 28,500,000 lbs.; which, at L6 per cwt., its cost in Jamaica, produced more than L1,700,000. It is calculated that L20,000,000 was invested in coffee estates. The coffee plant thrives in almost every soil about the mountains of Jamaica, and in the very driest spots has frequently produced abundant crops. In 1844 there were 671 coffee plantations in the island. Coffee is grown in the vicinity of the Blue Mountain Peak at a height of 4,700 feet above the level of the sea, and some of the finest and most productive plantations are in this locality. The branches of a coffee tree, on Radnor estate, covered, in 1851, a space of thirteen feet in diameter, and the tree was about thirteen years old.

In 1789 Hayti exported 77,000,000 lbs. of coffee, but in 1826 it had declined to 32,000,000 lbs., in 1837 it was 31,000,000 lbs., and the shipments of this staple are now very inconsiderable.

In the West Indies, I speak principally of Jamaica, where my experience extended, the soil best adapted for the cultivation of coffee is found to be loose gravelly or stony. A rich black mould will produce a luxuriant bush, which will yield little fruit. Decomposing sandstone, and slate, known in Jamaica as rotten rock, mixed with vegetable mould, is one of the most favorable soils. The subsoil should be also carefully examined by a boring augur, for a stiff moist clay, or marly bottom retentive of moisture, is particularly injurious to the plant. A dark, rusty-colored sand, or a ferruginous marl on a substratum of limestone, kills the tree in a few years. In virgin lands, after the wood has been felled and cleared, the land is lined off into rows of from six to seven feet square, and at each square a hole is made about eighteen inches deep, into which the young plant is placed and the earth plied gently about it, leaving from six to eight inches of the plant above ground.

Nurseries for raising plants from seeds were formerly made, but for many years this has been neglected, and plantations are set out now from suckers which are drawn and trimmed of their roots, and cut about two feet long.

The young plants require to be kept well clear from weeds, and four cleanings in the year may be deemed necessary, the plants which have failed must be supplied in order to ensure uniformity of appearance.

All manure, whether fluid or solid, in warm climates should be applied in wet seasons, where it is not practicable to dig or turn it in to prevent the escape of its volatile and nutritive principles.

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As respects situation, coffee thrives best on elevated situations, where the morning sun has most influence; and on lower mountains, where the temperature is higher, in situations facing the south-east, or where the sun does not act with such intensity. Low mountains, in which the thermometer ranges from 75 to 90 degrees Fahr., as well as those exposed to sea breezes, are less suitable for the cultivation of coffee than those districts where the temperature averages 65 to 80 degrees Fahr., and situated at higher elevations in the interior.

As a general rule, it may be asserted that the elevation best adapted for coffee is at an altitude ranging from 2,000 to 4,000 feet, at a temperature from 70 to 75 degrees Fahr. A west or south-west aspect is the best, and the field should be well sheltered from the north breezes. As a general rule in planting in light soils and high temperatures, trees may be placed at the distance of four or five feet, while in stronger soils and lower temperatures the average distance would be from five to seven feet.

Topping.—The young tree shoots out its lateral branches at each joint, which follow in regular succession, till the tree attains the height of about four feet six inches, when it is usual to top it down to four feet. But care should be taken that the wood has ripened, which is known by its assuming a brown and hard appearance, This strengthens the vegetation of the branches, which begin to throw out buds, and these shortly form collateral branches; in the course of eighteen months after the tree will have arrived at its bearing point. Trees, after being topped, throw off suckers, which are called gormandizers, from each joint, but more especially at the head. They should be plucked off with care, but not cut, as the sap would flow more readily if cut.

In pruning, one of the main objects is the admission of a free circulation of air and light through the branches to the root of the tree. No general rules can be laid down for pruning; much must depend on judgment, experience, and a nice eye to appearance and preservation of primary branches for bearing and ripening wood for the ensuing year, as well as to regulate and proportion the size of the tree to the functions of the roots in supplying sustenance, and the convenience of picking the berries when ripe. Every old bough which has seen its day, every wilful shoot growing in a wrong direction, every fork, every cross branch or dead limb, must be cut away.

The blossoming, and ripening of the fruit varies according to the situation and temperature of the plantation. In low and hot situations, where the thermometer ranges from 78 to 90 degrees, the tree shows its first blossoms when about two-and-a-half years old. In higher and colder situations the tree will not blossom in profusion until the fourth or fifth year. If there be light showers, the blossoms will continue on the tree for a week or more,

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and by the setting of the blossoms the planter can determine what germs will become fruit. The trees will blossom in low situations as early as March, but the April bloom is considered the most abundant. In higher elevations, the trees will bloom even so late as August or September. In warm climates the fruit advances as rapidly, and in a month will have attained the size of a pea; in more elevated and colder localities, it will take two months to arrive at this stage. The fruit will be ripe in from six to eight months after the blossom has set; it ripens in warm districts about the month of August, while in others the crop will not be mature till February. An acre will usually contain 1,200 trees in Jamaica, and the produce would be about 400 lbs. of coffee an acre, or six ounces as the produce of each tree annually. In some instances, but very seldom, one pound a tree may be obtained. A bushel of cherry coffee will produce about ten or twelve pounds of merchantable coffee.

The coffee berry, after being pulped and soaked for a day and night to free it from the mucilage, is spread out on barbacues to dry; in ten or twelve days, if the weather has been good, it will be sufficiently cured for the peeling mill.

Mr. W.H. Marah, of Jamaica, in a Prize Essay on the Cultivation and Manufacture of Coffee in that Island, published in my “Colonial Magazine,” makes some useful remarks: —

The manufacture of this staple commodity, with a view to its improvement in quality, is a subject which demands our serious attention; and when we observe the vast importance and pecuniary advantage which accrue upon the slightest shade of improvement either in colour or appearance, it becomes the more imperative on us to use all those means which are available, in order to place ourselves on a footing with the foreign grower. It is true that we are unable to enter the contest with the East Indian or slave cultivator, from the abundance and cheapness of labour which is placed at their command; but by means of our skill and assiduity, we can successfully compete with them by the manufacture of superior produce.To this portion of plantation management I have given an attentive inquiry, and shall shortly proceed to state my views on the system best adapted to the curing and preparing for market of good quality produce.The fruit should be gathered in when in a blood-ripe state, to all appearance like cherries. The labourers are principally accustomed to reap the crop in baskets, of which they carry two to the field; and when the coffee is bearing heavily, and is at its full stage of ripeness, the good pickers will gather in four bushels *per diem*, and carry the same on their heads to the works.The fruit is then measured and thrown into a loft above the pulper in a heap. It should be submitted to the first process of machinery, the pulper, within twenty-four hours after, if

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not immediately; but it not unfrequently happens that the manager is unable to pulp his coffee for two and sometimes three days, by which time fermentation ensues, and it becomes impossible after pulping to wash off the mucilage, which rather adheres to the outer envelope of the berry, and gives the produce what is termed a “red” or “blanketty” appearance when spread out on the barbacues. The produce is let down by means of a small hole cut into the floor of the loft, or a floating box, into the hopper of the pulper, and by means of a grater forcing the fruit against the chops, the berries are dislodged from the pulp and fall upon a sieve, which being shaken by the machinery, lets the berries fall into the cistern, whilst the grater catches the pulp and carries it backwards at each evolution of the roller, around which it is encircled.The fruit which might have passed through without being more than half squeezed, and having only ejected one berry, is then returned (after being shaken off by the sieve) into the hopper, to undergo the process a second time. The pulped coffee is then permitted to remain in the cistern for a day and a night, during which period it undergoes a process of fermentation; it is then washed out in two or three waters, and the whole of the mucilaginous stuff which had risen from the berry by the fermentation is entirely washed off, and the coffee presents a beautiful white appearance. From this the produce is turned out to drain on a barbacue, sloped so as to throw all the water to the centre, where a drain is placed to carry it all off.In an hour or so after, the coffee may be removed to the barbacues for curing; it is there spread out thinly and exposed to the sun, which, if shining strong, will in eight or nine hours absorb all the water, and the coffee be fit for housing that day. I say fit for housing, because I have repeatedly seen coffee washed out early in the morning and put up the same evening. I cannot say I approve of the system, though in fine weather it has been attended with success. From the time the coffee is first exposed to the sun till the silver skin starts, is the stage, in my opinion, during which the produce suffers most injury. In the first instance, it should be kept constantly turned, in order to get the water absorbed as early as possible; and after it has been housed, the greatest precaution should be taken to prevent its heating: and it is for this reason that I disapprove of early housing, for if wet weather should intervene, and the coffee cannot be turned out, it is sure to get heated. From this neglect I have seen a perfect steam issuing from the house in the morning when the doors have been opened; and I have known, as a natural consequence, the adhesion of the silver skin to the berry so firm, that it could not be removed by a sharp penknife without slicing the berry.In a succession of wet weather the produce has remained on the barbacues for several weeks, without the slightest advance in curing; and, unless it be frequently turned while in this wet state, it is sure to germinate; the berries first swell, then a thin white spire issues from the seam, and on opening the berry the young leaves will be actually seen formed inside, so rapid is the course of vegetation.I am of opinion that coffee should not be housed till the silver skin begins to start, when no danger can ensue; for if a few wet days should intervene, by turning the coffee over in the house, and allowing a current of air to pass through it, it will keep for weeks. It is at this stage that the parchment skin begins to show itself, for at first it adheres to the inner kernel, but the heat of the sun starts it from its hold and it separates; thus, on shaking a handful of the produce it will be heard to rattle, a sure indication that the silver skin has risen from the bean, without even threshing it to ascertain the fact. The bean is perfectly white till the silver skin starts; it then begins gradually to assume the dark, or what is called the half-cured appearance. A good day’s strong sun will then half cure it, and by subsequent exposure the produce takes another stage, and gradually loses the half-cured, and assumes a blue colour; and when the produce is properly cured and fit for the mill, not the slightest dark spot will be perceptible in the bean, but it will exhibit a horny blue colour.It is within my observation that coffee has been gathered from the field on the Monday, and prepared for market on the Saturday, in a spell of dry weather; but I have known it also to lie on the barbacues for as many weeks in contrary weather, before it had gone through the same ordeal. With good weather and smooth terraces whereon to cure, nothing but gross ignorance and unpardonable carelessness can produce a bad quality of coffee. The difficulty arises in wet weather, when one’s skill and assiduity is called into action to save the produce from being spoiled. After coffee has been half-cured, the putting it up hot at an early period of the day has the effect of curing it all night. I have noticed produce housed in this manner, and requiring another day’s exposure to fit it for the mill, found perfectly cured next morning.The barbacues should be kept in good order—all ruts and holes neatly patched every crop, for to them and other roughnesses is to be attributed the peeling of the berries, their being scratched, and various injuries which the produce sustains. And while on the subject of “Works,” I cannot help noticing the extreme carelessness and inattention which, on visiting properties, the works and buildings present to our view. It is utterly impossible to manufacture good produce unless the machinery and buildings are kept in good order; and the parsimony which is thus displayed in this necessary outlay is fallacious,

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when one thinks of the result of one or two shillings per 100 lbs. lost on a crop through this neglect.When the coffee is perfectly cured—which is generally ascertained by threshing out a few berries in one’s hands, and seeing if it has attained its horny blue colour—it is then fit for milling, which is the second process of machinery which it has to undergo. Here the parchment and silver skins are dislodged from the berry, by means of the friction of a large roller passing over the produce in a wooden trough. It is then taken out of the trough, and submitted to the fanner or winnowing machine, when the trash is all blown away, and the coffee, passing through two or three sieves, comes away perfectly clean and partially sized. From this it is again sieved in order to size it properly, hand-picked, put into bags, and sent on mules’ backs to the wharf. It is then put into tierces and sold in the Kingston market, or shipped to Britain.A variety of circumstances tend to injure the quality of the coffee, which it is beyond human agency to control. Dry weather intervening at the particular period when the berry is getting full, subjects it to be stinted and shrivelled; and strong dry breezes happening at the same period, will cause an adhesion of the silver skin which the ordinary process of curing and manufacture will not remove. Late discoveries in the latter have, however, shown the possibility of divesting the produce of that silvery appearance, when brought about under the foregoing circumstances. It is almost, unnecessary to state that this improvement in manufacture refers to the inventions of Messrs. Myers and Meacock, whose respective merits have already undergone public revision. In reference to Mr. Myers’ plan of immersing coffee in warm water, I may be allowed to state that it has come under my own observation, that produce which had previously been heated through some carelessness in the curing, subsequently was exposed to a slight sprinkling of rain, and when ground out and fanned, was found to have lost its silvery appearance.To the invention of Mr. Meacock, a preference has, however, been given, in consequence of the impression that the produce thus immersed in water will absorb a portion of the liquid, which will deteriorate its quality in its passage across the Atlantic. Several gentlemen have shipped coffee submitted to this process to England, but I have not learnt the result.It appears very manifest that a great deal might be done in the way of machinery, to relieve produce of that silvery or foxy appearance which is so prejudicial to its value in the British market, and which appearances might accrue from a variety of incidents to which all plantations are more or less subject.A manifest preference is given in the leading European markets to coffee which has gone through the pulping and washing process; but, strange

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to say, the consumers of this beverage are totally ignorant of the fact, that the produce which is cured in the pulp furnishes a stronger decoction than an equal quantity of the same which has undergone the other process. Many persons are of opinion that the mucilaginous substance which is washed off in pulping is absorbed by the bean when cured in the pulp, and which gives strength to the produce and enhances its aromatic flavour. On most properties it has been customary to cure the remnants of the crop in this way, for the use of the plantation; and it has been well noticed by great epicures in the flavour of the decoction, that the coffee thus cured produced the strongest and best beverage."

Trinidad.—The coffee plant does not succeed well in Trinidad, the tree giving but little fruit, and perishing at the end of ten or twelve years; though the article is always of a superior quality, and has the advantage over that of Martinique and the other Antilles of not requiring age to produce an agreeable beverage. It is from the fault and obstinate attachment to old habits of the planters, that this cultivation has not been more successful in Trinidad. Because coffee trees thrive in St. Domingo, Guadalupe, Dominica, St. Lucia and Martinique, on the hills, they had concluded that it would be the same in Trinidad; without noticing that the hills of that island are composed only of schistus covered with gravel, on which lies a light layer of vegetative earth, that the rain washes away after some years of cultivation; whilst the hills of the Antilles, much more high and cool, are covered with a deep bed of earth, which is retained by enormous blocks of stone, that at the same time maintain humidity and freshness.

Messrs. Branbrun, of Tacarigua, and Don Juan de Arestimuno, of Cariaco, worthy and intelligent planters, some years ago adopted the plan of planting coffee trees on the plains, in the manner cacao trees are planted, that is, in the shade of the *Erythrina*, and this mode of cultivation has perfectly succeeded. It is to be hoped that their success will encourage the cultivation of this valuable tree in the united provinces of Venezuela, and in those parts of Trinidad which were deemed unfavorable to it from the too great dryness of the climate.

In 1796, the year preceding its capture, there were 130 coffee plantations in Trinidad, which produced 330,000 lbs. of coffee. In 1802, the produce had slightly increased to 358,660 lbs., but there were two plantations less.

In the island of Grenada, according to the returns made to the local Treasury of the staple products raised, while there were 64,654 lbs. made-in 1829, the quantity had decreased to 13,651 lbs. in 1837.

The colony of British Guiana was formerly noted for its produce of coffee. The following figures mark the decline of the culture of this staple, showing the exports in Dutch pounds:—

Demerara and Essequibo. Berbice.

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1834 1,102,200 1,429,800 1835 1,299,080 1,979,850 1836 2,117,250 2,684,100 1837 1,849,650 2,217,300 1838 2,486,240 1,700,550 1839 747,450 1,255,800 1840 1,531,350 1,825,950 1841 568,920 519,750 1842 1,372,650 804,470 1843 428,800 999,300 1844 716,137 774,600

Thus the exports of the colony which in 1836 were 4,801,350 lbs. had declined in 1844 to 1,490,737; whilst in 1831 we received from British Guiana 3,576,754 lbs. of coffee, in 1850 we only received 8,472 lbs.

There are about 500 acres under cultivation with coffee in St. Lucia. The exports, which in 1840 were 323,820 lbs., had declined, in 1844, to 58,834 lbs.

The British West Indies exported to Great Britain, in 1829 and 1850, the following quantities of coffee:—

	1829.	1850.
	lbs.	lbs.
Jamaica	18,690,654	4,156,210
Demerara	4,680,118	17,774
Berbice	2,482,898	698
Trinidad	73,667	96,376
Dominica	942,114	792
St. Lucia	303,499	35

Cuba.—For the following valuable remarks and details of coffee culture in Cuba, I am indebted to Dr. Turnbulls “Travels in the West:”—

At the period of the breaking out of the French revolution, the cultivation of coffee could scarcely be said to have reached the South American continent; so that till that its cultivation was in a great measure confined to Arabia and the Caribbean Archipelago. Its extreme scarcity during the war enhanced its price so enormously, that on the first announcement of peace in 1814, the plants were multiplied to infinity, and coffee plantations were formed in every possible situation—on the Coste Firme of South America, along the Brazilian shores of that continent, and even at some points on the coast of Southern Africa. To show the extreme rapidity with which the cultivation has been extended, take the statistical returns of La Guayra, the chief port of the State of Venezuela, from whence the whole export of coffee in the year 1789 was not more than ten tons; and of late years from that port alone, and in spite of the internal disunions of the country, it has reached the enormous quantity of 2,500 tons. In the Isle of Bourbon (now Reunion), and the Mauritius and Ceylon, the planters have also applied themselves to this branch of industry; it has been prosecuted successfully in our Eastern Possessions, and the French government, not content with the natural influence of the universal demand for it, have been endeavouring to stimulate the production by means of premiums and other artificial advantages.In forming a coffee plantation, the choice of situation and soil becomes a consideration of the first importance. A very high temperature

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is by no means a favourable condition. If a spot could be found where the range of the Fahrenheit thermometer did not sink below 75 degrees, nor rise above 80 degrees, and where the soil was otherwise suitable, no planter could desire a more favourable situation. In the mountainous islands of Jamaica and St. Domingo, the nearest approach to this temperature is found where the elevation is not less than 2,000, and not more than 3,000 feet above the level of the sea; and it is most successfully cultivated in the two islands I have named. The Island of Cuba being much less mountainous, but at the same time being nearer the tropical limit, the planter in seeking the degree of heat he requires is forced to confine himself in a great measure to the northern side of the island, where, accordingly, we find that the cultivation of coffee is most successfully carried on.The vicinity of the *cafetal* to a convenient place of embarcation, enters largely, of course, into the consideration of the planter when choosing a suitable locality. A compact form is also thought desirable, in order to save the time and labour of the negroes; and the ordinary extent is about six caballerias, or something less than 200 English acres.The locality being finally chosen, such open places are formed or selected, from distance to distance, as may be found most suitable, in respect to shade and moisture, for the establishment of convenient nurseries. The fruit which has been gathered in the beginning of the month of October, and which has been dried in the shade, is preferred for seed. The seed is sown in drills half a yard asunder, and introduced, two beans together, by means of a dibble, into holes two inches deep and ten or twelve inches apart. The extent of one of these nurseries is generally about 100 yards square, which, with such intervals as I have mentioned, ought to contain about 60,000 plants.A quarter of a *caballeria*, or about eight English acres, is visually set apart, in a central and convenient position, for the site of the buildings, and for growing provisions for the use of the labourers on the future plantation. In favourable seasons it is found that heavier crops are obtained from coffee trees left wholly unshaded; but, in the average of two years, it seems to be settled, in the island of Cuba at least, that a moderate degree of protection from the scorching rays of the sun produces a steadier, and, upon the whole, a more advantageous return.The distribution of the land into right-angled sections, and the planting of the trees in straight lines, is so contrived as to favour the future supervision of the labourers much more than from any strict attention to mere symmetry. The distance of the trees from each other ought to be regulated by the quality of the soil, and the degrees of heat and shade they are to enjoy. The ranges from north to south are usually four yards apart, and

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those from east to west not more than three; but the lower the temperature the wider should be the interval, because in that case the vegetation is more active and more rapid, and the tree requires a wider space over which to extend itself.The best season for planting the trees is the middle of the month of May, if there be then a sufficient degree of moisture; but the operation is often performed successfully during the rainy month of October; subject always to the risk, however, of serious injury to the young plantation from the north winds which prevail at that advanced season of the year. The holes prepared to receive the plants are eighteen inches in diameter, and about two feet deep.

> In the island of Cuba there are two rival modes of planting the coffee tree. The one is called “la siembra a la mota;” the other “la siembra a la estaca.”

By the method “a la mota,” a circle is formed around the plant in the nursery, and care is taken to remove it without disturbing the earth around the roots. The plants are then placed carefully in willow baskets, prepared for the purpose, and carried to the holes already opened for their reception; gathering up the earth around the stem, and pressing it carefully down with the foot, in such a manner as to form a basin or filter for the reception of the rain-water, and for suffering it to percolate among the roots, and also to provide a convenient place of deposit for the subsequent application of manure.The “siembra a la estaca” is differently executed. Such plants are selected from the nursery as are of the thickness of the little finger, or from that to an inch in diameter. In withdrawing them from the ground, great care is taken not to injure or compress the bulbs or buttons within, eight or ten inches of the level of the soil, because these are to serve for the production of fresh roots when the “estaca” is afterwards planted more deeply in its permanent position. The greater part of the capillary roots are cut away with a knife; but a few, together with the principal root, are suffered to remain from four to six inches long. In planting them, from three to four inches of the trunk are left above ground. The little basin of earth for the reception and filtration of the rain-water, is not so large in the stake system of planting as in that with the clod of earth “a la mota;” but if the soil be poor, it must be proportionably enlarged to admit the application of the necessary quantity of manure.The stake system, requiring much less labour than the other, is generally preferred; but when there is abundance of shade to protect the young plant from drought, and always, of course, in replacing the decayed trees of an old plantation, it is considered more desirable to remove the whole plant, its roots and branches entire, with as much as possible of the adhering soil from the nursery,

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according to the system “a la mota.”In the third or fourth year of the plantation, the trees, according to the best system of husbandry, are pruned down to the height of three feet from the ground on the richest soil, and still lower in proportion to its sterility. All the branches which are not as nearly as possible at right angles with the trunk, are likewise removed by the pruning-knife, so that in the following spring the whole stem is covered with fresh shoots. By this operation the power of nature seems to be exhausted, as for that year the trees in general bear no fruit; but in subsequent seasons the loss is amply repaid by a crop often greater than the branches can support, or than the flow of nourishment is always able to bring to full size and maturity.The machinery for removing the external pulp of the coffee-bean is seldom of a very perfect description in this island, and the loss sustained in consequence is often very considerable. It is almost uniformly moved by the power of horses or oxen, working in a gin, and the name it bears is that of the *Descerecador*. The Barbecues, when the coffee is laid out to dry, are called indiscriminately *Tendales* or *Secadores*. They are more numerous and of smaller dimensions than is customary in the British colonies, where a single barbecue, laid down with tiles or plaster, is considered sufficient for a whole estate.The warehouse for receiving the crop and preserving the coffee after it is put into bags and ready for the market, is generally of such limited dimensions as to be barely sufficient for the purposes for which it is designed; so that, when the harvest has been abundant, or when anything has occurred to interfere with the despatch of what is ready for removal, the constant accumulation is attended with serious inconvenience. In fact, the occupation of the coffee planter has been for some time on the decline in the island, owing to the superior rate of profit derived from the making of sugar; and everything reminds you of it, the *moleno de pilar*, the *aventador*, and the *separador*, down to the humblest implement of husbandry on the estate.The gathering of the fruit commences in Cuba in August; but November and December are the most active and important months of the harvests. The labourers are sent out with two baskets each, one large, the other small. Every labourer has a file of coffee trees assigned to him; the large basket he leaves near the place where his work is to begin; the other he carries with him to receive the berries from the trees; and as often as it is full he empties it into the large one. The baskets are made of rushes, willows, or bamboo; and the large one is of such a size that three of them ought to fill the barrel, without top or bottom, which serves the purposes of a measure at the *Tendal* or Secador.

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Three baskets, or one barrel-measure, of the newly-gathered coffee berry, ought to produce thirty pounds after the process of drying, the removal of the pulp, and the final preparation for the market. When there is a sufficient number, or a sufficient space of Barbecues or Secadors, sixty or seventy barrels only are put together; but from want of room it often happens that the quantity amounts to a hundred barrels. In either case, the whole is gathered into two great heaps, and in this state it is allowed to remain for four-and-twenty hours, in order to subject it to a certain degree of fermentation. After this, it is spread out to dry over the whole surface of the Barbecue, and until it is sufficiently so, it remains there uncovered day and night. When the dessication is found to be far enough advanced, it is no longer exposed during the night; nor even during the day, if the weather be damp or unfavorable. The subsequent operations are certainly not better, probably not so well, conducted as in our own West India possessions.In the fourth year, it is presumed that the agricultural produce of the land, and the first returns of coffee, should be sufficient to meet all the current expenses. At the end of the fifth year there ought to be forty thousand coffee trees four years old on the estate, 60,000 of three years, and 100,000 of two and one year, the produce of which ought to be at least 400 quintals, which, at a moderate estimate, should be worth 2,400 dollars. Thus the calculation goes on until we arrive at the end of the seventh year, when the estate ought to be in full bearing. The returns are estimated at 3,000 arrobas, or 750 quintals, which, at eight dollars per quintal delivered free on board, make 6,000 dollars. The minor products of the estate, such as Indian corn, pigs, and oil, are given at 1,130 dollars, making the gross returns 7,130 dollars; and, after deducting the annual expenses, leaving 5,300 dollars as the regular return on the capital invested, which, having been about 40,000 dollars, gives about thirteen per cent.; not certainly to be considered extravagant in a country where twelve per cent, is the regular rate of interest. The produce of coffee from each section is given at 400 arrobas, or 3,500 arrobas for the whole of the nine sections. The average price of coffee, free of the expense of carriage, is assumed to be two dollars the arroba, or eight dollars per quintal, which would give a return of 7,200 dollars, besides the repayment of the rent by the colonists.

The cultivation of coffee has been falling off in Cuba for several years past, the crops it is asserted being too precarious there, and the prices too low to encourage the continuance of planting. On the northern side of the island is where this decrease is most perceptible, several of the largest estates having been converted to the growth of sugar and tobacco, others abandoned to serve as pasture fields, and the

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very few remaining yielding less and less every year. Henceforward the culture of this berry here is likely to be very insignificant, and not many years will elapse before the amount produced will merely suffice for the local consumption. About St. Jago de Cuba the cultivation is more attended to, the article forming still their principal export. Taking five quinquennial periods, the following figures show the average annual exports of coffee:—

	arrobas.
1826 to 1830	1,718,865
1830 " 1835	1,995,832
1835 " 1840	1,877,646
1841 " 1846	1,887,444
1846 " 1851	768,244

The better to exhibit the decrease of production throughout the island, I may state that the export from 1839 to 1841 inclusive, was in the aggregate 1,332,221 quintals; 1842 to 1844, inclusive, was in the aggregate 1,217,666 quintals; 1845 to 1847, inclusive, was in the aggregate but 583,208 quintals. The exports of coffee for the whole island, were, in 1840, 2,197,771 arrobas; in 1841, 1,260,9201/2 arrobas.

In 1847 there were 2,064 plantations under cultivation with coffee in Cuba, in 1846 there were only 1,670. The production of 1849 was 1,470,754 arrobas, valued at 2,206,131 dollars. From the year 1841 to 1846, the average yearly production was 45,236,100 lbs.; but from 1846 to 1851, it was only 19,206,100 lbs.; showing a falling off of 72 per cent.; the production still further decreased in 1851, it being only 13,004,350 lbs., or 1.52 per cent. less than the preceding year. This enormous decline in the production of coffee has been caused by the low price of the article in the markets of Europe and the United States, coupled with the more remunerative price of sugar, during the same period; causing capitalists rather to invest money in the formation of new sugar estates. As a consequence, many coffee plantations have been turned into cane cultivation; or, being abandoned, the slaves attached thereto were sold or leased to sugar planters.

The following is private information from a correspondent:—

“We generally plant about 200,000 trees within a space of 500 feet, choosing the strongest soil. I have adopted a different system from the one generally in use here, for they usually plant the trees too near each other. I find by giving them space and air, that the plant develops itself and yields more beans. It is very important to protect the trees from the rays of the sun, for which purpose I plant bananas at intermediate rows; their broad leaves, like parasols, shed a delightful shade round the coffee plant, and tend to accumulate the moisture which strengthens the roots of the young tree.When the tree is about two years old the top branches are lopped off for the purpose of throwing the sap into the bean. Some planters cut the trees so short, that they do not allow them to stand more than five or six feet above the ground; but I allow mine to attain greater height prior to lopping them, whereby they produce larger crops. Nor do I allow my negroes to beat the trees, or force them to pluck a certain quantity a day, for I discovered that they picked the ripe and unripe beans indiscriminately—frequently injuring the trees. I only allow them to shake the tree, and pick up the beans that have fallen during the night.”

Coffee exports from the ports of Havana and Matanzas, in Cuba, for the years ending December in

	Quintals.
1839	344,725
1840	402,135
1841	212,767
1842	314,191
1843	223,265
1844	186,349
1845	42,409
1846	65,045
1847	106,904
1848	31,674
1849	92,974
1852	42,510

Porto Rico exported 85,384 cwt. of coffee in 1839.

Africa.—Coffee will require some four years to grow before it will give to the cultivator any income, but it should be known that after that time the tree, with little or no labor bestowed on it, will yield two crops a year. The quality of coffee grown in the republic of Liberia, on the western coast of Africa, is pronounced by competent judges to be equal to any in the world. In numerous instances, trees full of coffee, are seen at only three years old. 214 casks and bags of coffee were imported from the western coast of Africa in 1846.

Coffee, it has been proved, can be cultivated with great ease to any extent in the republic of Liberia, being indigenous to the soil, and found in great abundance. It bears fruit from thirty to forty years, and yields 10 lbs. to the shrub yearly! A single tree in the garden of Colonel Hicks, a colonist at Monrovia, is said to have yielded the enormous quantity of 16 lbs. at one gathering. Judge Benson, in 1850, had brought 25 acres under cultivation, and many others had also devoted themselves to raising coffee. It was estimated there were about 30,000 coffee trees planted in one of the counties, that of Grand Bassa, and the quality of the produce was stated to be equal to the best Java.

About the villages and settlements of the Sherbro river, and Sierra Leone, wild coffee-trees are very abundant. In several parts of the interior, the natives make use of the shrub to fence their plantations.

Coffee has been successfully grown at St. Helena, of an excellent quality, and might be made an article of export.

Portugal sent to the Great Exhibition, in 1851, a very valuable series of coffees from many of her colonies; of ordinary description from St. Thomas; tolerably good from the Cape de Verd islands; bad from Timor; worse (but curious from the very small size of the berry) from Mozambique; good from Angola; and excellent from Madeira.

Aden, alias Mocha coffee, is, along with the other coffees of the Red Sea, sent first to Bombay by Arab ships, where it is “garbelled,” or picked, previously to its being exported to England.

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An excellent sample of coffee, apparently of the Barbera (Abyssinia) variety, was contributed to the Great Exhibition from Norfolk Island. It was of good color, well adapted for roasting, and a most desirable novelty from that quarter.

Dr. Gardner, of Ceylon, has taken out a patent for preparing the coffee leaf in a manner to afford a beverage like tea, that is by infusion, “forming an agreeable refreshing and nutritive article of diet.” An infusion of the coffee-leaf has long been an article of universal consumption amongst the natives of parts of Sumatra; wherever the coffee is grown, the leaf has become one of the necessaries of life, which the natives regard as indispensable.

The coffee-plant, in a congenial soil and climate, exhibits great luxuriance in its foliage, throwing out abundance of suckers and lateral stems, especially when from any cause the main stem is thrown out of the perpendicular, to which it is very liable from its great superincumbent weight compared with the hold of its root in the ground. The native planters, availing themselves of this propensity, often give this plant a considerable inclination, not only to increase the foliage, but to obtain new fruit-bearing stems, when the old ones become unproductive. It is also found desirable to limit the height of the plant by lopping off the top to increase the produce, and facilitate the collecting it, and fresh sprouts in abundance are the certain consequence. These are so many causes of the development of a vegetation, which becomes injurious to the quantity of the fruit or berry unless removed; and when this superabundant foliage can be converted into an article of consumption, as hitherto the case in Sumatra, the culture must become the more profitable; and it is clearly the interest of the planters of Ceylon to respond to the call of Dr. Gardner, and by supplying the leaf on reasonable terms, to assist in creating a demand for an article they have in abundance, and which for the want of that demand is of no value to them. It ought to be mentioned also, that the leaves which become ripe and yellow on the tree and fall off in the course of nature, contain the largest portion of extract, and make the richest infusion; and I have no doubt, should the coffee leaf ever come into general use, the ripe leaf will be collected with as much care as the ripe fruit.

The mode of the preparation by the natives is this. The ends of the branches and suckers, with the leaves on; are taken from the tree and broken into lengths of from twelve to eighteen inches. These are arranged in the split of a stick or small bamboo, side by side, forming a truss in such a manner, that the leaves all appear on one side, and the stalk on the other, the object of which is to secure equal roasting, the stalks being thus exposed to the fire together, and the leaves together. The slit being tied up in two or three places, and a part of the stick or bamboo left as a handle, the truss is held over a

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fire without smoke, and kept moving about, so as to roast the whole equally, without burning, on the success of which operation the quality and flavor of the article must depend. When successfully roasted, the raw vegetable taste is entirely dissipated, which is not the ease if insufficiently done. When singed or overdone, the extract is destroyed and the aroma lost. When the fire is smoky, the flavor varies with the nature of the smoke. The stalks are roasted equally with the leaves, and are said to add fully as much to the strength of the infusion. By roasting the whole becomes brittle, and is reduced to a coarse powder by rubbing between the hands. In this state it is ready for use, and the general mode of preparing the beverage is by infusion, as in the case of common tea.

That it would soon become a most valuable article of diet amongst the laboring classes, and on ship board particularly, if, once brought into use, there can be no doubt. The coffee-tree can be grown to advantage for the leaf in the lowlands of every tropical country, where the soil is sufficiently fertile, whilst it requires a different soil and climate to produce the fruit[7]. Dr. Hooker, in the Jury Reports, observes upon the prepared coffee leaves, submitted by Dr. Gardner, of Ceylon, to be used as tea leaves, that they are worthy of notice as affording a really palatable drink when infused as tea is; more so, perhaps, than coffee is to the uninitiated. That this preparation contains a considerable amount of the nutritious principles of coffee, is evident from the analysis; but as the leaves can only be collected in a good state at the expense of the coffee bush, it is doubtful whether the coffee produced by the berries be not, after all, the cheapest, as it certainly is the best.

TEA.

The immense traffic in the produce of this simple shrub, the growth of a remarkable country, hitherto almost entirely isolated from the western nations, is one of the most remarkable illustrations of the enterprise and energy of modern commerce. The trade in tea now gives employment to upwards of 60,000 tons of British shipping, and about ten millions sterling of English capital, producing a revenue to this country of nearly six millions sterling.

Every reflecting man will admit that articles of such vast consumption as tea and coffee (amounting together to more than 343,500 tons annually), forming the chief liquid food of whole nations, must exercise a great influence upon the health of the people.

There is scarcely any country in the world in which a dietetic drink or beverage resembling tea, is not prepared, and in general use, from some exotic or indigenous shrub. The two chief plants laid under contribution are, however, the Chinese tea-plant, and a species of holly peculiar to South America, producing the Paraguay tea. *Astoria* *theiformis* is used at Santa Fe as tea. The leaves of *Canothus Americanus*, an astringent herb, have been used as a substitute, under the name of New Jersey tea.

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It has been a matter of surprise why tea should be so much sought after by the poorer classes, since by many it is looked on more as a luxury than of use to the human system. The manner in which it acts, and the cause why it is so much in demand by all classes, is satisfactorily explained by Liebig; and the benefit, therefore, which will be conferred by selling it at a low rate, and thus placing it within the means of all, has at last come to be duly appreciated. Liebig says, without entering minutely into the medical action of caffeine, theine, &c., it will surely appear a most striking fact, even if we were to deny its influence on the process of secretion, that the substance, with the addition of oxygen and the elements of water, can yield taurine, the nitrogenised compound peculiar to bile:—

	Carbon.	Nitrogen.	Hydrogen.	Oxygen.
1 atom caffeine or theine =	8	2	5	2
9 atoms water =	—	—	9	9
9 atoms oxygen =	—	—	—	9
	__	__	__	__
= 2 atoms taurine	8	2	14	20
=	2	4	9	10

To see how the action of caffeine, theobromine, theine, &c., may be explained, we must call to mind that the chief constituent of the bile contains only 3.8 per cent. of nitrogen, of which only the half, or 1.9 per cent., belongs to the taurine; bile contains, in its natural state, water and solid matter, in the proportion of ninety parts by weight of the former, to ten of the latter. If we suppose these ten parts, by weight of solid matter, to be chloric acid, with 3.87 per cent. of nitrogen, then 100 parts of theine would contain 0.171 of nitrogen in the shape of taurine. Now this quantity is contained in 0.6 parts of theine, or 2 grains 8/10ths of theine can give to an ounce of bile the nitrogen it contains in the form of taurine.

Although an infusion of tea contains no more than the one-tenth of a grain of theine, still, if it contribute in point of fact to the formation of bile, the action even of such a quantity cannot be looked upon as a nullity. Neither can it be denied, that in the case of an excess of non-azotised food, and a deficiency of motion, which is required to cause the change of matter of the tissues, and thus to yield the nitrogenised product which enters into the composition of the bile, that in such a condition the health may be benefited by the use of compounds which are capable of supplying the place of the nitrogenised substances produced in the healthy state of the body, and essential to the production of an important element of inspiration. In a chronical sense, and it is this alone which the preceding remarks are intended to show, caffeine, or theine, &c., are, in virtue of their composition, better adapted to this purpose than all nitrogenised vegetable principles. The action of these substances in ordinary circumstances is not obvious, but it unquestionably exists. Tea and coffee were originally met with among nations whose diet was chiefly vegetable.

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Considerable discussion has taken place regarding the tea plants; some say that there is only one species; others that there are two or three. Mr. Fortune, who visited the tea districts of Canton, Fokien, and Chekiang, asserts that the black and green teas of the northern districts of China are obtained from the same species or variety, known under the name of *Thea Bohea*. Some make the Assam tea a different species, and thus recognise three: *T. Cantoniensis* or *Bohea*, *T. Viridis*, and *T. Assamica*. The quality of the tea depends much on the season when the leaves are picked, the mode in which it is prepared, as well as the district in which it grows. The green teas include Twankay, Young Hyson, Hyson, Gunpowder, and Imperial; while the black comprise Bohea, Congou, Souchong, Oolong, and Pekoe. The teas of certain districts, such as Anhoi, have peculiar characters.

The first tea imported into England was a package of two pounds, by the East India Company, in 1664, as a present to the king; in 1667, another small importation took place, from the company's factory at Bantam. The directors ordered their servants to "send home by their ships 100 pounds weight of the best *tey* they could get." In 1678 were imported 4,713 lbs.; but in the six following years the entire imports amounted to no more than 410 lbs. According to Milburn's "Oriental Commerce," the consumption in 1711 was 141,995 lbs.; 120,595 lbs. in 1715, and 237,904 lbs. in 1720. In 1745 the amount was 730,729 lbs. For above a century and a half, the sole object of the East India Company's trade with China was to provide tea for the consumption of the United Kingdom. The company had the exclusive trade, and were bound to send orders for tea, and to provide ships to import the same, and always to have a year's consumption in their warehouses. The teas were disposed of in London, where only they could be imported, at quarterly sales. The act of 1834, however, threw open the trade to China.

From a Parliamentary return, showing the quantity of tea retained for home consumption in the United Kingdom, in each year, from 1740 to the termination of the East India Company's sales, and thence to the present time, it appears that in 1740, 1,493,695 lbs. of tea were retained for home consumption. Two years afterwards, the quantity fell to 473,868 lbs., and in 1767 only 215,019 lbs. were retained. Next year the amount increased to 3,155,417 lbs.; in 1769 it was 9,114,854 lbs.; in 1795, 21,342,845 lbs.; in 1836, 49,842,236 lbs.

The return in question also specifies the quantity of the various kinds of tea, with the average sale prices.

According to the annual tea reports of Messrs. W.J. Thompson and Son, and Messrs. W.E. Franks and Son, the total imports of tea during the last fifteen years were as follows, reckoned in millions of lbs.:—

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Years. Black. Green. Total. Home Consumption. 1838 26,786 8,215 35,001 36,415 1839 30,644 7,680 38,324 36,351 1840 21,063 7,161 28,224 31,716 1841 24,915 6,303 31,218 36,811 1842 31,915 9,729 41,644 37,554 1843 39,513 7,340 46,853 39,902 1844 39,644 8,749 48,393 41,176 1845 39,518 11,790 51,338 44,127 1846 44,017 12,486 55,503 47,534 1847 46,887 8,368 55,255 46,247 1848 37,512 7,611 45,123 48,431 1849 43,234 9,156 52,400 50,100 1850 39,873 8,427 48,300 51,000 1851 62,369 9,131 71,500 54,000 1852 55,525 9,175 64,700 54,724

The duty on tea was gradually raised from 9d. per lb. in 1787 to 3s. a lb. in 1806. It was 2s. 2d. per lb. until May, 1852, when 4d. per lb. was taken off, and further annual reductions are to be made. Down to the year 1834 the duty was an *ad valorem* one of 96 per cent. on all teas sold under 2s. a lb., and of 100 per cent. on all that were sold at or above 2s., charged on the prices which they brought at the East India Company's sales. The *ad valorem* duties ceased on the 22nd of April, 1834, and under the act 3 and 4 William IV. c. 100, all tea imported into the United Kingdom for home consumption was charged with a customs as follows:—

Bohea 1s. 6d. per lb.
Congou, twankay, hyson skin, orange
  pekoe, and campoi 2 2 "
Souchong, flowery pekoe, hyson, young
  hyson, gunpowder, imperial, and
  other teas not enumerated 3 0 "

In 1836, the uniform duty of 2s. 1d. per lb. on all descriptions of tea was imposed, which, with the additional 5 per cent, imposed in 1840, made the total duty levied per lb. 2s. 2d. and a fraction.

During the years from 1831 to 1841, in spite of an increase of nearly three millions in the population of the country, and notwithstanding the impetus given to the tea-trade by the abolition of the East India Company's monopoly in 1833, the increased consumption was only 6,675,566 lbs. Great as the increase has been of late years, however, it is very far short of what we might expect to see were the duty reduced to a moderate per centage on the value of the article as it comes from the Chinese merchant. In Jersey and Guernsey, where there is no duty on tea, the average consumption is 41/2 lbs. per head per annum. The same rate for the United Kingdom would require an annual importation of nearly 150 million lbs. I asserted, many months ago, if the duty could be gradually reduced from its present exorbitant amount to 1s. per lb., the revenue would not suffer much, whilst the comfort of the people would be much increased, and our trade with China greatly improved.

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Years. Teas Imported, lbs. Entered for Home Consumption, lbs. 1843 42,779,265 35,685,262 1844 50,613,328 41,176,00 1845 53,570,267 44,127,000 1846 57,584,561 46,554,787 1847 55,255,000 50,921,486 1848 47,774,755 48,735,696 1849 53,460,751 50,024,688 1850 50,512,384 51,178,215 1851 71,466,421 53,965,112 1852 66,361,020 54,724,615

Amount of duty received on tea:—

L		Prices of Sound Common Congou per lb.
1841	3,973,668	1s. 7d. to 2s. 0d.
1842	4,088,957	1 7 1 10
1843	4,407,642	1 0 1 2
1844	4,524,093	0 10 1 0
1845	4,833,351	1 0 1 91/2
1846	5,112,005	0 9 0 91/2
1847	5,066,860	0 81/2 0 91/2
1848	5,330,515	0 8 0 81/2
1849	5,471,641	0 81/2 0 91/2
1850	5,597,708	0 101/2 1 1
1851	5,902,433	0 8 0 81/2
1852	5,986,482	0 71/2 2 2

Mr. Montgomery Martin, in his work on China, published in 1847, gave the average annual consumption of tea, the produce of China, as follows:—

lbs.
Great Britain and Ireland 45,000,000
British North America and West Indies 2,500,000
Australasia, Cape of Good Hope, &c. 2,500,000
British India and Eastern Islands 2,000,000

Total used throughout the British Empire 52,000,000

United States of North America *	7,000,000
Russia	10,000,000
France and Colonies	500,000
Hanse Towns, &c.	150,000
Holland and its Colonies	1,000,000
Belgium	200,000
Denmark, Sweden, and Norway	250,000

The German States	500,000
Spain and Portugal	100,000
Italian States	50,000
South American States	500,000

Total consumption in foreign countries	20,250,000

[* This is only one-third the actual consumption.]

According to this statement, it would seem that the English consume twice the quantity of tea that is used by all the other countries excepting China and Japan.

The consumption of tea in Europe and America I estimated a year or two ago as follows:—

	lbs.
Russia	15,000,000
United States of America	18,000,000
France	2,000,000
Holland	2,800,000
Other countries	2,000,000
Great Britain	50,000,000

Total	89,800,000

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The estimated consumption, at the rate of consumption found where taxation is favorable (as for instance 11/2 pounds—the average of this country) would give the following:—

	cwts.
England	400,000
France	510,000
Germany	400,000
Austria	500,000
Prussia	...
Belgium	63,000
Russia	900,000
Rest of Europe	750,000

The total exportation of tea by sea from China, was estimated by Mr. Martin in 1847 at 76 millions of pounds, *viz*.:—

England 50,000,000
United States 20,000,000
All other countries 5,000,000

75,000,000

which, at 20 taels per picul (133 lbs.) amounts to 11,280,000 taels of silver at 80d. per tael, L3,760,000. The present Chinese duty of two taels five mace, does not include shipping and other charges; the old duty was five taels, and included all charges paid the Hong merchants. The export by sea is now about 97 millions of lbs.

The following was the returned value of the tea exported from the five Chinese ports in 1844 and 1845:—

	1844.	1845.
Canton	L2,910,474	L3,429,790
Shanghae	67,115	462,746
Ningpo	2,000	2,000
Amoy		544
Foo-chow-foo		638
	---------	---------
	L2,979,589	L3,895,718

The average cost of tea in China at the ship's side is 10d. per pound, while it is confidently asserted that it could be produced in many parts of America at 5d. the pound. The great cost in China is owing to the expensive transportation, the cultivation of the fuel used, the absence of all economy of machinery, &c. It is only by adulteration that tea is sold in China as cheap as 10d. In America the beating and rolling of the leaves (one half of the labor) could be done by the simplest machinery, fuel could be economised by flues, &c.

The Russian teas, brought by caravans, are the most expensive and best teas used in Europe. The Chinese themselves pay 71/2 dollars per pound for the "Yen Pouchong" teas.

Full chests were exhibited in 1851, by Mr. Ripley, of various Pekoe teas, some of which fetch 50s. per lb. in the China market; whilst 7s. is the very highest price any of the sort will fetch in England, and this only as a fancy article. The plain and orange-scented Pekoes now fetch little with us; but as caravan teas, are purchased by the wealthier Russian families. The finest, however, never leave China, being bought up by the Mandarins; for though the transit expenses add 3s. to 4s. per lb. to the value when sold in Russia, the highest market price in St. Petersburg is always under 50s. Among these scented teas are various caper teas, flavoured with chloranthus flowers and the buds of some species of plants belonging to the orange tribe, *magnolia fuscata*, olea flowers,

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&c. The Cong Souchong, or Ning-young teas, are chiefly purchased for the American market. Oolong tea is the favourite drink in Calcutta, though less prized in England, its delicate flavor being injured by the length of the voyage. For delicacy, no teas, approach those usually called “Mandarin teas,” which being slightly fired and rather damp when in the fittest state for use, will bear neither transport nor keeping. They are in great demand among the wealthy Chinese, and average 20s. per lb in the native market.—(Jury Reports.)

The consumption of tea in the United Kingdom may now be fairly taken at fifty-four million pounds yearly, and sold at an average price to the consumer of 4s. 6d., per pound. The money expended for tea is upwards of twelve millions sterling.

The expenditure of this sum is distributed as follows, in round numbers:—

Net cost of 54,000,000 pounds, average 1s. per pound L2,700,000
Export duty in China of 11/2d. a lb. 337,500
Shipping charges, &c., in China 25,000
Freight, &c., China to England, about 2d. per lb. 450,000
Insurance, 1/2d. per lb. 112,500
Commission, about 1/4d. per lb. 56,250
Tasting charges, &c., about 1/8 of a penny per lb. 28,125
Interest for 6 months on L3,709,375 at 5 per cent. 92,734

Total outlay in China L3,802,109
Profit to exporters in China,(about 12 per cent.) 445,116
Landing charges, &c., in England 39,000

Cost price in bond in England L4,286,225
Duty received by government at 2s. 21/2. per lb., about 5,985,482

L10,271,707
Profit divided among tea-brokers, wholesale and retail
dealers, &c 1,878,293

Total outlay by British public for tea, at 4s. 6d. per lb. L12,150,000

The tea imported into England in 1667 was only 100 lbs., while for the year ending June 30, 1851, the export from China to Great Britain was 64,020,000 lbs., employing 115 vessels in its transportation; and to the United States, during the same time, 28,760,800 lbs., in sixty-four vessels. Within the last five years, the export has increased 10,000,000 lbs. to the United States, and 17,000,000 to Great Britain. These statistics will show the immense importance of this article to commerce, and the vast amount of shipping it supports. But let us follow out the statistics a little more in detail.

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The population of the Chinese provinces, as quoted by Dr. Morison, from an official census taken in 1825, was 352,866,012, and we may fairly conclude that during the last twenty-eight years this population has extensively increased. If we assume the annual consumption of tea at four lb. per head on the above population; and this is no unreasonable assumption in a country, where, to quote from Murray's valuable work on China, tea "is the national drink, which is presented on every occasion, served up at every feast, and even sold on the public roads;" we shall have a tolerably accurate result as to the total consumption in the empire. Indeed this computation falls short of the actual relative consumption in the island of Jersey, where, as we have seen, nearly five lbs. is the annual allowance of each individual.

If we multiply the population of China by four, we have—

&nb
sp; lbs.
Total consumption of tea in China 1,411,464,048
Export of Great Britain and Ireland, for the year ending
June 30, 1851. 64,020,000
Export to the United States, same period 28,760,800
Export to Holland, returned at 2,000,000 in Davis's
"China" 3,000,000

Inland trade to Russia 15,000,000
Export to Hamburg, Bremen, Denmark, Sweden, &c.,
seven cargoes, about 3,000,000
Export to Sydney, and Australasian Colonies, at least 6,000,000
Export to Spain and France, four cargoes 2,000,000

Total lbs. 1,533,244,848

The above is exclusive of the heavy exportation in Chinese vessels to all parts of the east where Chinese emigrants are settled, such as Tonquin, Cochin China, Cambodia, Siam, the Philippines, Borneo, and the various settlements within the Straits of Malacca. In comparison with such an enormous quantity, the 54 million lbs. consumed in the United Kingdom sink into insignificance.

L
The cost of tea to America, at the ship's side in China,
say 29,000,000 lbs., at an average of 1s. per lb.,
would be 1,450,000
The cost to England, 64,000,000, at the same price 3,200,000
The cost to other places, say 25,000,000 1,250,000
Russia, 15,000,000 750,000

Total L6,650,000

It is therefore clear, that were the demand to be doubled from Great Britain, it would make very little difference in the Chinese market; since it would be only a question of letting us have six per cent, of their growth of the article, instead of three.

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When we remember that the tea plant attains to maturity in three years, and its leaves are then fit for picking; and that there is a vast extent of country to which it is indigenous, growing in every climate between the equator and the latitude of 45 degrees, it is evident that, were there a necessity for it, the actual production of tea in China could be increased to an almost unlimited extent in the space of three or four years, an extent far more than compensating for the extra three per cent., which might be, in the first instance, required by the British.

The certainty of an increased consumption following upon a reduction in the price of tea to the actual consumers of it, is so obvious as to require demonstration to those only who have not considered the subject. The population of Great Britain and Ireland is, say in round numbers 30,000,000, the actual consumption of tea is only 54,000,000 lbs., or little more than one pound and three quarters for each individual. In the neighbouring island of Jersey, there are nearly five lbs. of tea consumed by every inhabitant yearly; and as we may fairly infer from analogy that similar results would arise from a similar cause, the consumption in the United Kingdom in the same ratio would amount to no less than 150 millions of pounds annually.

Tea, observes a most competent authority (Mr. J. Ingram Travers), is the favourite drink of the people: all desire to have it strong and good, and none who can afford it are without it. But in the agricultural districts the laborers use but little; numbers of them "make tea with burnt crusts, because the China tea is too dear." In Ireland the consumption is greatly below that of England; there are comparatively few people who do not, on company occasions, make their tea stronger than for ordinary use, and the general economy in the use of tea forms an exception to almost every other article of consumption. As to the working classes in the manufacturing districts, Mr. Bayley, President of the Manchester Chamber of Commerce, himself a very extensive manufacturer, and therefore well qualified to speak to the fact, says:—"The common calculation of two ounces per head per week I should think is very much in excess of what the working classes consume. Domestic servants, I believe, have that quantity allowed them, but I should say that the working classes do not consume one quarter of that." And yet it is these classes who are the great consumers of everything cheap enough to be within their reach. It is this consumption that, under better earnings, has sustained the steady increase of nearly two million pounds of tea per annum for the last eight years, and still there is such ample room for increase that domestic servants are allowed at least four times as much per head as those working people who value, more than any other class, the cheerful refreshingness of tea, but who, stinted in its use by the exorbitant duty, are tempted and almost driven to the use, instead, of degrading drinks.

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And if the general consumption of the population should rise to even half servants' allowance, or one ounce per head per week, the consumption of tea would reach 97,500,000 lbs. per annum. And as to what might be used if the taste for it had free scope, some idea may be formed from the fact that the consumption of such people as have found their way from these countries, where the consumption is 1 lb. 9 ozs. per head, to Australia, has there risen to 7 lbs. per head, at which rate the consumption of the United Kingdom would be about 210,000,000 lbs. per annum, and which, even at a 6d. duty, would produce five millions and a half. There is nothing in the air of Australia to give any especial impulse to tea drinking: on the contrary; in this comparatively cold, damp climate, people would naturally use a hot beverage more largely than in the dry warm climate of Australia; and, after all, great as the Australian consumption seems, it is scarcely more than a quarter of an ounce per head per week above the allowance to English domestic servants.

The consumption of tea, notwithstanding the dicta of Mr. Montgomery Martin, is destined to a prodigious increase. Nor is it solely to an increase in the consumption of tea, that we must look to prevent any deficiency in the revenue, as there is no doubt that a reduction in the price of the article would lead to a prodigious increase in the quantity of sugar consumed, especially by the lower classes, who seldom take the one without the other.

It is not, however, merely that they would buy sugar in proportion to the quantity of tea that they consume; the circumstance of a smaller sum being requisite for their weekly stock of tea, would enable them to spend a larger amount in other articles, among which sugar would, undoubtedly, be one of the most important. The merchant, shipowner, manufacturer, and all connected with the trade between Great Britain and China, are in a position to see the prodigious advantages that such a measure as an extensive reduction of the impost on tea would occasion to the general trade of the country; and the public at large, who are not practically familiar with the subject, only require it to be brought before them in a distinct point of view, when the important results of such a reduction cannot fail to be apparent to them.

Tea is not now within the reach of the poor man. A person taking tea once a day, will consume about 71/2 lbs. a year.

lbs.
Say 500,000 persons take tea twice a day, or 15 lbs. a year, is 7,500,000 Say 4,000,000 persons take tea once a day, or 71/2 lbs. a year, is 30,000,000 Say 12,000,000 persons take tea once a week, or 1 lb. a year, is 12,000,000

49,500,000

Which shows that, at present, only one person out of every sixty can have tea twice a day; one of every seven only once a day; and that out of the remaining 13,500,000 persons, only five millions and a half can procure it once in the week. The exact state of the case shows that only eight millions of the people of the United Kingdom enjoy the use of tea, leaving the other twenty-two millions excluded. A Chinese will consume thirty pounds of tea in the year.

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But it is said we must not, if our accumulated stocks be drank off this year, expect the Chinese to meet at once so huge an increase in the demand as to supply us with as much next year.

Now on no point of the case is the evidence so clear as upon the capacity of the Chinese to furnish, within any year, any quantity we may require. The Committee of 1847, on Commercial Relations with China, state—“That the demand for tea from China has been progressively and rapidly rising for many years, with no other results than that of diminished prices:”—a fact to be accounted for only upon the supposition that our ordinary demand is exceedingly small in proportion to the Chinese supply. Nor is it an unreasonable inference, that if so much more than usual was to be had at a less price than before, any rise of price, however trivial it might be, would bring forward a much larger quantity:[8] a supposition which is completely confirmed by a review of prices here, and exports from China within the last four years; and in considering which it is important to bear in mind—1st, that our tea trade year, on which our account of import, export, home consumption, and stock on hand is taken, is from January to January, and the Chinese tea year from July to July; 2nd, that a rise at the close of the last months of the year in England, influences the next year’s exports from China; and 3rdly, that of late years, since something of decrepitude has fallen upon the Chinese Government, smuggling there, to escape the export duty, has been carried on largely and at an increasing rate, so that the return is considerably below the real export.

In the Chinese tea year, July to July, 1848-9, the price of good ordinary congou, the tea of by far the largest consumption here, and which, in fact, rules the market, was 81/2d. to 9-1/3d., and the export from China 47,251,000 lbs. The year closed with the higher price, and the Chinese export from July 1849, to July 1850, was 54,000,000 lbs., showing an increase of export on the year of 6,750,000 lbs. Throughout 1850, here, prices fluctuated a good deal. They were low in the earlier part of the year, but in January went up from 91/2d. to 111/2d., and from July 1850, to July 1851, the export from China rose to 64,000,000 lbs., being an increase of ten million pounds on a previous increase of nearly seven million lbs. Prices here, during 1851, varied very much: it was difficult to say whether any rise would be established, but the export still went up and reached, from July 1851, to July 1852, 67,000,000 lbs., giving a total increase in three years of 19,750,000 lbs. Nor was it pretended that in any of those years the Chinese market showed even the least symptoms of exhaustion. “We know,” say the Committee, “that the Chinese market has never been drained of tea in any one year, but that there has been always a surplus left to meet any extraordinary demand.” But the effect of the rise in price in 1850 is still more forcibly shown by a comparison of our total imports in that and the following year. In 1850 we imported 48,300,000 lbs.; in 1851, 71,500,000 lbs., being an increase of 23,200,000 lbs. Doubtless the Chinese export, if made up totally with our year, would not account for the whole quantity, part of which is to be set down to Chinese export-smuggling, and part to arrivals from America and the Continent. The probability is that the increase of price referred to above never reached the Chinese tea farmers; the supply came from the merchants' stock on hand. The rise was, besides, uncertain, and from any established advance a much larger increase of export might be looked for.

But the mistake made in England in estimating what tea we may look for from China goes upon the supposition that they grow expressly for us: the fact being, as stated by Mr. Robt. Fortune, in his recently published "Tea Districts of China," "that the quantity exported bears but a small proportion to that consumed by the Chinese themselves." On this point the report of the Parliamentary Committee is explicit:—"There is a population in China, commonly assumed at above three hundred millions, at all hours in the day consuming tea, which only requires some change of preparation to be fit for exportation; thus implying an amount of supply on which any demand that may be made for foreign export can be, after a very short time, but slightly felt." Mr. Fortune, in his evidence, says "that the Chinese drink about four times as much as we do: they are always drinking it." Four times as much is probably very much an under-estimate. With rich and poor of all that swarming population, tea, not such as our working classes drink, but fresh and strong, and with no second watering, accompanies every meal. But even taking their consumption at four times as much per head as ours, and their population at the lowest estimate, at three hundred millions, their consumption, setting ours at 55,000,000 lbs., will be no less than two thousand two hundred millions of pounds per annum, or forty times the quantity used in the United Kingdom. As reasonably might the few foreigners who visit the metropolis in the summer expect to cause a famine of fruit and vegetables in London, as we that a doubling of our demand for tea would be felt in China. The further fifty-five million pounds would be but another fortieth of what they use themselves, and would have no more effect upon their entire market than the arrival of some thousand strangers within the year in London would have upon the supply of bread or butchers' meat. There is no need, therefore, to wait for the extension of tea plantations, and so far from taking for granted the statement of the late Chancellor of the Exchequer, "that time must be given to increase production, and that the point of its taking three or four years to make a tea-tree is to be considered in dealing with the duties," we have the fact unmistakeably before

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us, that the production is already so vast, that any demand from us could have no appreciable effect. And as to future supplies, if we should come to drink as much as the Chinese themselves, a matter not at all needful to be considered at present, the Committee report that "the cultivation of the plant may be indefinitely extended;" whilst Mr. Fortune, who has been upon the spot, states "that there is not the slightest doubt that there is a great part of the land which is nearly uncultivated now, which, were there a demand for tea, could be brought into cultivation. The cost would be very little indeed; they would cut down a quantity of brushwood, and probably dig over the ground and plant the bushes. They could clear and plant it in the same year, and in about two years they could get something from it." As, however, without this extension they have hitherto found enough for the increase of their own vast population, for every extension of demand from us and every other foreign customer, whether by land or water, without the least tendency to an advance in price, there is no need to do more than thus touch upon the undeveloped resources of tea production.—*Travers on the Tea Duties*.

The consumption of tea in Russia is very great, as the middling classes make a more frequent use of that beverage than the rest. Every year 60,000 chests of tea arrive at Maimiatchin and Kiakhta, of the declared official value of L1,185,000 sterling; and to this may be added L38,650 for inferior tea used by the people of the south, which makes the total declared value of the tea introduced about one and a quarter million sterling. The consumption of Russia may be assumed at over fifteen millions of pounds, although we have no correct data, as in the case of shipping returns, to calculate from. In 1848, however, the Russians took 136,2171/2 boxes of fine tea of the Chinese, for which they paid 5,349,918 silver roubles—one million sterling. The quantity forwarded from Kiakhta into the interior consisted of—

	Foods.
Flowery or Pekoe tea	69,677
Ordinary tea	183,752
Brick tea	116,249

Equal to about fifteen million lbs. English.

Brick tea of Thibet.—A sample of this curious product was shown by the East India Company in 1851. It is formed of the refuse tea-leaves and sweepings of the granaries, damped and pressed into a mould, generally with a little bullock's blood. The finer sorts are friable masses, and are packed in papers; the coarser sewn up in sheep's skin. In this form it is an article of commerce throughout Central and Northern Asia and the Himalayan provinces; and is consumed by Mongols, Tartars, and Tibetans, churned with milk, salt, butter, and boiling water, more as a soup than as tea proper. Certain quantities are forced upon the acceptance of the Western tributaries of the Chinese Empire, in payment for the support of troops, &c.; and is hence, from its convenient size

and form, brought into circulation as a coin, over an area greater than that of Europe.—-
Dr. Hooker, in Jury Reports.

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The quantity and value of the tea imported into the United States, from 1821, is thus stated:—

Years. Pounds. Value, dolls. 1821 4,975,646 1,322,636 1822 6,639,434 1,860,777 1823 8,210,010 2,361,245 1824 8,920,487 2,786,812 1825 10,209,548 3,728,935 1826 10,108,900 3,752,281 1827 5,875,638 1,714,882 1828 7,707,427 2,451,197 1829 6,636,790 2,060,457 1830 8,609,415 2,425,018 1831 5,182,867 1,418,037 1832 9,906,606 2,788,353 1833 14,639,822 5,484,603 1834 16,282,977 6,217,949 1835 14,415,572 4,522,806 1836 16,382,114 5,342,811 1837 16,982,384 5,903,054 1838 14,418,112 3,497,156 1839 9,439,817 2,428,419 1840 20,006,595 5,427,010 1841 10,772,087 3,075,332 1842 13,482,645 3,567,745 1843 12,785,748 3,405,627 1844 13,054,327 3,152,225 1845 17,162,550 4,802,621 1846 16,891,020 3,983,337 1847 14,221,410 3,200,056 1848 18,889,217

The annual reports of the Secretary to the Treasury, for the last twenty years, show a considerable increase in the consumption of tea in the United States, but not so great as in the article of coffee. The establishment of tea shops, in all the large cities of America, is a new feature in the retail trade, dating only some six years back.

The average rate of duty, which previously ranged between thirty and thirty-four cents. per pound, was reduced in 1832 to fourteen cents (7d.) a pound.

The proportion of green to black used is shown by the following return of the imports:—

lbs.
1844 Green 10,131,837
Black 4,125,527

Total 14,257,364

1845 Green 13,802,099
Black 6,950,459

Total 20,752,558

The large import of 1840, of 250,000 chests, of which 200,000 were green, was in anticipation of the disturbances arising from the war with Great Britain, and the blockade of the ports.

In 1850, there were 173,317 chests of green tea, and 91,017 of black tea exported from China to America; these quantities, with a further portion purchased from England, made a total of about twenty-three million lbs. of tea which crossed the Atlantic in 1850.

The imports and exports of tea into the United States, in the years ending Dec. 31st, 1848 and 1849, were as follows:—

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IMPORTS.

	1849.	1848.
	lbs.	lbs.
Green	14,237,700	13,686,336
Black	5,999,315	3,815,652
	----------	----------
Total	20,236,916	17,503,988

EXPORTS.

Green	230,470	262,708
Black	186,650	194,212
	----------	----------
Total	417,120	456,920

The value of tea imported into the United States during the year ending June 30th, 1851, amounted to 4,798,006 dollars (nearly L1,000,000 sterling); of this was re-exported a little over 1,000,000 dollars worth, leaving for home consumption 3,668,141 dollars.

The quality of tea depends much upon the season when the leaves are picked, the mode in which it is prepared, as well as the district in which it grows.

The tea districts in China extend from the 27th degree to the 31st degree of north latitude, and, according to missionaries, it thrives in the more northern provinces. Koempfer says it is cultivated in Japan, as far north as 45 degrees. It seems to succeed best on the sides of mountains, among sandstone, schistus, and granite.

In 1834, the East India Company introduced the cultivation of tea in Upper Assam, where it is said to be indigenous; and they now ship large quantities of very excellent tea from thence.

Mr. Boyer, director of the museum at Port Louis, Mauritius, has succeeded in rearing 40,000 tea-trees, and expresses an opinion, that if the island of Bourbon would give itself up to the cultivation, it might easily supply France with all the tea she requires.

The culture has also been commenced on a small scale, in St. Helena, and the Cape Colony.

The cultivation of the tea-tree might be tried with probability of success in Natal, and the Mauritius. The plant grows in every soil, even the most ungrateful; resists the hurricanes, and requires little care. The picking of the leaves, like the pods of cotton, is performed by women, children, and the infirm, without much expense. The preparation is known to the greater part of the Chinese, of whom there are so many in Mauritius; besides, it is not difficult. A Mr. Duprat has, I am informed, planted a certain extent of land in the neighbourhood of Cernpipe, in that island, but I have not yet learnt with what success.

The tea-plant has been successfully cultivated, on a large scale, in the island of Madeira, at an elevation of 3,000 feet above the level of the sea, by Mr. Hy. Veitch, British ex-Consul. The quality of the leaf is excellent. The whole theory of preparing it is merely to destroy the herbaceous taste, the leaves being perfect, when, like hay, they emit an agreeable odor. But to roll up each leaf, as in China, is found too expensive, although boys and girls are employed at about two-pence or three-pence per day. Mr. Veitch has, therefore, tried the plan of compressing the leaves into small cakes, which can be done at a trifling expense. It is performed when the leaf is dry; whereas, the rolling requires moisture, and subsequent roasting on copper plates is necessary to prevent mustiness. In this process the acid of the tea acts upon the copper, and causes that astringency which we remark in all the China teas.

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The tea of Cochin China is considered inferior to that of China, being less strong and pleasant in flavour.

An inferior sort of tea, with a leaf twice or thrice as large as that of Bohea, grows wild in the hilly parts of Quang-ai, and is sold at from 12s. 6d. to 40s. the picul of 133lbs.

The Dutch have devoted much attention to tea cultivation in Java, and the plantations are in fine order. Nearly a million lbs. of tea were shipped thence in 1848; but the tea is said to be of inferior quality, and grown and manufactured at considerable expense.

Japan produces both black and green tea. The Japanese prefer the latter to the Chinese green tea. The black tea is very bad. The Japanese tea-tree, is an evergreen, growing in the most sterile places to the height of about six feet. It is described as above, by Koempfer, as having leaves like the cherry, with a flower like the wild rose; when fresh, the leaves have no smell, but a very astringent taste. Tea grows in all the southern provinces of Japan, but the best green is produced in the principality of Kioto, where it is cultivated with great care.

A few years ago, Messrs. Worms attempted the cultivation of tea in Ceylon. The island, however, lies too far within the tropics to offer a climate like Assam, which is situate without them. The plants may thrive to appearance, but that is not a demonstration of their quality. The tea-plant has reached upwards of six feet in height at Pinang, and in as healthy a state as could be desired, but the leaf had no flavor, and although thousands of Chinese husbandmen cultivate spices, and other tropical productions on that island, no one thinks it worth while to extend the cultivation of the tea-plant in Pinang. The Chinese there laugh at the idea of converting the leaf into a beverage.

The cultivation of the tea-plant has been introduced into the United States, and those planters who have tried the experiment have succeeded beyond their highest expectations. Dr. Junius Smith had successfully cultivated the plant on his property called Golden grove, near Grenville, in South Carolina. His plants were in full blossom, and as healthy and flourishing as those of China at the same stage of growth. Everything connected with them looked favorable, and Dr. Smith felt abundantly encouraged to extend the culture of the several descriptions of tea upon his property. It is stated that his expectations were so great, that he contemplated to place fresh tea on the tea-tables of England and Paris in twenty days, from the plantation. He had a large supply of plants, and tea seed enough for a million more. The black descriptions blossomed earlier than the green plant, but the latter also blossomed luxuriantly.

He introduced at first about 500 plants of from five to seven years' growth, overland from the north-west provinces of India, and some from China direct.

In the close of 1849, he writes me:—

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“During the past year the tea-plant under my care has passed through severe trials, from the injury received in transplanting, from the heat generated in the packing-cases, from the want of shelter during the severe frosts of February, from the excessive heat in June, and from the drought of 58 days’ continuance in July and August. The plants were divested of their leaves and generally of their branches and twigs in February, during my absence in New York. Knowing that the plants were tender, and not fortified by age and mature growth against severe weather, I had directed them to be covered in case a material change of temperature should occur. But these orders were neglected, and they consequently suffered from that cause.

> The plant is sufficiently hardy to resist any weather occurring in this part of the country, when seasoned for one year.

The plant has grown thrifty since April, and the quantity of foliage, buds, and blossoms, show that the root has taken strong hold, and is now fully equal to produce its fruit next autumn, which always follows the year after the blossoms. I have a variety of both black and green tea-plants. The buds and blossoms of the latter did not appear until a fortnight after the black tea-plant. But the blossoms were larger when they did appear in September, October, November, and December. From present appearances, I think the blossoms of some of the late plants will continue to unfold until spring. It is not an unusual thing for the blossoms and the fruit to appear at the same time upon the same plant. In this particular it differs from any plant I have seen. As my chief object, at present, is to cultivate and increase the tea-nut, it will be a year or two perhaps before I attempt to convert the leaf into tea. The root supports the leaf and fruit, and the leaf the root, so that neither can be spared without detriment.This climate appears congenial to the growth of the plant, and the soil is so diversified in this mountainous district, that there is no difficulty in selecting that best adapted to seed-growing plants, or that designed for the leaf only. Upon the plantation purchased this summer, I have light-yellow, dark-brown, and red clay subsoil, of a friable character, with a surface soil sufficiently sandy to answer the demands of the plant. I do not see any reason to doubt, from a year’s experience, that the tea-plant in its varieties will flourish in what I heretofore denominated the tea-growing district of the United States, as well as in any part of China.The slowness of its growth requires patience. But when once established, the tea-nuts will supply the means of extending cultivation, and the duration of the plant for twenty years diminishes the expense of labor. To illustrate the hardihood of the plant, I may observe, that notwithstanding the zero severity of February frost destroyed

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the leaves and branches of most of the plants, and those now blooming in great beauty and strength are from roots the growth of this summer, I have one green tea-plant the stem and branches of which withstood the frost of February without the slightest protection, and is now a splendid plant, covered with branches and evergreen leaves, affording undeniable evidence not only of its capability of resisting frost, but of its adaptation to just such a degree of temperature.I have often remarked that the tea-plant requires for its perfection the influence of two separate and distinct climates, the heat of summer and the cold of winter. The thermometer in this vicinity during the heat of summer generally ranges from 74 at 6 o'clock a.m. to 82 at 3 o'clock p.m., only one day during the summer so high as 86.

> This is a most agreeable temperature, nights always cool, which the tea-plant enjoys, and the days hot and fanned with the mountain breeze.

The drought I found the most difficult point to contend with, owing to the want of adequate means for irrigation. I lost 20 or 30 plants through this, and learned that no tea plantation should he established without irrigation. After two or three years there will be little necessity for it, because the depth of the roots will generally then protect the plant.

> My plantation at Golden Grove is well supplied with water, or I should not have purchased it at any price.

> It is the first and most important point to secure a southern or western aspect, a gentle declivity the second, salubrious air and suitable soil the third.

> Our country is filled with natural tea plantations, which are only waiting the hand of the husbandman to be covered with this luxuriant and productive plant.

I know the public is naturally impatient of delay. Like corn, it is expected that the tea-nuts will be planted in the spring, and the crop gathered in the autumn. But they forget that the tea-plant does not interfere with any other crop, and when once planted it does not soon require a renewal.I have sometimes felt this impatience myself, and longed for a cup of tea of my own growing, but I have never had one. As a husbandman, I must wait some time longer, and let patience have her perfect work."

Again, under date May 1, 1850, he states that he has succeeded admirably in the culture. The plants bear the winter well, and their physiology and general characteristics remain unchanged by the change of climate and soil. The leaf puts out at the same period of the year that it does in China.

On the 27th of May, 1850, Dr. Smith received a further batch of trees, fresh, green and healthful, as if still growing in the plantations of China; after a passage of little more than five months. These plants, together with the seedlings and nuts, were of the green tea species, and obtained from a quarter situated about 700 miles from Canton.

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In a letter, dated Grenville, S.C., June 17th, 1850, with which I have been favored, he adds:—

"I never heard of the failure of the tea-crop. All vegetation may be retarded, or lessened, or augmented, in its production, in a slight degree, by excessive rains, or drought, or cold, or heat, or atmospheric action; but the tea-plant is sure to produce its leaf. From all I have observed, a decided drought is the most detrimental to the health of the tea plant. The almost continued rains which marked the advance of the past spring, seemed perfectly agreeable to the tea-plant, and facilitated the germination of the tea-nuts. Where any vitality remained in the nut, it was sure to germinate. Curiosity, on this point should be restrained, and no picking and pawing up of the nuts permitted. I have seedlings with tap roots four inches in length, where no appearance of germination is visible upon the surface of the ground. The chances are ten to one that the seedling would be destroyed by the tamperings of idle curiosity. Let nature have her own most perfect work, and see that the enemy, the drought, is vanquished by an abundant supply of water.From experience, I notice that nothing is more congenial to the germination of the tea-nut than a good stiff blue, clayed soil. The marly colour of the soil is undoubtedly the result of a rich loam, combined with the clay of a lighter hue. The adhesive nature of the clay retains moisture in an eminent degree, and the fertilising qualities of the loam are well known to every bottom land farmer.Plants put out three weeks ago, after a long voyage from China, are now taking root, and look fresh and vigorous, notwithstanding the recent heat and dryness of the atmosphere. But I have taken unwearied pains in the cultivation. Every plant is sheltered from the scorching influence of the sun, now from 70 deg. to 86 deg. of temperature. Although the soil is naturally moist and clayey, and half bottom land, from the work of gentle acclivities, rising on either hand, yet I have given the plants a liberal watering in the evening. By last summer's drought of fifty-seven days, I was taught the absolute necessity of deep digging and deep planting. None of my plants, of this season's planting, are more than two or three inches above the surface of the ground.If any of the plants have leaves, as most of them have, below that height, they are planted with the leaves retained; none are removed. Some of the older plants have no leaves remaining, and looked like dry sticks. Many of these are now beginning to break, and put forth fresh leaves."

In 1851, Mr. Frank Bonynge set on foot a subscription list of fifty dollars each, to procure tea and various Indian plants for culture in America. That tea can be grown successfully in Carolina, Georgia, and Florida, is almost certain, because the experiment has been pretty fairly tried, as above shown, by Dr. Smith. The thermometer at Shanghai indicates the cold as more severe by thirteen degrees than at Charleston, South Carolina. The cold winter of 1834-5, which destroyed the oranges in Mr. Middleton's plantation, in Charleston, left his tea plants uninjured.

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The question of cultivating tea in California has been seriously discussed, and will no doubt be gone into when the gold digging mania has a little subsided. There is the necessary labor and experience on the spot, in some 12,000 or 14,000 Chinese, most of whom doubtless understand the culture and manufacture. The climate, soil and surface of California exactly answer the requirements for the growth of this plant. The time may yet come when the vast ranges of hills that traverse this State shall present terraces of tea gardens, cultivated by the laborious Chinese, and adding millions to the value of its products.

A company for the cultivation of tea, under the title of the Assam Company, was established in March, 1839; and which, with a called-up capital of L193,337, has made up to the present time very profitable progress; having now got its plantations into excellent cultivation, and all its arrangements in admirable working order, it has sold teas to the amount of L90,000, and has a steam-boat, a considerable plant and machinery.

In the report of the Company, at their annual meeting, held at Calcutta, in Jan., 1850, it was stated, as the result of their operations, that during the year 1849, the manufacturing season was unusually cold and ungenial, in consequence of which the development of leaf for manufacture was much checked. Although some loss was sustained, there was considerable increase in the crop notwithstanding, attributable to the continued improvements in the culture which had been obtained, and improvements over the previous season in some departments of the manufacturing process. The gross quantity of unsorted tea manufactured in the southern division was 207,982 lbs., being 2,673 lbs. less than that of the previous season, but the actual net out-turn was expected to reach 200,000 lbs. As much as 157,908 lbs. of the crop had been already received and shipped to England. These teas consisted chiefly of the finer qualities. Whilst the crops have been thus sensibly advancing in quantity and quality, and the value of the company’s plantations permanently raised by extended and improved culture, and some increase to the sowings, the total outlay had been somewhat less than the previous year, the expenditure being limited to L500 for a crop of 12,000 acres of tea. With more extended gardens, the produce will be raised at a yet lower rateable cost than at present.

The number of acres in cultivation in 1849, was about 12,000; these were not all in bearing, but would shortly be so, and the produce from this extent might be estimated at 300,000 lbs., and the cost of producing this would be about L11,000. 1,010 chests of the produce were sold in London on the 13th of March, 1850, at a gross average of 1s. 111/2d. per lb. The produce of 1847, sold in England, was 141,277 lbs., at a gross average of 1s. 8d. per lb.: that of 1848 was 176,149 lbs. which sold at the average of 1s. 81/2d. per lb. The produce of 1849 was 216,000 lbs., and there was every expectation of the average prices realised being higher than those of the previous years. The season was cold and unfavorable, or the crop would have been 10,000 lbs. more.

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The exact amounts obtained for the Company’s teas in the five years, ending with 1851, will be seen from the following figures:—

Net produce, lbs. Average price. L
1847 144,164 at per lb. ls. 7-1/16d. 11,513
1848 182,953 " ls. 81/4d. 15,436
1849 216,000 " ls. 91/2d. 19,350
1850 253,427 " ls. 6-1/8d. 18,153
1851 271,427 " ls. 81/2d. 22,152
1852 esmtd. 280,000

This exhibits a progressive increase in the aggregate value of the Company’s produce, and this has been effected, it is stated, without any sensible increase of the current expenditure. It exhibits also a rise in the value of the tea (157,942 lbs. having been sold at the high average price of 1s. 111/4d.), a fact strongly indicative of its increasing excellence. The details of the crop of the season of 1849 showed a net produce of 237,000 lbs. of tea; so that the Company are increasing their cultivation to the extent of nearly ten per cent, per annum, and the increase will doubtless proceed with greater rapidity, whenever the increase of capital enables the directors to extend their operations.

In a report submitted to the Directors, by Mr. Burkinyoung, the managing director in Calcutta last year, he thus speaks of the Company’s field of operations and future prospects:—

“The box-making is especially worthy of notice for its effective organisation and economical arrangement; the work is performed chiefly by Assamese boys instructed at the factory: the number of boxes required for the year’s consumption will not be short of four thousand, the whole of which will be made at the factory,—an achievement that cannot be too highly estimated in a country so destitute of mechanical labor.Notwithstanding the high standard of quality and strength to which our teas have already attained, I am of opinion that, as experience advances, and our knowledge and system of plucking and manufacturing the crops become improved, and better organised, a higher standard of quality and value may yet be realised; in this opinion the superintendent concurs with me, and the attainment of this object is one to which his attention’s prominently directed.In the course of my enquiries and trials of different samples of tea in Assam, my attention was directed to one description of black tea, of rough strong flavor, made by a quicker process than that ordinarily used in the manufacture of black tea: under this mode of manipulation, a quality of tea is produced sufficiently distinctive in its flavor and appearance to render it worthy of attention and trial, and I think, when perfected in the process of manufacture, calculated to come into popular estimation. Samples of this tea the superintendent will forward to the board for trial.In conducting the operations in Assam,

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the chief difficulty of importance which has not yet been effectually met is the paucity of labor; this does not, however, exist to the extent of materially checking any of the important operations connected with the production of the tea, but it is felt in the arrear of various descriptions of work, in providing bricks for building, and in the preparation of a stock of seasoned timber and boards for building and box-making; while the out factories would be benefited by a larger proportion of agricultural labor. Great advance, however, has been made by the superintendent in the employment of Assamese labor in contract work: under the arrangement he has established, these contracts are now, for the most part, fulfilled with much punctuality, and there is reason to expect that this system of labor will be further extended. The Kachorie Coolies are a valuable class of laborers, but they do not appear to be sufficiently numerous, or to emigrate in sufficient numbers to afford with the native Assamese a supply of labor altogether equal to our wants, so as to render the concern independent of Bengal labor.The tea lands are for the most part advantageously situated, within convenient reach of water-carriage, either by the ‘Dickhoo,’ ‘Desang,’ and ‘Dehing’ rivers, or by means of small streams leading to them. The Plantations of the Satsohea and Rookang forests, and on the banks of the Tingri in the Northern Division, are all valuable centres of extension in each district. The lands suitable for tea cultivation are ample in extent, and of the highest fertility; while the Hill Factories of the Southern and Eastern Divisions, although secondary in importance, are, as regards extent and quality of soil, equally eligible as bases of extension.The prospects of the future, I entertain no doubt, will keep pace with the satisfactory results that have hitherto been realised, looking to the sound organisation that now exists in our establishment at Assam, an organisation that has already taken healthy root, and must in its growth gain strength and permanence. I think we may safely calculate, after the current year, upon an annual increase in our production of 40,000 lbs. of tea, until a larger system of operations can be matured, of which the basis is already laid down, in the new lands cleared and sown during the past cold season, averaging 225 to 250 poorahs; and this extended basis will be doubtless followed up by annual extensions of similar, if not larger, area. The concern is now taking a position which will place it on a scale of working commensurate with the objects entertained upon the first incorporation of the company, the profits now likely to be realised being adequate to all the outlay necessary.”

The prices in the last two years in London have been fully maintained at 1s. 3d. to 4s. 4d., according to sorts. Of Assam tea, the sales in the London market in 1851 amounted to 2,200 packages, against

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1,900 packages in 1850, and all were freely taken (on account of their great strength) at very full prices. Seventy-six packages of Kumaon tea, both black and green, grown by the East India Company, in the Himalayas, as an experiment, were also brought to sale. They were teas of high quality; but being of the light flavored class, and not duly esteemed in this market, they realised only about their relative value as compared with China teas of similar grade. The Souchong and Pouchong sold at 1s. 11/4d. to 1s. 31/2d.; the Hyson, Imperial, and Gunpowder realised 1s. 73/4d. to 2s. 61/2d.

Mr. Robert Fortune, who, in the service of the Horticultural Society of London, gave such satisfaction by his botanical researches in China, was, on his return to England, in 1848, engaged by the Directors of the East India Company to proceed again to the Celestial Empire, and procure and transmit to India such a quantity and variety of the tea plant, that its cultivation in the north-western provinces would be a matter of mere manual labor. Having penetrated about 300 miles into the interior, he left Hong Kong in the middle of 1851 for Calcutta, with a large quantity of choice plants, selected in the green tea districts, and these have flourished as well as could possibly be expected; so that, in the course of a few years, there is every probability that tea will form a considerable article of export from our Indian Presidencies. Mr. Fortune secured the services of, and took with him, eight Chinese, from the district of Wei-chow, under an agreement for three years, at the rate of fifteen dollars a month each. Six of these are regular tea-manufacturers; the other two are pewterers, whose sole business is that of preparing lead casings for tea-chests.

In the British portion of the Punjaub, it has been resolved to expend L10,000 a year on the cultivation of the tea plant on the banks of the Beas, as well as at Anarkullee, and Kotghur in the Simla jurisdiction. Beyond the Beas there is a series of valleys on to Noonpoor, *viz*., the Palklun, Kangra, Rillo, &c., from 3,000 to 4,000 feet above the level of the sea, separated from each other by small ranges of hills. The valleys are from three to four miles in breadth, and from sixty to seventy in length: they are sheltered on the north by high mountains. They are described as admirably suited for the cultivation of the plant, now about to be attempted under the able management of Dr. Jamieson. Should it prove successful, the benefits it will confer on the country will be enormous. Tea is a favorite beverage everywhere with the natives: at present their supplies come in scanty measure and bad condition, at extravagant charges, across the frontier.

The cultivation of the tea plant in the highlands of the Punjaub, is likely to be successful, even beyond the hopes of its promoters. Thousands of plants sown in 1849 have attained a height of four or five feet, and there seems no reason why tea should not ultimately become an important article of trade in the Punjaub, as well as in Kumaon. The Indian teas are already becoming popular in the English market, and the cultivators have the advantage of a demand which is almost unlimited, and of prices which seldom fluctuate to any great extent.

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The experiment of growing tea in the Madras Presidency has been often successfully tried, on a small scale. A number of plants supplied by government, through Dr. Wallich, were planted in the Shevaroy hills, about twelve or fourteen years since, and have thriven well; but though no doubt is entertained of the ease with which they could be propagated over a wide extent of country, no attempt has been made to give the cultivation a practical turn, or to make a cup of tea from the southern Indian tree. In Coorg, too, the experiment has been tested with like results, so that sufficient warranty exists to justify trials on the largest scale.

Tea plants grow in luxuriance in the open air, at the Botanical Gardens, at Kew. Mr. Bonynge has seen this plant growing wild in N. lat. 27 deg. 30 min. on hills from three to 500 feet in height, where too, there was an abundance of frost, snow and hail.

Those persons in England who possess tea plants, and who cultivate them for pleasure, should always bear in mind that, even in the tea districts of China, this shrub will not succeed if it be planted in low, wet land; and this is, doubtless, one of the reasons why so few persons succeed in growing it in this country. It ought always to be planted on a warm sloping bank, in order to give it a fair chance of success. If some of the warm spots of this kind in the south of England or Ireland were selected, who knows but that our cottagers might be able to grow their own tea? at all events, they might have the fragrant herb to look upon.

The Dutch made the first movement to break the charm of Chinese monopoly, by introducing and cultivating the tea plant in their rich and fruitful colony of Java. That island lies between the sixth and eighth degrees of south latitude.

In 1828, the first experiment in the cultivation of tea was made in the garden of the Chateau of Burtenzorg, at Java, where 800 plants of an astonishing vigor, served as an encouragement to undertake this culture, and considerable plantations were made in many parts of the island. The first trials did not answer to the expectations, as far as regards the quality of the article, the astringent taste and feeble aroma of which caused the conjecture that the preparation of the leaf, and its final manipulation, are not exactly according to the process used in China. At present tea is cultivated in thirteen Residencies: but the principal establishment, where the final manipulation is made, is in the neighbourhood of Batavia. The tea which Java now furnishes yearly to the markets of the mother country, may be stated at from 200,000 to 300,000 pounds. It is intimated that the government intends to abandon this culture to the industry of private individuals, under the guarantee of equitable contracts.

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The mountain range, which runs through the centre of the island, is the most productive, because the tea gardens, extending from near the base, high up the mountains, reach an atmosphere tempered by elevation. The plant escapes the scorching heats of the torrid zone, and finds a climate, by height rather than by latitude, adapted to its nature. But the plant is not confined to lofty ridges. In the plains, the hedges and fences, if one may so call them, are all planted with the tea shrub, which flourish in greater or less perfection throughout the island. But, as has already been intimated, the equatorial latitudes are not the most auspicious for the vigorous growth of a plant that requires a temperature equally removed from the extremes of heat and cold, and the quality of the tea is as much affected by the climate as the growth of the plant. A considerable quantity of tea is annually shipped from Java to Europe; but the extension of the cultivation is no doubt checked by the exceeding fertility of the soil, and its adaptation to the growth of the rich products of tropical regions.

Mr. Jacobson, inspector of tea culture in Java, has published at Batavia a work in three volumes, upon the mode of cultivating this plant, upon the choice of grounds, and the best processes for the preparation and manipulation of the leaves. This book, the fruit of many years of experience and care given to the subject, has been well received by the cultivators who devote themselves to this branch of industry. If, by means of careful experiments and experience, the government succeed in conferring on the island of Java this important branch of commerce, she may hope to obtain brilliant results; at all events, it will open to the country a new source of prosperity and riches.

An interesting account of the tea plants, and the manufacture of tea, will be found in Fortune's “Wanderings in China,” in Ball's “Account of the Cultivation and Manufacture of Tea,” Boyle's “Illustrations of Himalayan Botany,” and his “Productive Resources of India.”

From Fortune's “Travels” I take the following extract:—

“There are few subjects connected with the vegetable kingdom which have attracted such a large share of public notice as the tea-plant of China. Its cultivation on the Chinese hills, the particular species of variety which produces the black and green teas of commerce, and the method of preparing the leaves, have always been objects of peculiar interest. The jealousy of the Chinese government in former times, prevented foreigners from visiting any of the districts where tea is cultivated; and the information derived from the Chinese merchants, even scanty as it was, was not to be depended upon. And hence we find our English authors contradicting each other; some asserting that the black and green teas are produced by the same variety, and that the difference in colour is the result of a different mode of preparation;

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while others say that the black teas are produced from the plant called by botanists *Thea Bohea*, and the green from *Thea viridis*, both of which we have had for many years in our gardens in England. During my travels in China since the last war, I have had frequent opportunities of inspecting some extensive tea districts in the black and green tea countries of Canton, Fokien, and Chekiang: the result of these observations is now laid before the reader. It will prove that even those who have had the best means of judging have been deceived, and that the greater part of the black and green teas which are brought yearly from China to Europe and America are obtained from the same species or variety, namely, from the *Thea viridis*. Dried specimens of this plant were prepared in the districts I have named, by myself, and are now in the herbarium of the Horticultural Society of London, so that there can be no longer any doubt upon the subject. In various parts of the Canton provinces where I have had an opportunity of seeing tea cultivated, the species proved to be the *Thea Bohea*, or what is commonly called the black tea plant. In the green tea districts of the north—I allude more particularly to the province of Chekiang—I never met with a single plant of this species, which is so common in the fields and gardens near Canton. All the plants in the green tea country near Ningpo, on the islands of the Chusan Archipelago, and in every part of the province which I have had an opportunity of visiting, proved, without an exception, to be *Thea viridis*. Two hundred miles further to the north-west, in the province of Kiangnan, and only a short distance from the tea hills in that quarter, I also found in gardens the same species of tea. Thus far my actual observations exactly verified the opinions I had formed on the subject before I left England, viz: that the black teas were prepared from the *Thea Bohea*, and the green from *Thea viridis*. When I left the north, on my way to the city of Foo-chow-foo, on the river Min, in the province Fokien, I had no doubt that I should find the tea hills there covered with the other species, *Thea Bohea*, from which we generally suppose the black teas are made; and this was the more likely to be the case as this species actually derives its specific name from the Bohea hills in this province. Great was my surprise to find all the plants on the tea hills near Foo-chow exactly the same as those in the green tea districts of the north. Here were, then, green tea plantations on the black tea hills, and not a single plant of the *Thea Bohea* to be seen. Moreover, at the time of my visit, the natives were busily employed in the manufacture of black teas. Although the specific differences of the tea plant were well known to me, I was so much surprised, and I may add amused, at this discovery, that I procured a set of specimens for the herbarium, and also dug up a living plant, which I took northward

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to Chekiang. On comparing it with those which grow on the green tea hills, no difference whatever was observed. It appears, therefore, that the black and green teas of the northern districts of China (those districts in which the greater part of the teas for the foreign market are made) are both produced from the same variety, and that that variety is the *Thea viridis*, or what is commonly called green tea plant. On the other hand those black and green teas which are manufactured in considerable quantities in the vicinity of Canton, are obtained from the *Thea Bohea*, or black tea.In the green tea districts of Chekiang, near Ningpo, the first crop of leaves is generally gathered about the middle of April. This consists of the young leaf buds just as they begin to unfold, and forms a fine and delicate kind of young hyson, which is held in high estimation by the natives, and is generally sent about in small quantities as presents to their friends. It is a scarce and expensive article, and the picking off the leaves in such a young state does considerable injury to the tea plantation. The summer rains, however, which fall copiously about this season, moisten the earth and air; and if the plants are young and vigorous, they soon push out fresh leaves. In a fortnight or three weeks from the time of the first picking, the shrubs are again covered with fresh leaves, and are ready for the second gathering, which is the most important of the season. The third and last gathering, which takes place as soon as new leaves are formed, produces a very inferior kind of tea, which is rarely sent out of the district. The mode of gathering and preparing the leaves of the tea plant is very simple. We have been so long accustomed to magnify and mystify everything relating to the Chinese, that in all their arts and manufactures we expect to find some peculiar practice, when the fact is, that many operations in China are more simple in their character than in most parts of the world. To rightly understand the process of rolling and drying the leaves, which I am about to describe, it must be borne in mind that the grand object is to expel the moisture, and at the same time to retain as much as possible of the aromatic and other desirable secretions of the species. The system adopted to attain this end is as simple as it is efficacious. In the harvest seasons, the natives are seen in little family groups on the side of every hill, when the weather is dry, engaged in gathering tea leaves. They do not seem so particular as I imagined they would have been in this operation, but strip the leaves off rapidly and promiscuously, and throw them all into round baskets, made for the purpose out of split bamboo or ratan. In the beginning of May, when the principal gathering takes place, the young seed-vessels are about as large as peas. These are also stripped off and mixed with the leaves; it is these seed-vessels which we often see in our tea, and which has some slight resemblance to capers. When a sufficient quantity of leaves are gathered, they are carried home to the cottage or barn, where the operation of drying is performed.”

This is minutely described, and the author continues:—

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“I have stated that the plants grown in the districts of Chekiang produce green teas, but it must not be supposed that they are the green teas which are exported to England. The leaf has a much more natural color, and has little or none of what we call the ’beautiful bloom’ upon it, which is so much admired in Europe and America. There is now no doubt that all these ‘blooming’ green teas, which are manufactured at Canton, are dyed with Prussian blue and gypsum, to suit the taste of the foreign ‘barbarians;’ indeed the process may be seen any day, during the season, by those who give themselves the trouble to seek after it. It is very likely that the same ingredients are also used in dyeing the northern green teas for the foreign market; of this, however, I am not quite certain. There is a vegetable dye obtained from *Isatis indigotica* much used in the northern districts, and called *Teinsing*; and it is not unlikely that it may be the substance which is employed. The Chinese never use these dyed teas themselves, and I certainly think their taste in this respect is more correct than ours. It is not to be supposed that the dye used can produce any very bad effects on the consumer, for, had this been the case, it would have been discovered before now; but if entirely harmless or inert, its being so must be ascribed to the very small quantity which is employed in the manufacture.”

In short, the black and green teas which are generally exported to England and the United States from the northern provinces of China, are made from the same species; and the difference of color, flavor, &c., is solely the result of the different modes of preparation.

I shall make an extract, also, from Williams’s “Middle Kingdom:”—

“The native names given to the various sorts of tea are derived for the most part from their appearance or place of growth; the names of many of the best kinds are not commonly known abroad. *Bohea* is the name of the Wu-i hills, (or Bu-i, as the people on the spot call them,) where the tea is grown, and not a term for a particular sort among the Chinese, though it is applied to a very poor kind of black tea at Canton. *Sunglo* is likewise a general term for the green teas produced on the hills in Kiangsu. The names of the principal varieties of black tea are as follows: *Pecco*, ‘white hairs,’ so called from the whitish down on the leaves, is one of the choicest kinds, and has a peculiar taste; *Orange Pecco*, called *shang hiang*, or ‘most fragrant,’ differs from it slightly; *Hungmuey*, ‘red plum blossoms,’ has a slightly reddish tinge; the terms *prince’s eyebrows*, *carnation hair*, *lotus kernel*, *sparrow’s tongue*, *fir-leaf pattern*, *dragon’s pellet*, and *dragon’s whiskers*, are all translations of the native names of different kinds of Souchong or Pecco. *Souchong*, or *siau chung*, means *little plant* or

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sort, as *Pouchong*, or *folded sort*, refers to the mode of packing it; *Campoi* is corrupted from *kan pei i.e*. carefully fired; *Chulan* is the tea scented with the chulan flower, and applied to some kinds of scented green tea. The names of green teas are less numerous: *Gunpowder*, or *ma chu*, *i.e*. hemp pearl, derives its name from the form into which the leaves are rolled; *ta chu* or ‘great pearl,’ and *chu lan*, or ‘pearl flower,’ denote two kinds of *Imperial*; *Hyson*, or *yu tsien*, *i.e*. before the rains, originally denoted the tenderest leaves of the plant, and is now applied to *Young Hyson*; as is also another name, *mei pein*, or ‘plum petals;’ while *hi chun*, ‘flourishing spring,’ describes *Hyson*; *Twankay* is the name of a stream in Chehkiang, where this sort is produced; and *Hyson skin*, or *pi cha*, *i.e*. skin tea, is the poorest kind, the siftings of the other varieties; *Oolung*, ‘black dragon,’ is a kind of black tea with green flavor. Ankoi teas are produced in the district of Nganki, not far from Tsiuenchau fu, possessing a peculiar taste, supposed to be owing to the ferruginous nature of the soil. De Guignes speaks of the Pu-’rh tea, from the place in Kiangsu where it grows, and says it is cured from wild plants found there; the infusion is unpleasant, and is used for medical purposes. The Mongols and others in the west of China prepare tea by pressing it, when fresh, into cakes like bricks, and thoroughly drying it in that shape to carry in their wanderings.“Considering the enormous labor of preparing tea, it is surprising that even the poorest kind can be afforded to the foreign purchaser at Canton, more than a thousand miles from the place of its growth, for 9d. and less a pound; and in their ability to furnish it at this rate, the Chinese have a security of retaining the trade in their hands, notwithstanding the efforts to grow the plant elsewhere. Comparatively little adulteration is practised, if the amount used at home and abroad be considered, though the temptation is great, as the infusion of other plants is drunk instead of the true tea. The poorer natives substitute the leaves of a species of Rhamnus or Fallopia, which they dry; Camellia leaves are perhaps mixed up with it, but probably to no great extent. The refuse of packing-houses is sold to the poor at a low rate, under the name of tea endings and tea bones; and if a few of the rarest sorts do not go abroad, neither do the poorest. It is a necessary of life to all classes of Chinese, and that its use is not injurious is abundantly evident from its general acceptance and extending adoption; and the prejudice against it among some out of China may be attributed chiefly to the use of strong green tea, which is no doubt prejudicial. If those who have given it up on this account will adopt a weaker infusion of black tea, general experience

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is proof that it will do them no great harm, and they may be sure that they will not be deceived by a colored article; Neither the Chinese nor Japanese use milk or sugar in their tea, and the peculiar taste and aroma of the infusion is much better perceived without those additions; nor can it be drunk so strong without tasting an unpleasant bitterness, which the milk partly hides. The Japanese sometimes reduce the leaves to a powder, and pour boiling water through them in a cullender, in the same way that coffee is often made."

The following valuable details as to the cultivation and manufacture of tea in British India, are from interesting reports by Dr. Jameson, Superintendent of the Company's Botanical Gardens in the North West Provinces, published in 1847 in the Journal of the Agricultural and Horticultural Society of Calcutta;—and from Mr. Robert Fortune's report to the Hon. East India Company:—

The quantity manufactured.—The quantity of tea manufactured from five plantations, of 89 acres in all, amounted in 1845 to 610 lb. 2 oz., and in 1846, on 115 acres, to l,023 lb. ll oz. The small nursery of Lutchmisser, consisting of three acres of land, gave a return in 1845 of 216 lb., or 2 maunds and 56 pounds; in 1846 the return was 272 lbs., or 3 maunds and 32 pounds.The small plantation of Kuppeena, established in 1841-2, and then consisting of three acres (but increased in 1844 to four), yielded in 1845, 1 maund and 56 pounds, and in 1846, 2 maunds and 56 pounds. Thus we have received from a plantation of only five years' formation, and of four acres (one of these recently added), upwards of 21/2 maunds of tea, and from another, Lutchmisser, of three acres, which was established in 1835-6, 3 maunds and 30 pounds, equal to 272 pounds. I have, in a former report, asserted that the minimum return of tea for an acre of land may be estimated at 1 pucka maund, or 80 lb. The only plantations that I can as yet bring forward in favour of my assertion, are the two above-mentioned: Kuppeena has not yielded the proportion mentioned, but it was only established in 1841-42, and the tea-plants do not come into full bearing until the eighth year; on the other hand, Lutchmisser has given more than the average return. I think, therefore, that the returns already yielded are highly favorable, and that though the data are small, they are very satisfactory.*Soil best adapted for the tea-plant*.—The soil in which the tea-plant is now thriving in the Himalayas and in the valley of Deyrah Dhoon, varies exceedingly. At Bhurtpoor and Russiah it is of a light silico-aluminous nature, and abounding with small pieces of clay slate, which is the subjacent rock, and trap (green-stone), which occurs in large dykes, cutting through and altering the strata of clay slate; mixed with the stony soil, there is a small quantity of vegetable matter. The clay slate is metamorphic, being almost entirely

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composed of mica. In some places it is mixed with quartz, forming mica slate. From the decomposition of these rocks, mixed with a small quantity of vegetable matter, the soil is formed. At Kuppeena and Lutchmisser, the soil is also very stony, formed from the decomposition of clay slate, which, in many places, as at Russiah and Bhurtpoor, passes into mica slate, or alternates with it, and a little vegetable matter. The same remark applies to the plantations of Guddowli, Kouth, and Rumaserai. At Huwalbaugh part of the soil consists of a stiff clay, of a reddish-yellow colour, owing to peroxide of iron. Here, too, the tea-plants, provided that the ground around them is occasionally opened up, thrive well. In Mr. Lushington's garden at Lobha, in Kumaon, and in Assistant Commissioner Captain H. Ramsay's garden at Pooree, in Gurwahl, plants are thriving well in a rich, black, vegetable mould. The soil in the Deyrah Dhoon varies exceedingly from clayey and stiff soil to sand and gravelly soil, or light and free. The soil at Kaolagir is a compound of the two, neither clayey, nor free, nor light soil, but composed partly of clay and sand, mixed with vegetable mould, and in some places mixed with much gravel, consisting of limestone, marl, sandstone, clay slate, and quartz rock, or of such rocks as enter into the composition of the surrounding ranges of mountains, *viz*., the Sewalick range to the south, and the Himalayas, properly so called, to the north, From the above statement, we find that the tea-plant thrives well both in stiff and free soils, and in many modifications of these. But the soil which seems best adapted to its growth may be styled free soil, as at Russiah, or a mixture of both, as at Kaolagir, in the Deyrah Dhoon.In limestone districts, where the tea has been tried, if the super-imposed soil has been thin and untransported, and this proved from the decomposition of the subjacent rock, the plant has generally failed; and this has been particularly the case where the limestone, by plutonic action, has become metamorphic. These districts, therefore, in forming plantations, are to be avoided.From the writings of various authors, it appears that the districts where the tea-plant thrives best in China, have a geological structure very similar to that met with in many parts of the Himalayas, being composed of primitive and transition rocks.*Altitude above the sea best suited to the tea plant*.—To state what altitude is best adapted to the growth of the tea-plant, and for the production of the best kinds of tea, will require much more observation. At present the tea-plant thrives equally well at Kaolagir, in the Deyrah Dhoon; at Russiah, in the Chikata district; at Huwalbaugh; at Kuppeena and Lutchmisser; and at Rumaserai, or at heights ranging from 2,200 feet above the level of the sea to 6,000 feet.

> Moreover, the tea manufactured from leaves procured from Kaolagir, has been considered by the London brokers equal to that made from leaves procured from Lutchmisser and Kuppeena.

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On the method of preparing ground prior to forming a plantation.—In forming a plantation, the first object of attention, both in the hills and in the Deyrah Dhoon, is a *fence*. In the former, to prevent the depredations of wild animals, such as wild hog, deer, &c., which abound in the hills, and though they do not eat tea leaves, yet hogs, in search of tubers, in the space of a single night will do much damage by uprooting young shrubs—in the latter, to prevent the straying of cattle. The first thing to be done, therefore, is to dig a trench three feet broad and two deep, and to plant a hedge, if in the hills, of black thorn (*Cratoegus*); if in the plains, the different species of aloe are best adapted for the purpose. The fence being formed, all trees and shrubs are then to be uprooted; this is very heavy work, both in the hills and plains, from the vast number of shrubs, allowed by natives (from indolence to remove them) to grow everywhere throughout their fields. Roads are then to be marked off.After this has been accomplished, the land is to be drained, if necessary, by open drains—under drainage, for want of means and the expense, being impracticable—and then ploughed three or four times over. The beds for young tea-plants are then to be formed; these ought to be three feet in breadth, alternating with a pathway of two feet in breadth. By arranging beds in this manner much time and labour is saved in transplanting; in irrigation the water is economised, and in plucking tea leaves a road is given to the gatherer. In transplanting, each plant is allowed 41/2 feet; this is at once gained, the beds and pathways being formed by placing in one direction the plant in the centre of the bed.*Trenching*.—On the tea beds being marked off, they are to be trenched to a depth of from two to three feet, in order to destroy all the roots of weeds, which are to be carefully removed. The trenching is to be performed by the *fowrah*, or Indian spade.In the hills, in many places the *fowrah* cannot be used, owing to the number of stones. The work is then to be done by the *koatlah*, a flat-pointed piece of iron, of about eight inches in length, which is inserted into a wooden handle. It is in form like the pick, and is much used in hill cultivation for weeding and opening up the ground. It is, however, not much to be commended for trenching purposes, as natives, in using it, never penetrate the ground beyond a few inches. For weeding, however, it is particularly useful, and to such soil is much better adapted than most other implements.*Formation of roads and paths*.—In addition to the pathways of two feet in breadth, recommended to be formed between each bed, there ought, for general use, to be a four feet road carried round the plantation, and one of 10 feet through the centre. This applies to a limited plantation,

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that is, of from 200 to 400 acres. If, on the other hand, it was on a more extensive scale, several hackery roads of 10 feet in breadth would be necessary, in order to cart away weeds, &c., or carry manure to seedling beds.*On seeds when ripe, and method to be adopted to ascertain it*.—In all September and October the tea seeds ripen, but in the more elevated plantations, as at Rumaserai, many do not ripen until November. The seeds are contained in a capsule, and vary in number from one to seven; to ascertain that they are ripe, open the capsule, although green, and if their color is a nut-brown, they are sure to be so. If they are not ripe, they are of a reddish-brown above, mixed with white. If the seeds are allowed to remain a short time on the bushes, after they are ripe, the capsules burst, and they fall out; it is necessary, therefore, to remove them before this takes place.*On the method of sowing seeds, and season, and on the treatment of the young tea plants after they have germinated*.—The ground having been first well trenched and manured, that is, from sixty to seventy maunds of manure given to the acre, the seeds are, when ripe, to be removed from the capsules, and immediately sown to the depth of one inch, and very close, in drills 8 to 10 inches apart from each other. The sooner that they are sown after being removed from the capsules the better, as their germinating properties are apt to be destroyed if they are kept for any length of time. Some germinate in the space of a few weeks, others lie dormant until February and March, and others do not germinate until the rains.The method of sowing seeds in China is thus described, being similar to the native plan of sowing mangoes in India. “Several seeds are dropped into holes four or five inches deep and three or four feet apart, shortly after they ripen, or in November and December; the plants rise up in a cluster when the rains come on. They are seldom transplanted, but sometimes four to six are put quite close to form a fine bush."[9] By this method nothing is gained, and the expenditure of seeds great.

> If the plants germinate in November, which, as already stated, many do, they ought to be covered with a *chupper* made of bamboo and grass.

In the hills, everywhere at an elevation of 6,000 and 7,000 feet, the ringal, a small kind of bamboo, of which there are several species, is found in great abundance, and well adapted for the purpose, and in the Deyrah Dhoon the bamboo occurs in vast quantity; the market of the Upper Provinces being chiefly supplied from that valley and other forests at the base of the Himalayas. Bamboos are also met with to the height of six and seven thousand feet on the Himalayas in the neighbourhood of Almorah. During the day, in the cold weather, the *chuppers* ought to be removed, and again

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replaced at night; as the weather becomes hot, it is necessary to protect the young plants from the heat of the sun, that is, in April and May, and until the rains commence; the *chuppers* at this time ought to be put on about eight a.m., and removed again about four p.m.*Method of rearing plantations by layers, and by cuttings*.—The best season for laying down is when the sap is dormant, or in cold weather; or when in full action, as in the rains. "Laying," as expressed by Dr. Lindley, "is nothing but striking from cuttings, which are still allowed to maintain their connection with the mother plant by means of a portion of their stem." There are various methods of making layers, but the most simple and efficient is to bend down a branch, and sink it into the earth after having made a slit or notch in the centre of the embedded portion. By so doing, the descent of the sap is retarded, and thus the formation of radicles or young roots is promoted; about five or six inches or more, of the branch, is to be allowed to remain above ground, and in a position as perpendicular to the point where the plant is notched as possible. In three or four mouths these layers are ready to be removed and transplanted; the removal of the layers is to be gradual, that is, they ought first to be cut half through, then a little more, and finally altogether separated.The best season for propagating by cuttings is the cold weather, that is, from November to February; they may also be propagated, though not with the same success, during the rains; it is necessary to protect them against frost in the cold weather, and from the rays of the sun in the hot. Cuttings put in during the cold weather are ready to transplant in the rains, and if put in during the rains, they are generally fit for removal in February.*On the method of transplanting and season*.—In transplanting young tea-plants care should be taken to lift them with a good large ball of earth attached to their roots, as they throw out a long central or tap root, which, if cut through, invariably destroys the plant. On being placed in the ground, the earth around them is to be well pressed down and watered; the watering is to be continued every third or fourth day, until the plants have taken hold of the ground. During the rains, grass springs up with great rapidity, so as to render it impossible for one man to keep three acres (the quantity assigned by us) clean. This, however, is not necessary, if care be taken to make a golah round each plant, and keep it clear of weeds; these golahs ought always, in hill plantations where the ground is irregular, to be connected by small *khauls* or channels, in order to make irrigation easy; by so doing too, water, if the supply be scanty, which often happens in the hills in the hot weather, will be economised.
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|  b                              b  |
|        a         a         a       | a Tea plant.
Thus--      |        X----------X----------X        | b Bed
|            c         c             | c Watercourse
|  b                              b  |
+--------------------------------------+
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We have already stated that 41/2 square feet ought to be assigned to each plant. In China, according to Professor Royle, three to four feet are given; this, however, is too small a space to allow the plant to grow freely. After the tea plants are transplanted, it is not necessary to protect them.The best seasons for transplanting are towards the end of February, or as soon as the frost has ceased, and throughout March, and during the rains, and until the end or middle of November, depending on the season.In transplanting, four parties ought to be employed; *viz*., one person to dig holes, a second to remove plants, a third to carry them to the ground where they are required, and a fourth to plant. By this means, not only time is saved, but the plants have a much better chance, when thus treated, of doing well. When the seedling beds are extensive, so many of the plants ought not to be removed, that is, a plant left every 41/2 feet, and these beds added to the plantation.*On pruning, best season and mode*.—The plants do not require to be pruned until the fifth year, as the plucking of leaves generally tends to make the plants assume the basket shape, the form most to be desired to procure the greatest quantity of leaves; if, however, the plants show a tendency to run into weed, from central branches being thrown out, this ought to be checked by removing the central stem. In the fourth year a quantity of the old and hard wood ought to be removed, to induce the plants to throw out more branches. The best season for pruning is from November to March.

> *On irrigation*.—To keep the tea-plants healthy, irrigation for two or three years is absolutely necessary, and no land ought to be selected for a tea plantation which cannot be irrigated.

On the other hand, land liable to be flooded during the rains, and upon which water lies for any length of time, is equally detrimental to the growth of the plant. This applies to a small portion of the Kooasur plantation, which receives the drainage of the adjoining hills, and the soil being retentive, keeps the water. Deep trenches have been dug in order to drain it off—these, however, owing to the lowness of the surrounding country, act badly. Three successive seasons plants have been put into the ground, and as often have been destroyed on the setting in of the rains, showing the necessity of avoiding such kind of land for tea plantation.To facilitate irrigation, &c., as already stated, in the Deyrah Dhoon, I have limited the

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tea beds to three feet in breadth. This is particularly requisite in land so constituted as that of the Deyrah Dhoon, it being so porous, as mentioned by Major Cautley in his “Notes and Memoranda of Watercourses.” This is caused by the superincumbent soil not being more than from one to three feet thick, in some places more, but varying exceedingly. Beneath this there is a bed of shingle of vast thickness, through which the water percolates; it is this that renders the sinking of wells so difficult in the Deyrah Dhoon, and which has tended so much to retard individuals from becoming permanent residents; at present there are many tracts of several thousand acres in that valley unoccupied from want of drinking water, as for instance, at Innesphaeel.

Where the ground is very uneven, as is the case generally in the hills, the *khaul* system, already recommended, ought to be adopted.

On the tea-plant; season of flowering, its characters and species, and on the advantages to be derived from importing seeds from China.—From the importance of tea, as an article of commerce, the plant has attracted much attention; and from few qualified Europeans having travelled in the tea districts of China, there is much difference of opinion as to the number of species belonging to the genus Thea.In the government plantations in Kumaon and Gurwahl, the plants begin to flower about the end of August and beginning of September, or, as the seeds of the former year begin to ripen. They do not all come into flower at once, but some are in full blossom in September, others in October, November, December and January. Some throw out a second set of blossoms in March, April, and May, and during the rains; so that from the same plant unripe or ripe seeds and flowers may be collected at one and the same time.To the genus Thea, which belongs to the order Ternstraemiaceae, the following characters have been ascribed: calyx persistent, without bracts, five-leaved, leaflets imbricated and generally of the same size. Petals of the corolla vary in number from five to nine, imbricated, the inner ones much the largest. Stamens numerous, in several rows adhering to the bottom of the petals. Filaments filiform. Anthers incumbent, two-celled, oblong, with a thickish connectivum. Cells opening longitudinally. Ovary free, three-celled; ovules four in each cell, inserted internally into the central angle, the upper ones ascending, the lower pendulous. Style trifid, stigmas three, acute. Capsule spheroidal, 1-7-lobed with loculicidal dehiscence, or with dessepiments formed from the turned-in edges of the valves. Seeds solitary, or two in cells, shell-like testa, marked with the ventral umbilicus. Cotyledons thick, fleshy, oily, no albumen. Radicle very short, very near the umbilicus centripetal. In the plantations there are two species, and two well marked varieties.

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The first is characterised by the leaves being of a pale-green colour, thin, almost membraneous, broad lanceolate, sinatures or edge irregular and reversed, length from three to six inches. The color of the stem of newly-formed shoots is of a pale-reddish colour, and green towards the end. This species is also marked by its strong growth, its erect stem, and the shoots being generally upright and stiff. The flowers are small, and its seeds but sparing.In its characters this plant, received from Assam, agrees in part with those assigned by Dr. Lettsom and Sir W. Hooker to the *Thea viridis*, but differs in its branches being stiff and erect. The flowers small, or rather much about the same size as the species about to be described, and not confined to the upper axils of the plant, and solitary, as stated by them.[10] By the Chinese manufacturers it is considered an inferior plant for making tea, it is not therefore grown to any extent.The second species is characterised by its leaves being much smaller, and not so broadly lanceolate; slightly waved, of a dark-green color, thick and coriaceous, sinature or edge irregular, length from one to three inches and a half. In its growth it is much smaller than the former, and throws out numerous spreading branches, and seldom presents its marked leading stem. This species, therefore, in the above characters, agrees much with those that have been assigned to *Thea Bohea* by authors. The characters have been mixed up in an extraordinary manner. Thus it has been stated, that the *Thea viridis* has large, strong growing, and spreading branches, and that *Thea Bohea* is a smaller plant, with branches stiff and straight, and stem erect. No doubt the *Thea viridis* is a much larger and stronger growing plant than the *Thea Bohea*, or rather the plant now existing in the different plantations is so; but in the former the branches are stiff and erect, and in the latter inclined and branches. The marked distinguishing characters between the two species are the coriaceous dark-green leaves in the *Thea Bohea*, and the large pale-green monhanaeous leaves of the *Thea viridis*. The manner, too, of growth is very striking, and on entering the plantation the distinction is at once marked to the most unobservant eye. This species of *Thea Bohea* forms nearly the whole of the plantations, and was brought from China by Dr. Gordon.In the plantations there is a third plant, which, however, can only be considered a marked variety of *Thea Bohea*. Its leaves are thick, coriaceous, and of dark-green color, but invariably very small, and not exceeding two inches in length, and thinly lanceolate; the serratures, too, on the edge, which are straight, are not so deep. In other characters it is identical. This marked variety was received from Calcutta at the plantation in a separate despatch from

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the others.But in addition to these there are, no doubt, many more varieties, and though it may be a fact that, in certain districts, green tea is manufactured from a species differing from that from which black tea is manufactured, yet, in other districts, green and black teas are manufactured from one and the same plant. The Chinese manufacturers now in Kumaon state that the plant is one and the same, and that it can be proved by converting black tea into green. In manufacturing teas now in the manufactory, if a large quantity of leaves are brought in from the plantations, one half are converted into green, and one half into black tea. This only shows that much of the green and black teas of commerce are manufactured from one and the same plant. The Assam plant is, from the characters given, quite a distinct plant, and agrees, as already stated, most nearly with the species described as *Thea viridis*. It would, therefore, be most desirable to procure seeds of this so-called species, and also of other varieties, of which, no doubt, there is a great variety. From the northern districts of China in particular, seeds ought to be imported, not, however, in large quantities, but in quantities of two or three seers, so that they might, on arrival at Calcutta, be sent up the country as quickly as possible, for, if the seeds are kept long out of the ground, not one will germinate; such was the fate of all the seeds contained in ten boxes imported by government in 1845, not one having germinated, which was much to be regretted. Had they been sent in small parcels, well packed in wax cloth, to prevent them from being injured by moisture, and placed in an airy part of the vessel in transmission from China to Calcutta, and, on arrival there, sent by dawk banghay direct to the plantation, they would, I am confident, have reached in good condition. It is well worthy of a trial and seeds ought, if possible, to be obtained from every district celebrated for its teas. It is in this manner, by obtaining seeds of the finest varieties of plants, that the finest teas will be procured. I do not mean to infer that the tea plants now under cultivation are not the produce of fine varieties, for that has been proved by the undoubted testimony of the London brokers, but only that there are, no doubt, many others well worthy of introduction. In confirmation of what I have stated, I may quote the words of my late friend Dr. Griffith, who, in his report on the tea plant of Assam, says—"I now come to the consideration of the steps which, in my opinion, must be followed if any degree of success in the cultivation of tea is to be expected; of these the most important is the importation of Chinese seeds of unexceptionable quality, and of small numbers of their sorts."[11] Dr. Royle, too, who was the first person to point out that the Himalayas were well adapted to tea cultivation, and to whom the credit of recommending to government the introduction

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of the plant into Northern India is due, strongly urges the necessity of importing seeds from different localities in China celebrated for their teas.*Method and season for plucking and gathering leaves*.—The season for picking leaves commences in April and continues until October. The number of gatherings varies, depending on the moisture[12] or dryness of the season. If the season be good, as many as seven gatherings may be obtained. If, however, the rains are partial, only four or five. These, however, may be reduced to their general periods for gathering—that is, from April to June, from July to 15th August, and from September to the end of October. But few leaves are collected after the 15th of the latter month. As soon as the new and young leaves have appeared in April, the plucking takes place, this being done by the Chinese, assisted by the Mallees. The following is the method adopted:—A certain division of the plantation is marked off, and to each man a small basket is given, with instructions to proceed to a certain point, so that no plant may be passed over. On the small basket being filled, the leaves are emptied into another large one, which is put in some shady place, and in which, when filled, they are conveyed to the manufactory. The leaves are generally plucked with the thumb and forefinger. Sometimes the terminal part of a branch, having four or five young leaves attached, is plucked off. All old leaves are rejected, as they will not curl, and therefore are of no use.As the season advances, and manufactory and plantation works become necessary, the Mallees are assisted in gathering leaves by Coolies. The process is simple, and thus every man, woman, and child of villages could be profitably employed, on the plantations being greatly extended. Certain kinds of leaves are not selected in the plantation, in order to make certain kinds of tea, but all new and fresh leaves are indiscriminately collected together, and the different kinds separated on the leaves being fired.*Method of manufacturing black tea*.—The young and fresh leaves on being picked (they only being used, the old ones being too hard, and therefore unfit to curl), are carried to the manufactory, and spread out in a large airy room to cool, and are there kept during the night, being occasionally turned with the hand if brought in in the afternoon; or, if brought in during the morning, they are allowed to lie until noon. Early in the morning the manufacturers visit the airing room, and pack up the leaves in baskets and remove them to the manufacturing room. Each manufacturer takes a basketful, and commences to beat them between the palms of his hands with a lateral motion, in order to soften and make them more pliable for working, and thus prevent them, when rolled, from breaking. This beating process continues for about an hour, and it may either consist of one or two processes;

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the Chinese sometimes finish the beating process at once; at others, they allow the leaves, after being beat for half an hour, to remain a time and then resume it. They now go to breakfast, and in one hour and a half the leaves are ready for the pan. The pans being heated by wood placed in the oven, so as to feel hot to the hands, are filled to about two-thirds, or about three seers of leaves are thrown in at a time—the quantity which a manufacturer is capable of lifting with both hands. With the hands the leaves are kept moving with a rotatory motion in the pan, and when they become very hot, the motion is kept up with a pair of forked sticks. This process is continued for three or four minutes, depending on the heat of the pan, or until the leaves feel hot and soft. They are then, with one sweep of a bamboo brush, swept into a basket, and thrown on to the rolling-table, which is covered with a coarse mat made of bamboo. Each manufacturer then takes as much as he can hold in both hands, and forms a ball and commences to roll it with all his might with a semicircular motion, which causes a greenish yellow juice to exude. This process is continued for three or four minutes, the balls being occasionally undone and made up again. The balls are then handed to another party at the extremity of the table, to undo them and spread the leaves out thinly on flat baskets and expose them to the sun, if there is any; if not they are kept in the manufactory. After all the leaves have gone through this process, the first baskets are brought back, and the leaves again transferred to the pan, worked up in a similar manner for the same length of time, re-transferred to the table, and again rolled. This being done, the leaves are again spread out on large flat baskets to cool. On being cooled the leaves are collected together and thinly spread out on flat wicker-worked sieve-baskets, which are placed in others of a deep and of a double-coned shape. The choolahs being lighted for some time, and the charcoal burning clear, they are now ready to receive the coned baskets. The basket is placed over the choolah and kept there for about five minutes. The leaves are then removed, re-transferred to the flat baskets, and re-rolled for a few minutes. This being done, the leaves are again brought together, placed in the conical basket and kept over the charcoal fire for about two minutes. The contents of the conical baskets are then all collected together in a heap, and as much is placed in a conical basket as it will hold, and it is again placed over the charcoal choolah until the tea is perfectly dry. During this time the baskets are frequently removed and the tea turned, in order to allow the leaves to be completely and uniformly dried, and the basket too is generally struck, on removal, a violent side blow with the hand, to remove from the sieve any small particles that might otherwise fall into the fire. Before removing the basket from the choolah, a flat basket is always placed

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on the floor to receive it, and all the particles which pass through, on the coned basket being struck, are again replaced. On the conical basket being filled, before placing it over the choolah, a funnel is made in the centre of the tea with the hand, to allow the heated air to pass through. Sometimes a funnel made of bamboo is made for this purpose. After the tea feels perfectly dry, it is packed in boxes, and sent to the godown.Next day the different kinds of tea are picked, and on being separated they are again placed in the conical baskets and heated. During this process the baskets are frequently removed from the choolah in order to turn the tea, so that the heating may be general and uniform. In doing this a flat basket is always placed on the floor, as on the former day (and a flat basket, too, is placed on the top to confine the heat), to receive the conical one, which receive one or two blows to open the pores of the sieve. What passes through is replaced amongst the tea. When it is perfectly dry it is ready for finally packing.

> The kinds of black tea at present manufactured are—Souchong, Pouchong, Flowery Pekoe, and Bohea. The Flowery Pekoe is manufactured in September.

Method of manufacturing Green Tea.—On the young and fresh leaves being plucked they are spread out on the ground of the airing room and allowed to cool. After remaining for about two hours, or (if brought in late in the afternoon) during the night, they are removed to the green tea room. The pans being properly heated, the leaves, as in the case with the black tea, are thrown into the pans and kept either with the hand or two forked sticks in constant motion for three or four minutes, and are then removed to the rolling table, and then rolled in the same manner in balls as the black tea. They are then scattered most sparingly on large flat baskets and exposed to the heat of the sun. If there is no sun the baskets are arranged in frames, which are placed over the choolah, heated with charcoal. During the drying the leaves are frequently made into balls and rolled in the flat baskets, in order to extract the juice. The drying process continues for about two hours, and on the leaves becoming dry, those contained in two baskets are thrown together, and then four basketsful into one, and so on until they are all collected together. In this state the leaves still feel soft, damp, and pliant to the hand, and are now brought back to the tea manufacturing-room. Opposite to each of the inclined pans, which have been properly heated so as to feel warm to the hand by wood supplied to the ovens underneath, one of the Chinese stations himself, and puts as many leaves into it as it will hold. He then moves them in a heap gently, from before backward, making these perform a circle, and presses them strongly to the sides of the pan. As the leaves become hot he uses a flat piece of wood, in order that he

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may more effectually compress them. This process continues for about two hours, the leaves being compressed into at least half of their bulk, and become so dry that when pressed against the back part of the pan in mass, they again fall back in pieces. The tea, as by this time it has assumed this appearance, is now placed in a bag made of American drill or jean (the size depending on the quantity of tea), which is damped, and one end twisted with much force over a stick, and thus it is much reduced in size. After being thus powerfully compressed and beaten so as to reduce the mass as much as possible, the bag is exposed to the sun until it feels perfectly dry. If there is no sun it is placed in the heated pan, and there retained until it is so. This finishes the first day's process.On the second day it is placed in small quantities in the heated inclined pans, and moved up and down against the sides and bottom with the palm of the hand, which is made to perform a semi circle. This is continued for about six hours, and by so doing the colour of the tea is gradually brought out.The third day it is passed through sieve baskets of different dimensions, then exposed to the winnowing machine, which separates the different kinds of green teas. The winnowing machine is divided into a series of divisions, which receive the different kinds according to their size and weight. 1st. Coarsest Souchoo. This tea, owing to its coarseness, is not marketable. 2nd. Chounchoo. This is a large, round-grained tea. 3rd. Machoo. This is also a round-grained tea, but finer than the former. 4th. Hyson. 5th. Gunpowder Hyson. 6th. Chumat. This kind of tea consists of broken particles of other kinds of tea.On being separated, the different kinds are placed in baskets and picked by the hand, all the old or badly curled and also light-coloured leaves being removed, and others of different varieties, which by chance may have become mixed. To make the bad or light-colored leaves marketable, they undergo an artificial process of coloring, but this I have prohibited in compliance with the orders of the Court of Directors, and therefore do not consider this tea at present fit for the market[13]. On the different teas being properly picked, they are again placed in the heated inclined pans, and undergo separately the process of being moved violently up and down and along the bottom of the pan for three hours in the manner already described. The color is now fully developed. If the tea feels damp, it is kept longer than three hours in the pan. The tea is now ready to be packed.*Packing*.—As soon as the tea is prepared, boxes lined with sheet lead ought to be ready to receive it. On being packed it is to be firmly pressed down, and the lead is then to be soldered. Before the sheet lead box is placed in the wooden one it is covered with paper, which is pasted on to prevent any

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air acting on the tea through any holes which might exist in the lead. The box is then nailed, removed to the godown, papered, stamped, and numbered. It is then ready for sale.From what I have just stated, it will be perceived that box makers and sheet lead makers are essential to form a complete tea establishment. With reference to the box making it is unnecessary for me to make any remark, further than that care is to be taken in selecting wood for making boxes, as it ought to be free of all smell. All coniferous (pine) woods are therefore unfit for the purpose. In the hills the best woods are toon and walnut, and at Deyrah the saul (*Shorea Robusta*).*Manufacture of sheet lead*.—Sheet lead making is a much more complicated process, and therefore requires more consideration. To make sheet lead, the manufacturer mixes 11/2 to 3 seers of block tin with a pucka maund of lead, and melts them together in a cast metal pan. On being melted, the flat stone slabs, under which it is his intention to run the lead, are first covered with ten or twelve sheets of smooth paper (the hill paper being well adapted to the purpose), which are pasted to the sides, and chalked over. He then places the under stone in a skeleton frame of wood, to keep it firm, and above it the other stone. On the upper stone the manufacturer sits, and gently raises it with his left hand, assisted by throwing the weight of his body backwards. With his right hand he fills an iron ladle with the molten matter, throws it under the raised slab, which he immediately compresses and brings forward (it having been placed back, and thus overlapping the under slab by about half an inch) with his own weight. On doing so, the superabundant lead issues in front and at both sides; what remains attached to the slabs is removed by the iron ladle. The upper slab is now lifted, and the sheet of lead examined. If it is devoid of holes it is retained; if, on the other hand, there are several, which is generally the case with the first two or three sheets run, or until the slabs get warm, it is again thrown back to the melting pan. After having run off a series of sheets the slabs are to be examined, and, if the paper is in the least burnt, the first sheet is to be removed, and the one underneath taking its place, and thus securing an uniform smooth surface, is then to be chalked. According to the size of the stone slabs used, so is the size of the sheet lead. Those now in use are 16 inches square by 2 inches in thickness, and are a composition, being principally formed of lime.To make sheet lead boxes, a model one of wood (a little smaller than the box for which the lead is intended) is formed, which has a hole in the bottom, and a transverse bar of wood to assist in lifting it up, instead of a lid. The lead is then shaped on this model and soldered. This being done, the model is removed by the transverse

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bar, and by pressing, if necessary, through the hole. The lead box is then papered over, in case there should be any small holes in it, to prevent the action of air on the tea, and, when dry, transferred to the wooden box for which it was intended.*The manufactory*.—-The rooms of the manufactory ought to be large and airy, and to consist of—1st, a black tea manufactory; 2nd, a green tea manufactory; 3rd, winnowing room; and 4th, airing room. At Almorah the black tea manufacturing room is 53 feet long by 20 broad, and the other three, 20 by 24. The walls are 18 feet in height.*Implements required in manufacturing*.—In the body of this report I have noticed all the different kinds of implements required, I may however, again briefly notice them, and give a short account of each. Cast-iron Pans—In the manufactory there are two kinds in use, one received from China, the other from England. Both are considered equally good by the tea manufacturers, though in firing green tea they prefer the Chinese ones, as they are thinner, and are thus by them better able to regulate the heat. The Chinese pans are two feet two inches in diameter, and 10 inches in depth, by about one-eighth of an inch in thickness.

> The English pans are two feet two inches in diameter, and eight inches in depth, and rather thicker than the Chinese.

The oven for making black tea is made of kucha brick. In height it is two feet nine inches, in length, three feet, and in breadth three feet one inch. Door one foot five inches in height, and 11 inches in breadth. The base of the oven is 10 inches elevated above the floor of the manufacturing room.The oven with double pans for manufacturing green tea, is also built of kucha bricks. It is three feet in height and three feet in breadth; base of oven one foot in height. Door one foot six inches in height, and 10 inches in breadth. The pans are placed horizontally.

> A brush made of split bamboo, used in sweeping the tea leaves out of the pans.

> A basket for receiving tea from the pan when ready to be rolled. It is 2 feet long, and 11/2 feet broad, and gradually increases in depth from before backwards to 6 inches. It is made of bamboo.

> The mat made of bamboo for placing on the table when the tea leaves are about to be rolled. It is 8 feet long and 4 feet broad.

> A flat basket made of bamboo for spreading out the tea leaves when they have been rolled on the mat. These flat baskets are of various sizes, varying from 3 to 5 feet in diameter.

A flat sieve basket of 2 feet in diameter, made of bamboo, upon which the rolled tea leaves are placed, and which is deposited in the centre of the double-coned basket.

Double-coned baskets. The height of these baskets varies from 2 feet 2 inches to 2 feet 6 inches, external diameter 2 feet 8 inches. In the centre there are some pegs of bamboo to support the flat sieve basket on which the tea rests.

Forked sticks for turning leaves.

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Choolahs. These are formed of kucha bricks, and are 10 inches high, 101/2 inches deep, and generally about 2 feet in diameter.

Funnel made of bamboo to allow the heated air from the choolahs to pass through the tea; it is seldom used; the Chinese tea manufacturers preferring one made in the tea basket by the hand.

Oven for firing green tea made of kucha bricks. The pans are inclined at an angle of 50. In front the oven is 3 feet 2 inches in height, behind 4 feet 8 inches, length 51/2 feet, breadth 3 feet. Door 10 inches from the base, 1 foot 2 inches high, and 7 inches wide.

Frames for placing baskets. The first being inclined.

Baskets for collecting leaves.

Shovel, &c., used in regulating the fire.

Winnowing machine. This is a common winnowing machine, with a box 2 feet 10 inches in length, 1 foot 2 inches in breadth, and 1 foot 3 inches in depth, attached to the bottom of the hopper, and closely fitted into the middle of the circular apartment which contains the fanners. This box is entirely closed above (unless at the small opening receiving the hopper) and at the sides. At the base there are two inclined boards which project from the side of the machine 6 inches, and are partly separated from each other by angular pieces of wood. The end towards the fanners is open, the other is partly closed by a semicircular box which is moveable.

I shall now give the dimensions of the different parts of this machine, which may be useful to parties wishing to make up similar ones to those employed in the manufactories.

External frame 7 feet 2 inches in length, 18 inches in breadth, and 5 feet 8 inches in height. Hopper 2 feet 10 inches above, and 1 foot 8 inches in depth. Frame of box for fanners 3 feet 9 inches in diameter. Hopper frame 2 feet 7 inches. Semicircular box, in length 2 feet 5 inches and 7 inches in depth. Inclined plane at base, first 15 inches, second 13 inches.I may briefly state how this machine acts. With the right hand the fanners are propelled by the crank, and with the left hand the bottom of the hopper is opened by removing the wood. The flat piece of wood (the regulator) is held in the hand to regulate the quantity of tea that passes down. An assistant then throws a quantity of tea into the hopper which escapes through the apartment, and there meets the air. The first kind of tea falls down the inclined plane into one box which has been placed to receive them, the second are propelled further on, and fall into another box, and the lighter particles are propelled on to the semicircular end, and fall into a third box.*Note* *on the culture of the tea plant at Darjeeling, in 1847, by Dr. A. Campbell, Superintendant*.—About six years ago I received a few tea seeds from

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Dr. Wallich; they were of China stock, grown in Kumaon. I planted them in my garden in November, 1841, and had about a dozen seedlings in the month of May following, which were allowed to grow where they had come up, and rather close together. The plants were healthy from the commencement, and up to May, 1844, had grown very well; at this period the ground passed into other hands (Mr. Samuel Smith's), and I lost sight of them until last August, when Mr. Macfarlane, from Assam, who was acquainted with the tea plant in that province, arrived here. Being desirous of ascertaining how far the climate and soil of Darjeeling were suitable to the tea, I took him to examine the plants, and begged of him to record his opinion on their growth and qualities, with reference to their age, and his experience of the plant in Assam. The result was quite satisfactory. Encouraged by this result, I determined to give an extended trial to the plant, and through the kindness of Major Jenkins and Captain Brodie, of Assam, I procured a supply of fresh seed in October and November last, which was planted in November and the early part of December.The seed was of excellent quality. It commenced germinating in March, a few plants appeared above ground in the early part of May, and now I have upwards of 7,000 fine healthy seedlings in the plantation.For the information of those who may desire to try the tea culture in this soil and climate, I have to state the mode of planting pursued by me, and other particulars. The ground is a gentle sloping bank, facing the north and west; the soil is a reddish clay mixed with vegetable mould. After taking up a crop of potatoes, and carefully preparing the ground, I put in the seeds in rows six feet apart and six feet distance in the rows. The seeds were placed about three inches under the surface, five in number, at each place about four inches apart—-thus : . : On an average, two out of five have come up. The seedlings commenced appearing above ground early in May, and continued to show until the end of July. The earliest were, therefore, six months in the ground; the latest about eight months.The seed was of China stock, grown in Assam, and of the Assam plant mixed. I am anxious to have the China stock only, and purpose separating the plants of the Assam stock as soon as I can distinguish them, which Captain Brodie informs me can be readily done as they grow up; the China plants begin of a darker color, and smaller than the Assam ones.

I hope to have a supply of the seed of China stock from Kumaon next November, and with it to cause the extension of the experiment at this place.

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I think that it is reasonable to expect quite as good tea to be produced here as in Kumaon.[14] I have not tasted the Kumaon tea, but, from the opinion expressed on it in England, I am satisfied that it is a very drinkable beverage, and that with similar success here, the tea will be a valuable addition to our products. I have recently tried two kinds of the Assam tea presented by Mr. Stokes to a friend. They are excellent teas, and I shall be well content to have an equally good article manufactured here.

Mr. A. Macfarlane’s report on the tea plants in Mr. Smith’s ground is annexed:—

“According to your request I have the pleasure of transmitting you my opinion of the tea plants in your garden in this place. The two larger plants have made very good progress, considering their closeness to each other, which prevents them from throwing their branches freely in every direction, but as they have attained so great a size I would not recommend their being transplanted, because let it be done ever so carefully, the roots must receive more or less injury, and should the injury be great the death of the tree is certain.The smaller ones on the contrary are much stunted; this is caused by their confined situation, being completely choked up by the rose trees, which prevents their receiving a proper supply of light and air, so necessary to vegetation. They are also planted too closely, and, as the plants are still small, by availing yourself of the most favourable season, and using great care in the operation, they might he transplanted with safety, and should then be placed at a distance of not less than six feet apart. The difficulty of transplanting is occasioned by the depth to which the root penetrates, as it generally grows downwards, and in a large tree is principally in the subsoil. The larger plants should be pruned of their lower branches to allow a free current of air. This operation is generally performed in November, but any time during the cold season or before the rains, while the plant is at rest, would answer: as I have no knowledge of this climate, I would leave it to more experienced persons to judge of the proper season. To conclude, the plants are in a very healthy condition, and had they been in the hands of a cultivator, would now have been giving a very fair supply of produce.The small sample I tried was of a very good flavor, but on account of the defective manner of manufacture, for want of proper materials, no proper judgment can be formed.” (Simmonds’s Col. Mag., vol. xvi. p. 44.)

Report upon the Tea Plantations of Deyra, Kumaon and Gurhwal, by Robert Fortune, Esq., addressed to John Thornton, Esq., Secretary to the Government, North Western Provinces, dated Calcutta, September 6th, 1851:—

KAOLAGIR TEA PLANTATION.

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1. *Situation and extent*.—The Deyra Doon, or Valley of Deyra, is situated in latitude 3 deg. 18 min. north, and in longitude 78 deg. east. It is about 60 miles in length from east to west, and 16 miles broad at its widest part. It is bounded on the south by the Sewalick range of hills, and on the north by the Himalayas proper, which are here nearly 8,000 feet above the level of the sea. On the west it is open to the river Jumna, and on the east to the Ganges, the distance between these rivers being about 60 miles.In the centre of this flat valley, the Kaolagir tea plantation has been formed. Eight acres were under cultivation in 1847. There are now 300 acres planted, and about 90 more taken in and ready for many thousands of young plants raised lately from seeds in the plantation.2. *Soil and culture*.—The soil of this plantation is composed of clay, sand, and vegetable matter, rather stiff, and apt to get "baked" in dry weather, but free enough when it is moist or during the rains. It rests upon a gravelly subsoil, consisting of limestone, sandstone, clay-slate, and quartz rock, or of such rocks as enter into the composition of the surrounding mountain ranges. The surface is comparatively *flat*, although it falls in certain directions towards the ravines and rivers.The plants are arranged neatly in rows 6 feet apart, and each plant is about 41/2 feet from its neighbour in the row. A long, rank-growing species of grass, indigenous to the Doon, is most difficult to keep from over-topping the tea-plants, and is the cause of much extra labor. Besides the labor common to all tea countries in China, such as weeding, and occasionally loosening the soil, there is here an extensive system of irrigation carried on. To facilitate this, the plants are planted in trenches, from four to six inches below the level of the ground, and the soil thus dug out is thrown between the rows to form the paths. Hence the whole of the plantation consists of numerous trenches of this depth, and five feet from centre to centre. At right angles with these trenches a small stream is fed from the canal, and, by opening or shutting their ends, irrigation can be carried on at the pleasure of the overseer.3. *Appearance and health of plants*.—The plants generally did not appear to me to be in that fresh and vigorous condition which I had been accustomed to see in good Chinese plantations. This, in my opinion, is caused, 1st, by the plantation being formed on *flat land*; 2nd, by the system of *irrigation*; 3rd, by too early plucking; and 4th, by hot drying winds, which are not unfrequent in this valley from April to the beginning of June.

GUDDOWLI PLANTATION (NEAR PAORIE).

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1. *Situation and extent*.—This plantation is situated in the Province of Eastern Gurhwal, in latitude 30 deg. 8 min. north, and in longitude 78 deg. 45 min. east. It consists of a large tract of terraced land, extending from the bottom of a valley or ravine to more than 1,000 feet up the sides of the mountain. Its lowest portion is about 4,300 feet, and its highest 5,300 feet above the level of the sea; the surrounding mountains appear to be from 7,000 to 8,000. The plantation has not been measured, but there are, apparently, fully one hundred acres under cultivation.There are about 500,000 plants already planted, besides a large number of seedlings in beds ready for transplanting. About 3,400 of the former were planted in 1844, and are now in full bearing; the greater portion of the others are much younger, having been planted out only one, two, and three years.2. *Soil and culture*.—The soil consists of a mixture of loam, sand, and vegetable matter, is of a yellow colour, and is most suitable for the cultivation of the tea-plant. It resembles greatly the soil of the test tea districts in China. A considerable quantity of stones are mixed with it, chiefly small pieces of clay-slate, of which the mountains here are composed. Large tracts of equally good land, at present covered with jungle, are available in this district without interfering in any way with the rights of the settlers.I have stated that this plantation is formed on the hill side. It consists of a succession of terraces, from the bottom to the top, on which the tea bushes are planted. In its general features it is very like a Chinese tea plantation, although one rarely sees tea lands terraced in China. This, however, may be necessary in the Himalayas, where the rains fall so heavily. Here, too, the system of irrigation is carried on, although to a small extent only, owing to the scarcity of water during the dry season.3. *Appearance and health of plants*.—This plantation is a most promising one, and I have no doubt will be very valuable in a few years. The plants are growing admirably, and evidently like their situation. Some of them are suffering slightly from the effects of hard-plucking, like those at Kaolagir; but this can easily be avoided in their future management. Altogether, it is in a most satisfactory condition, and shows how safe it is in matters of this kind to follow the example of the Chinese cultivator, who never makes his tea plantations on *low rice land, and never irrigates*.

HAWULBAUGH PLANTATION (NEAR ALMORAH).

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1st. Situation and extent.—This tea farm is situated on the banks of the river Kosilla, about six miles north-west from Almorah, the capital of Kumaon. It is about 4,500 feet above the level of the sea. The land is of an undulating character, consisting of gentle slopes and terraces, and reminded me of some of the best tea districts in China. Indeed, the hills themselves, in this part of the Himalayas, are very much like those of China, being barren near their summit and fertile on their lower sides.Thirty-four acres of land are under tea cultivation here, including the adjoining farm of Chullar. Some of the plants appear to have been planted in 1844; but, as at Paorie, the greater number are only from one to three years old.2_nd. Soil and culture_.—The soil is what is usually called a sandy loam; it is moderately rich, being well mixed with vegetable matter. It is well suited for tea cultivation. The greater part of the farm is terraced as at Guddowli, but some few patches are left in natural slopes in accordance with the Chinese method. Irrigation is practised to a limited extent.3_rd. Appearance and health of the plants_.—All the young plants here are in robust health and are growing well, particularly where they are growing on land where water cannot flood or injure them. As examples of this, I may point out a long belt between Dr. Jameson's house and the flower garden, and also a piece of ground a little below the house in which the Chinese manufacturers live. Some few of the older bushes appear rather stunted; but this is evidently the result of water remaining stagnant about the roots, and partly also of over plucking; both defects, however, admit of being easily cured.

LUTCHMISSER AND KUPPEENA PLANTATIONS.

1_st. Situation and extent_.—These plantations are on the hill side near Almorah, and about 5,000 feet above the level of the sea. The situation is somewhat steep, but well adapted to the growth of tea. The former contains three acres, and the latter four acres under cultivation.2_nd. Soil and culture_.——The soil is light and sandy, and much mixed with particles of clay-slate, which have crumbled down from the adjoining rocks. I believe these plantations are rarely irrigated, and the land is steep enough to prevent any stagnant water from remaining about the roots of the plants.

3_rd. Appearance and health of plants_.—Most of the bushes here are fully grown, and in full bearing, and generally in good health. On the whole, I consider these plantations in excellent order.

BHEEMTAL PLANTATIONS.

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The lake of Bheemtal is situate in latitude 29 deg. 20 min. north, and in longitude 79 deg. 30 min. east. It is 4,000 feet above the level of the sea, and some of the surrounding mountains are said to be 8,000 feet. These form the southern chain of the Himalayas, and bound the vast plain of India, of which a glimpse can be had through the mountain passes. Amongst these hills there are several *tals* or lakes, some flat meadow-looking land, and gentle undulating slopes, while higher up we have steep and rugged mountains. It is amongst these hills, that the Bheemtal tea plantations have been formed. They may be classed under three heads, *viz*.—1_st. Anoo and Kooasur plantations_.—These adjoin each other, are both formed *on low flat land*, and together cover about forty acres. The plants do not seem healthy or vigorous; many of them have died out, and few are in that state which tea plants ought to be in. Such situations never ought to be chosen for tea cultivation. The same objection applies to these as to those at Deyra, but in a greater degree. No doubt, with sufficient drainage, and great care in cultivation, and the tea plant might be made to exist in such a situation; but I am convinced it would never grow with that luxuriance which is necessary in order to render it a profitable crop. *Besides, such lands are valuable for other purposes*. They are excellent rice lands, and as such of considerable value to the natives.2_nd. Bhurtpoor plantation_.—This plantation covers about four and a half acres of terraced land on the hill side, a little to the eastward of those last noticed. The soil is composed of a light loam, much mixed with small pieces of clay-slate and trap or green-stone, of which the adjacent rocks are composed. It contains a small portion of vegetable matter or *humus*. Both the situation and soil of this plantation are well adapted to the requirements of the tea shrub, and consequently we find it succeeding here as well as at Guddowli, Hawulbaugh, Almorah, and other places where it is planted on the slopes of the hills.3_rd. Russia plantation_.—This plantation extends over seventy-five acres, and is formed on sloping land. The elevation is somewhat less than Bhurtpoor, and although terraced in the same way, the angle is much lower. In some parts of the farm the plants are doing well, but generally they seemed to be suffering from too much water and hard plucking. I have no doubt, however, of the success of this farm, when the system of cultivation is improved. I observed some most vigorous and healthy bushes in the overseer’s garden, a spot adjoining the plantation, which could not be irrigated, and was informed they “never received any water, except that which fell from the skies.”In the Bheemtal district, there are large tracts of excellent tea land. In crossing

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over the hills towards Nainee Tal, with J.H. Batten, Esq., Commissioner of Kumaon, I pointed out many tracts admirably adapted for tea cultivation, and of no great value to the natives; generally, those lands on which the mundoca is cultivated are the most suitable.I have thus described all the Government plantations in Gurhwal and Kumaon. Dr. Jameson, the superintendent, deserves the highest praise for the energy and perseverance with which he has conducted his operations. I shall now notice the plantations of the zemindars, under the superintendence of the commissioner and assistant-commissioner of Kumaon and Gurhwal.

ZEMINDAREE TEA PLANTATIONS.

1_st, at Lohba_.—This place is situated in eastern Gurhwal, about 50 miles to the westward of Almorah, and is at an elevation of 5,000 feet above the level of the sea. It is one of the most beautiful spots in this part of the Himalayas. The surrounding mountains are high, and in some parts precipitous, while in others they are found consisting of gentle slopes and undulations. On these undulating slopes, there is a great deal of excellent land suitable for tea cultivation. A few tea bushes have been growing vigorously for some years in the commissioner’s garden, and they are now fully ten feet in height. These plants having succeeded so well, naturally induced the authorities of the province to try this cultivation upon a more extensive scale. It appears that in 1844, about 4,000 young plants were obtained from the Government plantations, and planted on a tract of excellent land, which the natives wished to abandon. Instead of allowing the people to throw up their land, they were promised it rent-free upon the condition that they attended to the cultivation of the tea, which had been planted on a small portion of the ground attached to the village.This arrangement seems to have failed either from want of knowledge, or from design, or perhaps partly from both of these causes. More lately, a larger number of plants have been planted, but I regret to say with nearly the same results.But results of this discouraging kind are what any one, acquainted with the nature of the tea plant, could have easily foretold, had the treatment, intended to be given it, been explained to him. Upon enquiry, I found the villagers had been managing the tea lands just as they had been doing their rice fields, that is, a regular system of irrigation was practised. As water was plentiful, a great number, indeed nearly all, the plants seem to have perished from this cause. The last planting alluded to had been done late in the spring, and just at the commencement of the dry weather, and to these plants little or no water seems to have been given; so that, in fact, it was going from one extreme to another equally bad, and the result was of course nearly the same.I have no hesitation in saying that

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the district in question is well adapted for the cultivation of tea. With judicious management, a most productive farm might be established here in four or five years. Land is plentiful, and of little value either to the natives or to the Government.2_nd, at Kutoor_.—This is the name of a large district 30 or 40 miles northward from Almorah, in the centre of which the old town or village of Byznath stands. It is a fine undulating country, consisting of wide valleys, gentle slopes, and little hills, while the whole is intersected by numerous streams, and surrounded by high mountains. The soil of this extensive district is most fertile, and is capable of producing large crops of rice, on the low irrigable lands, and the dry grains and tea on the sides of the hills. From some cause, however, either the thinness of population or *the want of a remunerative crop*, [15] large tracts of this fertile district have been allowed to go out of cultivation. Everywhere I observed ruinous and jungle-covered terraces, which told of the more extended cultivation of former years.Amongst some hills near the upper portion of this district, two small tea plantations have been formed under the patronage and superintendence of Captain Ramsey, Senior Assistant Commissioner of Kumaon. Each of them cover three or four acres of land, and had been planted about a year before the time of my visit. In this short space of time the plants had grown into nice strong bushes, and were in the highest state of health. I never saw, even in the most favoured districts in China, any plantations looking better than these. This result, Captain Ramsay informed me, had been attained in the following simple manner:—All the land attached to the two villages with which the tea farms are connected, is exempted from the revenue tax, a sum amounting only to 525 Rs. per annum. In lieu of this, the assamees (cultivators) of both villages assist with manure, and at the transplanting season, as well as ploughing and preparing fresh land. In addition to this, one chowdree and four prisoners are constantly employed upon the plantations. The chief reason of the success of these plantations, next to that of the land being well suited for tea cultivation, may, no doubt, be traced to a good system of management; that is, the young plants have been carefully transplanted at the proper season of the year, when the air was charged with moisture, and they have not been destroyed by excessive irrigation afterwards. The other zemindaree plantation at Lohba might have been now in full bearing had the same system been followed.From the description thus given, it will be observed that I consider the Kutoor plantations in a most flourishing condition. And I have no doubt they will continue to flourish, and soon convince the zemindars of the value of tea cultivation, providing three things, intimately connected with

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the success of the crop are strongly impressed upon their minds; *viz*., the unsuitableness of low wet lands for tea cultivation; the folly of irrigating tea as they would do rice, and the impropriety of commencing the plucking before the plants are strong, and of considerable size. I am happy to add, that amongst these hills there are no foolish prejudices in the minds of the natives against the cultivation of tea. About the time of my visit, a zemindar came and begged two thousand plants, to enable him to commence tea growing on his own account.It is of great importance, that the authorities of a district, and persons of influence, should show an interest in a subject of this kind. At present the natives do not know its value; but they are as docile as children, and will enter willingly upon tea cultivation, providing the “Sahib” shows that he is interested in it. In a few years the profits received will be a sufficient inducement.In concluding this part of my Report, I beg to suggest the propriety of obtaining some of the *best varieties* of the tea plant which have been introduced lately into the government plantations from China. Dr. Jameson could, no doubt, spare a few, but they ought to be given to those zemindars only who have succeeded with the original variety.Having described in detail the various government plantations, and also those of the zemindars which came under my notice in the Himalayas, I shall now make some general remarks upon the cultivation of tea in India, and offer some suggestions for its improvement.

GENERAL REMARKS.

1. *On land and cultivation*.—From the observations already made upon the various tea farms which I have visited in the Himalayas, it will be seen that I do not approve of *low flat lands* being selected for the cultivation of the tea shrub. In China, which at present must be regarded as the model tea country, the plantations are never made in such situations, or they are so rare as not to have come under my notice. In that country they are usually formed on the lower slopes of the hills, that is, in such situations as those at Guddowli, Hawulbaugh, Almorah, Kutoor, &c., in the Himalayas. It is true that in the fine green tea country of Hwuy-chow, in China, near the town of Tunche, many hundred acres of flattish land are under tea cultivation. But this land is close to the hills, which jut out into it in all directions, and it is intersected by a river whose banks are usually from 15 to 20 feet above the level of the stream itself, not unlike those of the Ganges below Benares. In fact, it has all the advantages of hilly land such as the tea plant delights in. In extending the Himalaya plantation this important fact ought to be kept in view.There is no scarcity of such land in these mountains, more particularly in Eastern Gurhwal and Kumaon. It abounds in the districts

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of Paorie, Kunour, Lohba, Almorah, Kutoor, and Bheemtal, and I was informed by Mr. Batten, that there are large tracts about Gungoli and various other places equally suitable. Much of this land is out of cultivation, as I have already stated, while the cultivated portions yield on an average only two or three annas per acre of revenue.Such lands are of less value to the zemindars than low rice land, where they can command a good supply of water for irrigation. But I must not be understood to recommend poor worn out hill lands for tea cultivation,—land on which nothing else will grow. Nothing is further from my meaning. Tea in order to be profitable requires a good sound soil,—a light loam, well mixed with sand and vegetable matter, moderately moist, and yet not stagnant or sour. Such a soil, for example, as on these hill sides produces good crops of mundooa, wheat or millet, is well adapted for tea. It is such lands which I have alluded to as abounding in the Himalayas, and which are, at present, of so little value either to the Government, or to the natives themselves.*The system of Irrigation* applied to tea in India is never practised in China. I did not observe it practised in any of the great tea countries which I visited. On asking the Chinese manufacturers whom I brought round, and who had been born and brought up in these districts, whether they had seen such a practice, they all replied, "*no, that is the way we grow rice: we never irrigate tea*." Indeed, I have no hesitation in saying that, in nine cases out of ten, the effects of irrigation are most injurious. When tea will not grow without irrigation, it is a sure sign that the land employed is not suitable for such a crop. It is no doubt an excellent thing to have a command of water in case of a long drought, when its agency might be useful in saving a crop which would otherwise fail, but irrigation ought to be used only in such emergent cases.I have already observed that good tea land is naturally moist, although not stagnant; and we must bear in mind that the tea shrub is *not a water plant*, but is found in a wild state on the sides of hills. In confirmation of these views, it is only necessary to observe further, that all the *best Himalayan plantations are those to which irrigation has been most sparingly applied*.In cultivating the tea shrub, much injury is often done to a plantation by *plucking leaves from very young plants*. In China young plants are never touched until the third or fourth year after they have been planted. If growing under favorable circumstances, they will yield a good crop after that time. All that ought to be done, in the way of plucking or pruning before that time, should be done with a view to *form the plants*, and make them *bushy* if they do not grow so naturally. If plucking is commenced too early and continued, the energies of the plants

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are weakened, and they are long in attaining any size, and consequently there is a great loss of produce in a given number of years. To make this more plain, I will suppose a bush that has been properly treated to be eight years of age. It may then be yielding from two to three pounds of tea per annum, while another of the same age, but not a quarter of the size, from over-plucking, is not giving more than as many ounces.The same remarks apply also to plants which become unhealthy from any cause; leaves ought never to be taken from such plants; the gatherers should have strict orders to pass them over until they get again into a *good state* of health.2_nd. On climate_.—I have already stated that eastern Gurhwal and Kumaon appear to me to be the most suitable for the cultivation of the tea plant in this part of the Himalayas. My remarks upon climate will therefore refer to this part of the country.From a table of temperature kept at Hawulbaugh from November 28th, 1850, to July 13th, 1851, obligingly furnished me by Dr. Jameson, I observed that the climate here is extremely mild. During the winter months, the thermometer [Fahr.] at sunrise was never lower than 44 deg., and only on two occasions so low, namely on the 15th and 16th of February, 1851. Once it stood so high as 66 deg. on the morning of February 4th, but this is full ten degrees higher than usual. The minimum in February must, however, be several degrees lower than is shown by this table, for ice and snow were not unfrequent; indeed, opposite the 16th of February in the column of remarks, I find written down *a very frosty morning*. This discrepancy no doubt arises either from a bad thermometer being used, or from its being placed in a sheltered verandah. We may, therefore, safely mark the minimum as 32 deg. instead of 44 degrees.The month of June appears to be the hottest in the year. I observe the thermometer on the 5th, 6th and 7th of that month stood at 92 deg. at 3 P.M., and this was the highest degree marked during the year. The lowest, at this hour, during the month was 76 deg., but the general range in the 3 P.M. column of the table is from 80 deg. to 90 degrees.*The wet and dry seasons* are not so decided in the hills as they are in the plains. In January, 1861, it rained on five days and ten nights, and the total quantity of rain which fell, as indicated by the rain gauge, during this month, was 5.25 inches; in February, 3.84 fell; in March, 2.11; in April, 2.24; in May, none; and in June 6.13. In June there are generally some days of heavy rain, called by the natives Chota Bursaut, or small rains, after this there is an interval of some days of dry weather before the regular “rainy season” commences. This season comes on in July and continues until September. October and November are said to be beautiful months with a clear atmosphere and cloudless sky.

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After this fogs are frequent in all the valleys until spring.In comparing the climate of these provinces with that of China, although we find some important difference, yet upon the whole there is a great similarity. My comparisons apply, of course, to the best tea districts only, for although the tea shrub is found cultivated from Canton in the south to Tan-chowpoo in Shan-tung, yet the provinces of Fokein, Kainsee and the southern parts of Kiangnan, yield nearly all the finest teas of commerce.The town of Tsong-gan, one of the great black tea towns near the far famed Woo-e-shan, is situated in latitude 27 deg. 47 min, north. Here the thermometer in the hottest months, namely in July and August, rarely rises above 100 deg. and ranges from 92 deg. to 100 deg., as maximum; while in the coldest months, December and January, it sinks to the freezing point and sometimes a few degrees lower. We have thus a close resemblance in temperature between Woo-e-shan and Almorah, The great green tea district being situated two degrees further north, the extremes of temperature are somewhat greater. It will be observed, however, that while the hottest month in the Himalayas is June, in China the highest temperature occurs in July and August: this is owing to the rainy season taking place earlier in China than it does in India.In China rain falls in heavy and copious showers in the end of April, and these rains continue at intervals in May and June. The first gathering of tea-leaves, those from which the Pekoe is made, is scarcely over before the air becomes charged with moisture, rain falls, and the bushes being thus placed in such favourable circumstances for vegetating are soon covered again with young leaves, from which the main crop of the season is obtained.No one, acquainted with vegetable physiology, can doubt the advantages of such weather in the cultivation of tea for mercantile purposes. And these advantages, to a certain extent at least, seem to be extended to the Himalayas, although the regular rainy season is later than in China. I have already shown, from Dr Jameson's table, that spring showers are frequent in Kumaon, although rare in the plains of India; still, however, I think it would be prudent to adopt the gathering of leaves to the climate, that is to take a moderate portion from the bushes before the rains, and the main crop after they have commenced.*3rd. On the vegetation of China and the Himalayas*. One of the surest guides from which to draw conclusions, on a subject of this nature, is found in the indigenous vegetable productions of the countries. Dr. Royle, who was the first to recommend the cultivation of tea in the Himalayas, drew his conclusions, in the absence of that positive information from China which we possess now, not only from the great similarity in temperature between China and these

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hills, but also from the resemblance in vegetable productions. This resemblance is certainly very striking. In both countries, except in the low valleys of the Himalayas (and these we are not considering), tropical forms are rarely met with. If we take trees and shrubs, for example, we find such genera as pinus, cypress, berberis, quercus, viburnam, indigofera, and romeda, lonicera, deutzia, rubus, myrica, spirae, ilex, and many others common to both countries.Amongst herbaceous plants we have gentiana, aquilegia, anemone, rumex, primula, lilium, loutodon, ranunculus, &c. equally distributed in the Himalayas and in China, and even in aquatics the same resemblance may be traced, as in nelumbium, caladium &c. And further than this, we do not find plants belong to the same genera only, but in many instances the identical species are found in both countries. The indigofera, common in the Himalayas, abounds also on the tea hills of China, and so does *Berberis nepaulencis*, *Lonicera diversifolia*, *Myrica sapida*, and many others.Were it necessary, I might now show that there is a most striking resemblance between the geology of the two countries as well as in their vegetable productions. In both the black and green tea countries which I have alluded to, clay-slate is most abundant. But enough has been advanced to prove how well many parts of the Himalayas are adapted for the cultivation of tea; besides, the flourishing condition of many of the plantations is, after all, the best proof, and puts the matter beyond all doubt.*4th. Concluding Suggestions*.—Having shown that tea can be grown in the Himalayas, and that it would produce a valuable and remunerative crop, the next great object appears to be the production of superior tea, by means of fine varieties and improved cultivation. It is well known that a variety of the tea plant existed in the southern parts of China from which inferior teas only were made. That, being more easily procured than the fine northern varieties, from which the great mass of the best teas are made, was the variety originally sent to India. From it all those in the Government plantations have sprung.It was to remedy this, and to obtain the best varieties from those districts which furnish the trees of commerce, that induced the Honourable Court of Directors to send me to China in 1848. Another object was to obtain some good manufacturers and implements from the same districts. As the result of this mission, nearly twenty thousand plants from the best black and green tea countries of Central China, have been introduced to the Himalayas. Six first-rate manufacturers, two lead men, and a large supply of implements from the celebrated Hwuy-chow districts were also brought round and safely located on the Government plantations in the hills.A great step has thus been gained towards

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the objects in view. Much, however, remains still to be done. The new China plants ought to be carefully propagated and distributed over all the plantations; some of them ought also to be given to the zemindars, and more of these fine varieties might be yearly imported from China.The Chinese manufacturers, who were obtained some years since from Calcutta or Assam, are, in my opinion, far from being first-rate workmen; indeed, I doubt much if any of them learned their trade in China. They ought to be gradually got rid of and their places supplied by better men, for it is a great pity to teach the natives an inferior method of manipulation. The men brought round by me are first-rate green tea makers, they can also make black tea, but they have not been in the habit of making so much black as green. They have none of the Canton illiberality or prejudices about them, and are most willing to teach their art to the natives. I have no doubt some of the latter will soon be made excellent tea manufacturers. And the instruction of the natives is, no doubt, one of the chief objects which ought to be kept in view, for the importation of Chinese manipulators at high wages can only he regarded as a temporary measure; ultimately the Himalayan tea must be made by the natives themselves; each native farmer must learn how to make tea as well as how to grow it; he will then make it upon his own premises, as the Chinese do, and the expenses of carriage will be much less than if the green leaves had to be taken to the market.But as the zemindars will be able to grow tea long before they are able to make it, it would be prudent, in the first instance, to offer them a certain sum for green leaves brought to the government manufactory.I have pointed out the land most suitable for the cultivation of tea, and shown that such land exists in the Himalayas to an almost unlimited extent. But if the object the government have in view be the establishment of a company to develop the resources of these hills, as in Assam, I would strongly urge the propriety of concentrating, as much as possible, the various plantations. Sites ought to be chosen which are not too far apart, easy of access, and, if possible, near rivers; for, no doubt, a considerable portion of the produce would have to be conveyed to the plains or to a sea-port.In my tour amongst the hills, I have seen no place so well adapted for a central situation as Almorah, or Hawulbaugh. Here the government has already a large establishment, and tea lands are abundant in all directions. The climate is healthy, and better suited to a European constitution than most other parts of India. Here plants from nearly all the temperate parts of the world are growing as if they were at home. As examples, I may mention myrtles, pomegranates, and tuberoses from the south of Europe; dahlias, potatoes, aloes, and yuccas from America; Melianthus major and bulbs

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from the Cape; the cypress and deodar of the Himalayas, and the lagerstroemias, loquats, roses and tea of China.In these days, when tea has become almost a necessary of life to England and her wide-spreading colonies, its production upon a large and cheap scale is an object of no ordinary importance. But to the natives of India themselves, the production of this article would be of the greatest value. The poor *paharie*, or hill farmer, at present has scarcely the common necessaries of life, and certainly none of its luxuries. The common sorts of grain which his lands produce will scarcely pay the carriage to the nearest market town, far less yield a profit of such a kind as will enable him to purchase some few of the necessary and simple luxuries of life. A common blanket has to serve him for his covering by day and for his bed at night, while his dwelling-house is a mere mud-hut, capable of affording but little shelter from the inclemency of the weather. Were part of these lands producing tea, he would then have a healthy beverage to drink, besides a commodity which would be of great value in the market. Being of small bulk compared with its value, the expense of carriage would be trifling, and he would return home with the means in his pocket of making himself and his family more comfortable and more happy.Were such results doubtful, we have only to look across the frontiers of India into China. Here we find tea one of the necessaries of life, in the strictest sense of the word. A Chinese never drinks cold water, which he abhors, and considers unhealthy. Tea is his favorite beverage from morning until night; not what we call tea, mixed with milk and sugar, but the essence of the herb itself, drawn out in pure water. One acquainted with the habits of this people can scarcely conceive the idea of the Chinese empire existing were it deprived of the tea plant; and I am sure that the extensive use of this beverage adds much to the health and comfort of the great body of the people.The people of India are not unlike the Chinese in many of their habits. The poor of both countries eat sparingly of animal food, and rice, with other grains and vegetables, form the staple articles on which they live; this being the case, it is not at all unlikely the Indian will soon acquire a habit which is so universal in the sister country. But in order to enable him to drink tea, it must be produced at a cheap rate; he cannot afford to pay at the rate of four or six shillings a pound. It must be furnished to him at four *pence* or six *pence* instead; and this can be done easily, but only on his own hills. If this is accomplished, and I see no reason why it should not be, a boon will have been conferred upon the people of India, of no common kind, and one which an enlightened and liberal government may well be proud of conferring on its subjects.”

I shall now add a description of the Chinese method of making black tea in Upper Assam, by Mr. C.A. Bruce, superintendent of tea culture:—

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“In the first place, the youngest and most tender leaves are gathered; but when there are many hands and a great quantity of loaves to be collected, the people employed nip off with the forefinger and thumb the fine end of the branch, with about four leaves on, and sometimes even more if they look tender. These are all brought to the place where they are to be converted into tea: they are then put into a large, circular, open worked bamboo basket, having a rim all round, two fingers broad. The leaves are thinly scattered in these baskets, and then placed in a framework of bamboo, in all appearance like the sides of an Indian hut, without grass, resting on posts, 2 feet from the ground, with an angle of about 25 deg. The baskets with leaves are put in this frame to dry in the sun, and are pushed up and brought down by a long bamboo with a circular piece of wood at the end. The leaves are permitted to dry about two hours, being occasionally turned; but the time required for this process depends on the heat of the sun. When they begin to have a slightly withered appearance, they are taken down and brought into the house, when they are placed on a frame to cool for half an hour; they are then put into smaller baskets of the same kind as the former, and placed on a stand. People are now employed to soften the leaves still more, by gently clapping them between their hands, with their fingers and thumbs extended, and tossing them up and letting them fall, for about five or ten minutes. They are then again put on the frame during half an hour, and brought down and clapped with the hands as before. This is done three successive times, until the leaves become to the touch like soft leather; the beating and putting away being said to give the tea the black color and bitter flavor. After this the tea is put into hot cast-iron pans, which are fixed in a circular mud fireplace, so that the flame cannot ascend round the pan to incommode the operator. This pan is well heated by a straw or bamboo fire to a certain degree. About two pounds of the leaves are then put into each hot pan, and spread in such a manner that all the leaves may get the same degree of heat. They are every now and then briskly turned with the naked hand, to prevent a leaf from being burnt. When the leaves become inconveniently hot to the hand, they are quickly taken out and delivered to another man with a close-worked bamboo basket, ready to receive them. A few leaves that may have been left behind are smartly brushed out with a bamboo broom: all this time a brisk fire is kept up under the pan. After the pan has been used in this manner three or four times, a bucket of cold water is thrown in, and a soft brick-bat and bamboo broom used, to give it a good scouring out; the water is thrown out of the pan by the brush on one side, the pan itself being never taken off. The leaves, all hot in the bamboo basket, are laid on a table that has a narrow rim on its back, to prevent these baskets from

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slipping off when pushed against it. The two pounds of hot leaves are now divided into two or three parcels, and distributed to as many men, who stand up to the table with the leaves right before them, and each placing his legs close together, the leaves are next collected into a ball, which he gently grasps in his left hand, with the thumb extended, the fingers close together, and the hand resting on the little finger. The right hand must be extended in the same manner as the left, but with the palm turned downwards resting on the top of the ball of tea leaves. Both hands are now employed to roll and propel the ball along; the left hand pushing it on, and allowing it to revolve as it moves; the right hand also pushes it forward, resting on it with some force, and keeping it down to express the juice which the leaves contain. The art lies here in giving the ball a circular motion, and permitting it to turn under and in the hand two or three whole revolutions, before the arms are extended to their full length, and drawing the ball of leaves quickly back without leaving a leaf behind, being rolled for about five minutes in this way. The ball of tea leaves is from time to time delicately and gently opened with the fingers lifted as high as the face, and then allowed to fall again. This is done two or three times to separate the leaves; and afterwards the basket with the leaves is lifted up as often, and receives a circular shake to bring these towards the centre. The leaves are now taken back to the hot pans and spread out in them as before, being again turned with the naked hand, and when hot taken out and rolled; after which, they are put into a drying basket and spread on a sieve, which is in the centre of the basket, and the whole placed over a charcoal fire. The fire is very nicely regulated; there must not be the least smoke, and the charcoal should be well picked.When the fire is lighted it is fanned until it gets a fine red glare, and the smoke is all gone off; being every now and then stirred, and the coals brought into the centre, so as to leave the outer edge low. When the leaves are put into the drying basket, they are gently separated by lifting them up with the fingers of both hands extended far apart, and allowing them to fall down again; they are placed three or four inches deep on the sieve, leaving a passage in the centre for the hot air to pass. Before it is put over the fire, the drying basket receives a smart slap with both hands in the act of lifting it up, which is done to shake down any leaves that might otherwise drop through the sieve, or to prevent them from falling into the fire and occasioning a smoke, which would affect and spoil the tea. This slap on the basket is invariably applied throughout the stages of tea manufacture. There is always a large basket underneath to receive the small leaves that fall, which are afterwards collected, dried, and added to the other tea; in no case are the baskets or sieves

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allowed to touch or remain on the ground, but always laid on a receiver, with three legs. After the leaves have bean half-dried in the drying-basket, and while they are still soft, they are taken off the fire and put into large open-worked baskets, and then put on the shelf, in order that the tea may improve in color.Next day the leaves are all sorted into large, middling, and small; sometimes there are four sorts. All these, the Chinese informed me, become so many different kinds of teas; the smallest leaves they call Pha-ho, the second Pow-chong, the third Souchong, and the fourth, or the largest leaves, Zoy-chong. After this assortment they are again put on the sieve in the drying-basket (taking care not to mix the sorts), and on the fire, as on the preceding day; but now very little more than will cover the bottom of the sieve is put in at one time; the same care of the fire is taken as before, and the same precaution of tapping the drying basket every now and then. The tea is taken off the fire with the nicest care, for fear of any particles of the tea falling into it. Whenever the drying-basket is taken off, it is put on the receiver, the sieve in the drying-basket taken out, the tea turned over, the sieve replaced, the tap given, and the basket placed again over the fire. As the tea becomes crisp, it is taken out and thrown into a large receiving-basket, until all the quantity on hand has become alike dried and crisp, from which basket it is again removed into the drying-basket, but now in much larger quantities. It is then piled up eight and ten inches high on the sieve in the drying-basket; in the centre a small passage is left for the hot air to ascend; the fire that was before bright and clear has now ashes thrown on it to deaden its effect, and the shakings that have been collected are put on the top of all; the tap is given, and the basket, with the greatest care, is put over the fire. Another basket is placed over the whole, to throw back any heat that may ascend. Now and then it is taken off, and put on the receiver; the hands, with the fingers wide apart, are run down the sides of the basket to the sieve, and the tea gently turned over, the passage in the centre again made, &c., and the basket again placed on the fire. It is from time to time examined, and when the leaves have become so crisp that they break by the slightest pressure of the fingers, it is taken off, when the tea is ready. All the different kinds of leaves underwent the same operation. The tea is now, little by little, put into boxes, and first pressed down with the hands and then with the feet (clean stockings having been previously put on).There is a small room inside of the tea-house, seven cubits square, and five high, having bamboos laid across on the top to support a network of bamboo, and the sides of the room smeared with mud to exclude the air. When there is wet weather, and the leaves cannot be dried in

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the sun, they are laid out on the top of this room, on the network, on an iron pan, the same as is used to heat the leaves; some fire is put into it, either of grass or bamboo, so that the flame may ascend high; the pan is put on a square wooden frame, that has wooden rollers on its legs, and pushed round and round this little room by one man, while another feeds the fire, the leaves on the top being occasionally turned; when they are a little withered, the fire is taken away, and the leaves brought down and manufactured into tea, in the same manner as if it had been dried in the sun. But this is not a good plan, and never had recourse to if it can possibly be avoided."

In 1810, a number of tea plants were introduced into Brazil, with a colony of Chinese to superintend their culture. The plantation was formed near Rio Janeiro and occupied several acres. It did not, however, answer the expectations formed of it, the shrubs became stunted, cankered and moss grown, and the Chinese finally abandoned them. The culture was again tried in 1817. The plantations lie between the equator and 10 deg. south latitude, nearly parallel with Java, and of course are exposed to the same intemperate climate, and suffer in a similar manner. In addition to these physical disabilities, the enterprise has had to contend with the natural indolence of the natives, the universal repugnance to labor, the crushing effect of committing so important a work to the superintendence of slaves and overseers, the amazing fertility of the soil, the extent of unappropriated land, the ease with which subsistence can be obtained and the low degree of personal enterprise. These are frowning features, and would rather seem to indicate a failure, before the attempt at cultivation was made. But, nevertheless, the plant does nourish to some extent, even in Brazil, under all the disparaging circumstances which surround it. From the Brazilian Consul General, I learn that although the plant for some years after its introduction received but little attention and was almost abandoned, yet within the last few years the cultivation has revived and is now prosecuted with energy and with a corresponding success. Some of the large and wealthy land proprietors of Brazil have directed their attention to tea culture, and one gentleman has given up his coffee plantation and directed his attention exclusively to the cultivation of the tea plant. The market of Rio Janeiro is said to be largely and almost entirely supplied with tea of domestic growth, and the public mind is awakened to the prominent fact, that no plant cultivated in Brazil is more profitable and none is deserving more decided attention.

Experimental cultivation of the tea plant in Brazil.—I now proceed to notice the report of M. Guillemin, presented in 1839 to the French Minister of agriculture and commerce, on the culture and preparation of the tea plant in Brazil—in a climate of the southern hemisphere just equivalent to that of Cuba in the northern. The report enters very minutely into the incidents of temperature and cultivation, and cannot fail to strike the attention when disclosing the important fact, that the tea plant grows luxuriantly with the coffee and other valuable plants of the equatorial regions, and even on low-lying lands, on a level with the sea, and exposed to the full rays of a burning sun.

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“As the tea shrub,” says M. Guillemin, “is grown in several plantations about two days’ journey distant from Rio, in different directions, I hired a lodging at St. Theresa, sufficiently contiguous to all the establishments I meant to visit, and further recommended by having a small garden attached to the house, where I could deposit the growing plants of tea, and sow seeds. During the month of November, except when hindered by slight indispositions incidental to the Brazilian climate, I pursued my researches, and principally in the charming valleys of the Tijuka and Gavia mountains. There, together with coffee, their principal product, the most valuable plants of the equatorial region are cultivated.In the middle of November I had an opportunity of observing the method pursued when culling the tea, which is performed by black slaves, chiefly women and children. They carefully selected the tenderest and pale-green leaves, nipping off with their nails the young leaf bud, just below where the first or second leaf was unfolded. One whole field had already undergone this operation; nothing but tea shrubs stripped of their foliage remained. The inspector assured me that the plant received no injury from this process, and that the harvest of leaves was to become permanent by carefully regulating it, so that the foliage should have grown again on the first stripped shrubs at the period when the leaves of the last plant were pulled off. About 12,000 tea shrubs are grown in this garden: they are regularly planted in quincunxes, and stand about one metre distant from each other; the greater number are stunted and shabby looking, probably owing to the aspect of the ground, which *lies low, on the level of the sea, and exposed to the full rays of a burning sun*; perhaps the quality of the soil may have something to do with it, though this is apparently similar to what prevails in the province of Rio Janeiro. This soil, which is highly argillaceous, and strongly tinged with tritoxyde of iron, is formed by the decomposition of gneiss or granite rocks. The flat situation of this tea ground is unfavorable to the improvement of the soil, for the heavy rains which wash away the superfluous sand from slanting situations, of course only consolidate more strongly the remaining component parts, where the land lies perfectly level, and thus the tea plants suffer from this state of soil.The kindness of M. de Brandao, director of the Botanic Garden, induced him to invite me, shortly after I had seen the above described tea ground, that I might inspect all the operations for the preparation of tea. I found that the picking of the leaves had been commenced very early in the morning, and two kilogrammes were pulled that were still wet with dew. These were deposited in a well-polished iron vase, the shape being that of a very broad flat pan, and set on a brick furnace, where a brisk wooden fire kept the temperature

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nearly up to that of boiling water. A negro, after carefully washing his hands, kept continually stirring the leaves in all directions, till their external dampness was quite evaporated, and the leaves acquired the softness of linen rag, and a small pinch of them, when rolled in the hollow of the hand, became a little ball that would not unroll. In this state the mass of tea was divided into two portions, and a negro took each and set them on a hurdle, formed of strips of bamboo, laid at right angles, where they shook and kneaded the leaves in all directions for a quarter of an hour, an operation which requires habit to be properly performed, and on which much of the beauty of the product depends. It is impossible to describe this process; the motion of the hands is rapid and very irregular, and the degree of pressure requisite varies according to circumstances; generally speaking, the young negro women are considered more clever at this part of the work than older persons. As this process of rolling and twisting the leaves goes on, their green juice is drained off through the hurdle, and it is essential that the tea be perfectly divested of the moisture, which is acrid, and even corrosive, the bruising and kneading being especially designed to break the parenchyma of the leaf, and permit the escape of the sap.When the leaves have been thus twisted and rolled, they are replaced in the great iron pan, and the temperature raised till the hand can no longer bear the heat at the bottom. For upwards of an hour the negroes are then constantly employed in separating, shaking, and throwing the foliage up and down, in order to facilitate the dessication, and much neatness and quickness of hand were requisite, that the manipulators might neither burn themselves nor allow the masses of leaves to adhere to the hot bottom of the pan. It is easy to see that, if the pan was placed within another pan filled with boiling water, and the leaves were stirred with an iron spatula, much trouble might be obviated. Still, the rolling and drying of the leaves were successfully performed; they became more and more crisp, and preserved their twisted shape, except some few which seemed too old and coriaceous to submit to be rolled up. The tea was then placed on a sieve, with wide apertures of regular sizes, and formed of flat strips of bamboo. The best rolled leaves, produced from the tips of the buds and the tenderest leaves, passed through this sieve, and were subsequently fanned, in order to separate any unrolled fragments which might have passed through them; this produce was called *Imperial*, or *Uchim Tea*. It was again laid in the pan till it acquired the leaden grey tint, which proved its perfect dryness, and any defective leaf which had escaped the winnowing and sifting was picked out by hand. The residue, which was left from the first fanning, was submitted to all the operations of winnowing, sifting, and scorching, and it then afforded the *Fine*

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Hyson Tea of commerce; while the same operations performed on the residuum of it yielded the *Common Hyson*; and the refuse of the third quality again afforded the *Coarse Hyson*.—Finally, the broken and unrolled foliage, which were rejected in the last sittings, furnish what is called *Family Tea*, and the better kind of which is called *Chato*, and the inferior *Chuto*. The latter sort is never sold, but kept for consumption in the families of the growers.Such is the mode of preparation pursued at Rio Janeiro, though I must add that the process employed at the Botanic Garden being most carefully performed in order to serve as a model for private cultivators of tea, the produce is superior to the generality, so that we dare not judge of all Brazilian tea by what is raised at the garden of Rio. I was also assured, that at Saint Paul each grower had his own peculiar method, influencing materially the quality of the tea, which decided me to visit that province, where I hoped to gain valuable information respecting the culture and fabrication of tea, especially considered as an article of commerce.In the interim, the month of December proving excessively hot and rainy, so as to forbid any distant excursions, I turned my attention to the important object of procuring *tea plants* in number and state fit for exportation; and, observing that almost all the shrubs I saw were too large for this purpose, I applied to M. de Brandao for his help and advice. This gentleman, in the most courteous manner, offered me either seeds or slips from his own tea shrubs. The striking of the latter was, he owned, a hazardous and uncertain affair, though it had the probable advantage of securing a finer kind of plant than could with certainty be raised from seed. I, however, began by asking him for newly gathered seeds, in order to set them in my little nursery garden at Santa Theresa, and he obligingly gave me a thousand of the seeds, perfectly ripe and sound, which is easily known by the purplish-brown color of their integument. M. Houlet immediately set about preparing the soil in which to plant these seeds, and the earth being excessively argillaceous and hard, much digging, manuring, and dressing were needful; in a word, we neglected no precautions which could contribute to the growth of our seeds. In the interim I allowed not a single dry day to elapse without visiting the country house near Rio, in all of which I saw something more or less interesting, either in the culture of tea, or other vegetable productions of commercial value.

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I detected, growing not unfrequently in the environs of Rio, the *Ilex Paraguayensis* of M. Auguste de St. Hilaire, perfectly identical with the tree which the Jesuits planted in the missions of Paraguay, and whose foliage is an article of great importance throughout Spanish America, and vended under the name of *Paraguay Tea*. A living plant of this shrub was brought home by me, and placed in the Royal Garden at Paris, as well as a species of Vanilla, and many other rare and interesting plants. I also made a valuable collection of woods employed for dyeing, building, and cabinet work, with samples of their flowers, fruits, and leaves, to facilitate botanical determination.Early in January, 1839, M. Houlet began anew sowing tea, not only in the open ground in our little garden, but also in pans, in order to facilitate the lifting of the young plants, and putting them into the cases that I had brought for the purpose. The heat being excessive, we purchased mats, that we might shelter them from the sun, and we gave them water far more frequently. Many of the seeds that we had sown a month previously, were already appearing above the ground, but the soil being of too compact a nature, some did not come up, which warned us to make choice in future of a lighter kind of soil.The period now arrived when I was to visit the tea plantations in the province of St. Paul; and hoping that the cultivators would give me some of the young shrubs, I took M. Houlet with me, leaving the charge of our collections and seedlings to M. Pissis, a French geologist and engineer, with whom I had formed an intimate acquaintance, and who most obligingly offered to attend to them during my absence. Many were the influential persons at Rio Janeiro, who gave me introductory letters to the proprietors and tea growers of St. Paul.We started on the 15th January, by steam-boat, and in two days reached Santos, the principal port in the province of St. Paul; thence crossing the great chain of mountains, named the Serra do Mar, in caravans drawn by mules, we reached the city of St. Paul on the 20th January, where I experienced the warmest reception from the governor, two ex-governors, and some other gentlemen.

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Accompanied by M.J. Gomez and a M. Barandier, an historical painter, whom the desire to visit a new country, and to see its inhabitants, had induced to become *my compagnon de voyage*, we visited almost immediately a M. Feigo, ex-Regent of the Empire, and now President of the Provincial Senate. We found this venerable ecclesiastic at his country-house, two leagues distant from the city, and here we saw all the process pursued on the tea leaf, commencing by the bruising, drying, and scorching of a large quantity of foliage picked the preceding evening. The chief difference that struck me in the mode here adopted, was, that

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the tender, flexible, and not brittle leaves, were gathered with the petiole and tip extremity of every bud, and that some water was put with them into the iron pan, in which the negresses twisted, squeezed, broke and shook the masses of foliage. The operation was, on the whole, more neatly performed than at Rio. When the tea was perfectly dry and removed from the pan, it was placed aside in a box, shaded from the air and light, and was considered ready for present use, on the spot; but M. Feigo informed me, that when sent to a distance, the cases were hermetically closed, and the tea underwent an extra dessication over the fire.The plantations belonging to M. Feigo, and surrounding his chagara, are extensive, containing about 20,000 tea shrubs, of fine growth and high vigor, most of them six or eight years old, set in regular lines, a metre asunder from each other, and the lines with a metre and a half between them. The soil is excellent, argillaceo-ferruginous, as is generally the case near St. Paul.

> In the Botanic Garden at St. Paul, some squares are devoted to the growth of tea; but I am not aware that the leaves are ever subject to preparation.

M. da Luz had invited us to inspect his tea-grounds near Nossa Senhora da Penha, and I went thither, accompanied by Messrs. Barandier and Houlet. The cultivation is admirable, the soil excellent, and the tea-plants peculiarly vigorous. Each shrub was so placed that a man can easily go all round it, and *young plants, self-sown, were springing up below every old one*; of these offsets, I was made welcome to as many as I could take away, and should have had a great stock, but that the ground had been very recently cleared. M. da Luz showed me his magazines of prepared tea, which were extensive and well stocked.Hence I went to the property of a lady, Donna Gertrude Gedioze Larceda, situated at the foot of Jarigur, a mountain famed for its gold mines, and passed two days in exploring this celebrated locality, and then visited the Colonel Anastosio on my way back to St. Paul. These plantations are in the most prosperous condition, situated on a sloping and well-manured tract behind the habitations. The shrubs are generally kept low, and frequently cut, so as to, make them branching, by which the process of picking the leaves is rendered easier. There may be 60,000 or 70,000 plants, but a third of them were only set a year before. Every arrangement is excellently conducted here; the pans kept very clean, though perhaps rather thin from long use and the fierceness of the fires. But the general good order that prevails, speaks much in favor of the tea produced in this neighbourhood. The colonel showed me his warehouse, where the tea is stored in iron jars, narrow-necked and closed by a tight fitting stopper. I ventured to put some questions to Colonel Anastosio respecting the sale of the produce. He gave me to understand

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that he was by no means eager to sell; but, confident of the good quality, he waited till application was made to him for it, as the tea is thought to improve by time, and the price is kept up by there being a small supply. With respect to the cost of its production in Brazil, he said, this was so great that, to make it answer to the grower, a price of not less than 2,000 reis, about six francs (5s.), must be got for each pound. The whole labor in Brazil is done by slaves, who certainly do not cost much to keep, but who, on the other hand, work as little as they can help, having no interest in the occupation. The slaves, too, bear a high price, and the chances of mortality, with the exorbitant value of money in Brazil, augment their selling value.The Major da Luz kindly presented me with 300 young tea-plants, which he had caused his negroes to pull up for me; and in an adjoining farm, where an immense tract planted with tea is now allowed to run to waste, being no object of value to the proprietor, I was permitted to take all I could carry away; and in a single day's time, M. Houlet and I, aided by some slaves, succeeded in possessing ourselves of 3,000 young plants, which we carefully arranged in bamboo baskets (here called cestos). To diminish the weight, M. Houlet removed as little soil as possible; but carefully wetted the roots before closing the baskets, and covered them with banana leaves. In one garden, the largest I have seen devoted to the growth of tea, but which is not particularly well kept, I saw that the spaces between the shrubs were planted with *maize*, and the bordering of the squares which intersect this vast plantation, and the whole of which is inclosed with valleys of *Araucaria Brasiliensis*, is formed of little dwarf tea-plants, which are kept low by cutting their main shoots down to the level of the soil.On the 8th of February I again embarked in the steam-boat to return to Rio Janeiro, and when we came in sight of St. Sebastian, I left M. Houlet to proceed to the city alone, charging him to take the very greatest care of our package of tea-plants, as well as of the nursery-ground at St. Theresa, while I should visit the flourishing colony of Ubatuba, inhabited by French families, who cultivate most successfully *coffee*, and other useful vegetables. After a delightful sail through an archipelago of enchanting islands, I landed at Pontagrossa, where I was most kindly received, and spent a week, obtaining much and varied information, both respecting cultivated plants and the kinds of trees which grow spontaneously in the virgin forests of this lovely land, and afford valuable woods for building, cabinet work, and dyeing. Finally, I visited the tea plantations of M. Vigneron, which are remarkably fine, though their owner finds a much more profitable employment in the growth of *coffee*, which is very lucrative. He kindly gave me a quantity of young tea-plants and chocolate trees. Reluctantly quitting these worthy colonists, I re-embarked in a Brazilian galliot, which took me back to Rio Janeiro in the close of February. There I found the tea-plants from St. Paul, set by M. Houlet, in our garden at St. Theresa, and I added to them the stock I had brought from Ubatuba. All the very young ones had perished on the way, from the excessive heat, and M. Houlet had much difficulty in saving the others.

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M. Guillemin concludes his interesting narration with this partially discouraging fact;—-that though the culture of the tea-shrub succeeds perfectly well in Brazil; though the gathering of the foliage proceeds with hardly any interruption during the entire year; though the quality (setting aside the aroma, which is believed to be artificially added) is not inferior to that of the finest tea from China—still the growers have not realised any large profits. They have manufactured an immense quantity of tea, to judge by what he saw in the warehouses at St. Paul, but they cannot afford to sell it under six francs for the half kilogramme (a pound weight), which is higher than Chinese tea of equally good quality. This is, however, precisely one of those commodities in which free labour, that is, the labor of a free peasant's family, the wife and children, the young and the old, can successfully compete with slave labor, and considerably undersell it. It is manifest, from the remarks of M. Guillemin, that the cost for plantation slaves, under a system apparently so profitable as labor without wages, is a dead weight on the Brazilian planter."

Paraguay Tea.—A species of holly (*Ilex Paraguensis*), which grows spontaneously in the forest regions of Paraguay, and the interior of South America, furnishes the celebrated beverage called *Yerba Mate*, in South America. The evergreen leaf of this plant is from four to five inches long; when prepared for use as tea it is reduced to powder, and hence the decoction has to be quaffed by means of a tube with a bulb perforated with small holes.

The leaves yield the same bitter principle called theine, which is found in the leaf of the Chinese tea-plant, the coffee berry, &c. Various other species of Ilex are sometimes employed in other parts of South America for a similar purpose. Although the leaves may not contain as much of the agreeable narcotic oil as those of the China shrub, in consequence of the rude way in which it is collected and prepared for use, yet it is much relished by European travellers in South America, and would doubtless enter largely into consumption if imported into this country at a moderate rate of duty.

The consumption in the various South American Republics is estimated at thirty or forty millions of pounds annually. It is generally drank without sugar or milk.

There are no correct data for calculating the exports, but some authorities state the amount sent to Santa Fe and Buenos Ayres at eight millions of pounds.

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A great trade is carried on with it at Sta. Fe, where it is brought from the Rio de la Plata. There are two sorts, one called “Yerba de Palos,” the other, which is finer, “Yerba de Carnini.” Frezier tells us that, in the earlier part of the 17th century, above 50,000 arrobas, or more than 12,000 cwt. of this herb were brought into Peru from Paraguay, exclusive of about 25,000 arrobas taken to Chile; and Father Charleroix, in his “History of Paraguay,” states the quantity shipped to Peru annually at 100,000 arrobas, or nearly 2,500,000 lbs.

My friend, Mr. W.P. Robertson, has favored me with some details as to the production of Paraguay tea. His brother has graphically described a visit he paid to the wastes or woods of the Yerba tree, with a colony of manufacturers from Assumption. These woods were situated chiefly in the country adjacent to a small miserable town called Villa Real, about 150 miles higher up the river Paraguay than Assumption. The master manufacturer, with about forty or fifty hired peons or servants, mounted on mules, and a hundred bulls and sumpter mules, set out on their expedition, and having discovered in the dense wood a suitable locality, forthwith a settlement is established, and the necessary wigwams for dwellings, &c., run up. The next step is the construction of the “tatacua.” This was a small space of ground, about six feet square, of which the soil was beaten down with heavy mallets, till it became a hard and consistent foundation. At the four corners of this space, and at right angles, were driven in four very strong stakes, while upon the surface of it were laid large logs of wood. This was the place at which the leaves and small sprigs of the yerba tree, when brought from the woods, were first scorched—fire being set to the logs of wood within it. By the side of the tatacua was spread an ample square net of hidework, of which, after the scorched leaves were laid upon it, a peon gathered up the four corners and proceeded with his burthen on his shoulders to the second place constructed, the barbacue. This was an arch of considerable span, and of which the support consisted of three strong trestles. The centre trestle formed the highest part of the arch. Over this superstructure were laid cross-bars strongly railed to stakes on either side of the central supports, and so formed the roof of the arch. The leaves being separated after the tatacua process, from the grosser boughs of the yerba tree, were laid on this roof, under which a large fire was kindled. Of this fire the flames ascended, and still further scorched the leaves of the yerba. The two peons beneath the arch, with long poles, took care, as far as they could, that no ignition should take place; and in order to extinguish this, when it did occur, another peon was stationed at the top of the arch. Along both sides of this there were two deal planks, and, with a long stick in his hand, the peon ran along these planks, and instantly extinguished any incipient sparks of fire that appeared.

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When the yerba was thoroughly scorched, the fire was swept from the barbacue or arch; the ground was then swept, and pounded with heavy mallets, into the hardest and smoothest substance. The scorched leaves and very small twigs were then thrown down from the roof of the arch, and, by means of a rude wooden mill, ground to powder.

The yerba or tea was now ready for use; and being conveyed to a larger shed, previously erected for the purpose, was then received, weighed, and stored by the overseer. The next and last process, and the most laborious of all, was that of packing the tea. This was done by first sewing together, in a square form, the half of a bull's hide, which being still damp, was fastened by two of its corners to two strong trestles, driven far into the ground. The packer then, with an enormous stick, made of the heaviest wood, and having a huge block at one end, and a pyramidal piece to give it a greater impulse at the other, pressed, by repeated efforts, the yerba into the hide sack, till he got it full to the brim. It then contained from 200 to 250 pounds, and being sewed up, and left to tighten over the contents as the hide dried, it formed at the end of a couple of days, by exposure to the sun, a substance as hard as stone, and almost as weighty and impervious too.

Having described the process of making ready the yerba for use, we will now accompany Mr. Robertson to the woods, to see how it is collected.

“After all the preparations which I have detailed were completed (and it required only three days to finish them), the peons sallied forth from the yerba colony by couples. I accompanied two of the stoutest and best of them. They had with them no other weapon than a small axe; no other clothing than a girdle round their waist and a red cap on their head; no other provision than a cigar, and a cow's horn filled with water; and they were animated by no other hope or desire, that I could perceive, than those of soon discovering a part of the wood thickly studded with the yerba tree. They also desired to find it as near as possible to the colonial encampment, in order that the labor of carrying the rough branches to the scene of operations might be as much as possible diminished.We had scarcely skirted for a quarter of a mile the woods which shut in the valley where we were bivouacked, when we came upon numerous clumps of the yerba tree. It was of all sizes, from that of the shrub to that of the full-grown orange tree; the leaves of it were very like those of that beautiful production. The smaller the plant, the better is the tea which is taken from it considered to be.To work with their hatchets went the peons, and in less than a couple of hours they had gathered a mountain of branches, and piled them up in the form of a haystack. Both of them then filled their large ponchos with the coveted article of commerce in its raw state, and they marched

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off with their respective loads. Having deposited this first load within the precincts of the colony, the peons returned for a second, and so on till they had cleared away the whole mass of branches and of leaves cut and collected during that day. When I returned to the colony I found the peons coming by two and two, from every part of the valley, all laden in the same way. There were twenty tatacuas, twenty barbacues, and twenty pies of the yerba cut and ready for manufacture. Two days after that the whole colony was in a blaze, tatacuas and barbacues were enveloped in smoke; on the third day all was stowed away in the shed; and on the fourth the peons again went out to procure more of the boughs and leaves."—(*Letters on Paraguay*, vol. ii. p. 142-147).

Each peon or laborer, going into the woods for six months, can procure eight arrobas, or 200 lbs. of yerba a day. This, at the rate of two rials, or 1s. for each arroba, would make his wages per day 8s.; and this for six months' work, at six days in the week, would produce to the laborer a sum of L57 12s.

Wilcockes, in his "History of Buenos Ayres," published in 1807, states:—"Though the herb is principally bought by the merchants of Buenos Ayres, it is not to that place that it is carried, no more being sent thither than is wanted for the consumption of its inhabitants and those of the vicinity; but the greatest part is dispatched to Santa Fe and Cordova, thence to be forwarded to Potosi and Mendoza. The quantity exported to Peru is estimated at 100,000 arrobas, and to Chile 40,000. The remainder is consumed in Paraguay, Tucuman, and the other provinces. It is conveyed in parcels of six or seven arrobas, by waggons, from Santa Fe to Jugui, and thence by mules to Potosi, La Paz, and into Peru proper. About four piastres per arroba is the price in Paraguay, and at Potosi it fetches from eight to nine, and more in proportion as it is carried further."

SUGAR.

Sugar is obtained from many grasses; and, indeed, is common in a large number of plants. It is procured in Italy from *Sorghum saccharatum*; in China, from *Saccharum sinense*; in Brazil, from *Gynerium saccharoides*; in the West Indies, from *saccharum violaceum*; and in many other parts of the world from *S officinarrum*. The last two are commonly known as sugar canes, and they are generally considered as varieties of a single species, *S. officinarum*, which is now widely spread over different parts of the world.

Some curious specimens of palm sugars were exhibited at the Great Exhibition of 1851, among others,—gomuti palm sugar (*Arenga saccharifera*) from Java; date palm sugar, from the Deccan; nipa sugar, from the stems of *Nipa fruticans*, and sugar from the fleshy flowers of *Bassia latifolia*,—an East Indian tree.

Among the other sugars shown were beet root sugar, maple sugar, date sugar, from Dacca, sugar from the butter tree (*Bassia butyracea*), produced in the division of Rohekkund, in India; and sugar candy, crystallized by the natives of Calcutta and other parts of India.

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Sugar and molasses from the grape, were also shown from Spain, Tunis and the Zollverein.

Sugar, or sugar candy, has been made in China from very remote antiquity, and large quantities have been exported from India, in all ages, whence it is most probable that it found its way to Rome.

The principal impurities to be sought for in cane sugar are inorganic matter, water, molasses, farina, and grape, or starch sugar. The latter substance is occasionally, for adulterating purposes, added in Europe to cane sugar; it may be detected by the action of concentrated sulphuric acid and of a solution of caustic potassa; the former blackens cane sugar, but does not affect the starch sugar, while potassa darkens the color of starch sugar, but does not alter that of cane sugar. But the copper test is far more delicate. Add to the solution to be tested, a few drops of blue vitriol, and then a quantity of potassa solution, and apply heat; if the cane sugar is pure, the liquor will remain blue, while, if it be adulterated with starch sugar, it will assume a reddish yellow color.

Inorganic matter is determined by incineration, farina by the iodine test, water by drying at 210 deg., and molasses by getting rid of it by re-crystalization from alcohol, as also by the color and moisture of the article.

The natural impurities of sugar are gum and tannin; gum is detected by giving a white precipitate with diacetate of lead, and tannin by giving a black coloration or precipitate with persulphate of iron.

An experienced sugar dealer easily judges of the value of sugar by the taste, smell, specific gravity, moisture and general appearance.

The value of molasses may be determined by drying at 220 degs., and by the taste.

The commercial demand for sugar is mainly supplied from the juice of the cane, which contains it in greater quantity and purity than any other plant, and offers the greatest facilities for its extraction.

Although sugar, identical in its character, exists in the maple, the coco-nut, maize, the beet root, and mango, and is economically obtained from these to a considerable extent, yet it is not sufficiently pure to admit of ready separation from the foreign matter combined with it, at least by the simple mechanical means, the ordinary producers usually have at command; unless carried onto a large extent, and with suitable machinery and chemical knowledge and appliances.

The different species of commercial sugar usually met with in this country, are four, viz: —brown, or muscovado sugar (commonly called moist sugar); clayed sugar, refined or loaf sugar, and sugar candy; these varieties are altogether dependent on the difference in the methods employed in their manufacture.

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The cultivation of the sugar cane, and the manufacture of sugar, were introduced into Europe from the East, by the Saracens, soon after their conquests, in the ninth century. It is stated by the Venetian historians, that their countrymen imported sugar from Sicily, in the twelfth century, at a cheaper rate than they could obtain it from Egypt, where it was then extensively made. The first plantations in Spain were at Valencia; but they were extended to Granada, Mercia, Portugal, Madeira, and the Canary Islands, as early as the beginning of the fifteenth century. From Gomera, one of these islands, the sugar cane was introduced into the West Indies, by Columbus, in his second voyage to America in 1493. It was cultivated to some extent in St. Domingo in 1506, where it succeeded better than in any of the other islands. In 1518, there were twenty-eight plantations in that colony, established by the Spaniards, where an abundance of sugar was made, which, for a long period, formed the principal part of the European supplies. Barbados, the oldest English settlement in the West Indies, began to export sugar in 1646, and as far back as the year 1676 the trade required four hundred vessels, averaging one hundred and fifty tons burden.

The common sugar cane is a perennial plant, very sensitive to cold, and is, therefore, restricted in its cultivation to regions bordering on the tropics, where there is little or no frost. In the Eastern hemisphere its production is principally confined to situations favorable to its growth, lying between the fortieth parallel of north latitude and a corresponding degree south. On the Atlantic side of the Western continent, it will not thrive beyond the thirty-third degree of north latitude and the thirty-fifth parallel south. On the Pacific side it will perfect its growth some five degrees further north or south. From the flexibility of this plant, it is highly probable that it is gradually becoming more hardy, and will eventually endure an exposure and yield a profitable return much further north, along the borders of the Mississippi and some of its tributaries, than it has hitherto been produced. In most parts of Louisiana the canes yield three crops from one planting. The first season is denominated “plant cane,” and each of the subsequent growths, “ratoons.” But, sometimes, as on the prairies of Attakapas and Opelousas, and the higher northern range of its cultivation, it requires to be replanted every year. Within the tropics, as in the West Indies and elsewhere, the ratoons frequently continue to yield abundantly for twelve or fifteen years from the same roots.

The cultivation of this plant is principally confined to the West Indies, Venezuela, Brazil, Mauritius, British India, China, Japan, the Sunda, Phillippine, and Sandwich Islands, and to the southern districts of the United States. The varieties most cultivated in the latter are the striped blue and yellow ribbon, or Java, the red ribbon, violet, from Java, the Creole, crystalline or Malabar, the Otaheite, the purple, the yellow, the purple-banded, and the grey canes. The quantity of sugar produced on an acre varies from five hundred to three thousand pounds, averaging, perhaps, from eight hundred to one thousand pounds.

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Six to eight pounds of the saccharine juice of the plant, yield one pound of raw sugar; from 16 to 20 cart-loads of canes, ought to make a hogshead of sugar, if thoroughly ripe. The weight necessary to manufacture 10,000 hhds of sugar, is usually estimated at 250,000 tons, or 25 tons per hhd. of 15 or 16 cwt.

The quantity of sugar now produced in our colonies is in excess of the demands of the consumers, that is, of their demands cramped as they are by the duties still levied on sugar consumed in Great Britain, imposed for the purposes of revenue; the high duty on all other but indigenous sugar, consumed all over the continent, imposed to promote the manufacture of beet-root sugar, and the legal duty levied on all other than indigenous sugar used in the United States, for the purpose of protecting the sugar production of that country; and so long as that excess exists——until a further reduction of duties shall increase consumption and cause sugar to be used for many purposes which the present high rates prohibit its being applied to—any improvement which may be effected in the quality—any increase which may take place in the quantity of colonial sugar—will only result infinitely more to the benefits of the consumers than the producers. In 1700 the quantity consumed in Great Britain and Ireland was only about 200,000 cwt. In 1852, including molasses, &c., it was not less than 8,000,000 cwt., a forty-fold increase in the century and a-half. Taking the whole population last year, it was nearly 28 lbs. per head. In 1832 the consumption in Great Britain alone was put down by Mr. M'Culloch at 23 lbs.; and as my estimate includes Ireland, where the consumption is notoriously small, we may infer that it has increased in Great Britain since 1832 at least 5 lb. per head. As the allowance to servants is from 3/4 lb. to 1 lb. per week, it may be assumed that 50 lb. a year, at least, is not too much for grown persons. In sugar-producing countries the quantity consumed is enormous; the labourers live on it in the manufacturing season; and a Duke of Beaufort, who died about 1720, consumed one pound daily for forty years, and enjoyed excellent health till he was seventy years of age. The consumption of sugar has increased considerably since it has become cheap; and we may expect, therefore, that the consumption will extend more rapidly than ever. The whole quantity consumed in Europe last year, including beet-root sugar, was not less than 16,000,000 cwt. If peace be preserved and prosperity continue, the market for sugar will extend amazingly, and force the cultivation by free men in all tropical countries.

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Years.	British Plantation tons	East India and Mauritius tons	Total of B.P. E.I. and Mauritius tons.	Consumption tons.
1838-39	176,033	54,017	230,050	195,483
39-40	141,219	60,358	201,577	191,279
40-41	110,739	52,232	162,971	179,741
41-42	107,560	97,792	205,352	202,971
42-43	123,685	80,429	204,114	199,491
43-44	125,178	78,943	204,121	202,259
44-45	122,639	81,959	204,598	206,999
45-46	142,384	102,690	245,074	244,030
47-48	164,646	125,829	290,475	289,537
48-49	139,868	107,844	247,712	308,131
49-50	142,203	121,850	264,053	296,119
50-51	129,471	119,317	248,788	305,616
51-52	148,000	110,000	258,000	312,778

—The above figures refer to raw sugar only.

At these periods, calculating from 1838-39, the duty on British sugar ranged from 24s. down to 10s. per cwt., and foreign slave-grown sugar from 63s. down to 14s. The greatest impetus was given to foreign sugar when the duties were reduced, in 1846.

The extension of sugar cultivation in various countries where the climate is suitable, has recently attracted considerable attention among planters and merchants. The Australian Society of Sydney offered its Isis Gold Medal recently to the person who should have planted, before May, 1851, the greatest number of sugar canes in the colony. I have not heard whether any claim was put in for the premium, but I fear that the gold fever has diverted attention from any new agricultural pursuit, and that honorary gold medals are therefore unappreciated. Moreton Bay and the northern parts of the colony of New South Wales, are admirably suited to the growth of all descriptions of tropical products.

The Natal Agricultural Society is also making great exertions to promote sugar culture in that settlement. Mr. E. Morewood, one of the oldest colonists, has about 100 acres under cultivation with the cane, and I have seen some very excellent specimens of the produce, notwithstanding the want of suitable machinery to grind the cane and boil the juice. Many planters from the East Indies and Mauritius are settling there. His Royal Highness Prince Albert awarded, through the Society of Arts, a year or two ago, a gold medal, worth 100 guineas, to Mr. J.A. Leon, for his beautiful work descriptive of new and improved machinery and processes employed in the cultivation and preparation of sugar in the British colonies, designed to economise labor and increase production.

The centrifugal machines, recently brought into use, for separating the molasses from the sugar, more quickly than the old-fashioned method of coolers, have tended to cheapen the production and simplify the processes of sugar making. The planters object, however, to the high prices which they are charged for these machines, so simple in their construction; and that they are not allowed, by the patent laws, to obtain them in the cheaper markets of France and Belgium.

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Great loss has hitherto taken place annually, in the sugar colonies, through the drainage of the molasses, resulting from the imperfect processes in use; but this can now be obviated, by the use of the centrifugal machine. It is a modification of the "hydro-extractor," and is the invention of Mr. Finzel, of Bristol.

The machine being filled with sugar, appropriately placed, is rapidly revolved, and a powerful ceutrifugal force generated; the moisture is speedily removed to the circumference of the revolving vessel, and passes off through apertures adapted for the purpose.

Various other improvements in the making of sugar have been carried into effect within the last few years, by Dr. Scoffern, Messrs. Oxland and M. Melsens, but the description of these would occupy too much of my space, and those who are desirous of growing sugar on an extensive scale, I must refer to Dr. Evans' "Sugar Planter's Manual," Mr. Wray's "Practical Sugar Planter," Agricola's "Letters on Sugar Farming," and other works which treat largely and exclusively of the subject.

An announcement has recently been made, that a Mr. Ramos, of Porto Rico, has discovered some new dessicating agent, to be used in sugar making, which is to cost next to nothing, but improves most materially the quality of the sugar made, and also increases considerably the quantity obtained by the ordinary process.

The average annual quantity of cane sugar produced and sent into the markets of the civilised world, at the present time, may be taken at 1,500,000 tons, exclusive of the amount grown and manufactured for local consumption in India, China, Cochin-China, and the Malay Archipelago, of which no certain statistics exist, but which has been estimated at about another million tons.

So far back as 1844, the Calcutta "Star," in an article on sugar, estimated the domestic consumption in India, at 500,000 tons. This is considerably below the mark, even if India is taken in its limited signification, as including only British subjects. On this estimate the 94,000,000 of British subjects, men, women and children, would not individually consume more than one pound avoirdupois by the month. A fat, hungry Brahmin, at any of the festivals given by the great, will digest for his own share four pounds, without at all embarrassing his stomach.

Assuming the million and a half of tons that find their way into civilized markets, to represent an average value at the place of production of L15 per ton, we have here the representation of L22,500,000 sterling. But this value may fairly be increased by one-fourth.

The whole exportable production of the sugar-growing countries was found to be, in 1844, about 780,000 tons, of which Cuba furnished 200,000 tons. In 1845, notwithstanding Cuba only produced 80,000 tons, the increase from other sources was so considerable (namely:—the British Colonial supply 40,000, United States 40,000, Porto Rico 15,000, Brazil 10,000 tons) that the total produce fell very little short of the previous year—having reached 764,000 tons.

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The present SUPPLY of sugar to the markets of Europe, is nearly as follows:—

	Cwts.
England	8,000,000
France	2,550,000
German League	1,350,000
Prussia	220,000
Austria, (ten Provinces)	560,000
Belgium	294,000
Other States not defined.	

The present DEMAND, according to the estimated consumption per head (28 lbs.), found to exist in England, where taxation is favorable, and the price moderate, would be about 31/4; million tons, *viz*.:—

	Cwts.
England	8,000,000
France	8,875,000
Germany	5,750,000
Prussia	4,100,000
Austria	8,642,857
Belgium	1,250,000
Russia	15,250,000
Rest of Europe	12,500,000

The whole annual PRODUCTION of the world is estimated by another party at 1,471,000,000 lbs., of which the United States produce 150,000,000 lbs., including 40,000,000 lbs. of maple sugar. Of the whole amount of sugar produced, Europe consumes about 648,700 tons, divided nearly as follows:—

	lbs.
Great Britain	803,360,096
France	160,080,000
Belgium	19,840,000
Netherlands	42,000,000
Russia	70,000,000
Denmark and Sweden	22,000,000
German Zollverein	101,300,000
Other parts of Germany	160,000,000
Austria	50,000,000

1,428,580,096

The following figures show the quantities of raw sugar in general, in tons, imported into the British markets for the last five years, compared with consumption:—

	Entire British		
Years.	Importations.	Consumption.	Surplus.
1847	415,289	290,281	125,008
1848	354,834	309,424	45,410
1849	362,087	299,041	63,046
1850	332,470	310,391	22,089
1851	419,083	329,561	89,472
1852	360,033	358,642	1,391

Deduced from Parliamentary Paper, No. 461, Session 1853.

The consumption of sugar then in the whole world may be roughly estimated at two and a half million tons, of which the United Kingdom may now be put down for 350,000; the rest of Europe 420,000, and the United States 300,000.

The United States produce about 140,000 tons of cane and maple sugar, which are exclusively used for home consumption, the remainder of their requirements being made up by foreign importation. The American consumption, which in 1851 amounted to 133,000 tons of sugar cane reached last year a total of 321,000 tons, almost as much as England consumed—358,000—and more than the consumption of 100,000,000 of persons on the continent.

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The whole production of tropical sugar, is about one million and a-half tons, while the consumption is probably two million tons; but the manufacture of sugar from beet root, maple and other sources, supplies the deficiency.

The total quantities of sugar, and molasses as sugar, consumed in the United Kingdom in the last six years, were, according to a Parliamentary paper, No. 292, of the last session, as follows:—

	Cwt. sugar.	Cwt. molasses.
1847	4,723,232	1,256,421
1848	5,003,318	865,752
1849	5,283,729	1,021,065
1850	5,570,461	752,027
1851	5,043,872	1,522,405
1852	7,203,631	799,942

The returns further specify that the annual average consumption of *British colonial sugar*, in the five years ending 1851, was 5,124,922 cwt.; and in the five years ending 1846, was 4,579,054 cwt.; the average consumption of British colonial sugar, has, therefore, exceeded in the five years since the duties were reduced, in 1846, the average consumption for the five previous years by 545,868 cwt. per annum; or in the aggregate in the five years, the excess has been 3,239,338 cwt. The quantity consumed in the year ending December, 1852, was 4,033,879 cwt.[16] There can be no doubt whatever, that the consumption of sugar in Great Britain is capable of very large increase; moderate cost, and the removal of restrictions to its general use, being the main elements required to bring it about. The question of revenue must of course be a material consideration with Government; but recent experience certainly leads to the conclusion that it would not suffer under a further reduction of duty.

The revenue derived from sugar before the reduction of the duty, was five millions per annum; in the past two years it reached nearly four millions.

The reduction in duties which took place in 1845, may be said to have answered the expectations formed of it, as regards the increase of consumption, which there is no doubt would have even gone beyond the estimate, if the failure in the crop of sugar in Cuba—that most important island, which usually yields one-fifth of the cane crop of the whole world—had not driven up prices in the general market of the continent, and, in consequence, diverted the supply of free labor sugar from this country. As it was, however, the consumption of the United Kingdom, which in 1844 was 206,472 tons, in 1845 was not less than 243,000—Sir Robert Peel's estimate was 250,000 tons—the average reduction in price to the consumer during the latter year having been 20 per cent. The large increase in subsequent years I have already shown.

The consumption of sugar we find, then, has been steadily and rapidly increasing in this country, and if we add together to the refined and raw sugar and molasses used, it will be seen that the consumption of 1852 amounted to 400,178 tons; which is at the rate of 29 lbs. per head of the population per annum. Whilst the quantity retained for home consumption in the United Kingdom, in 1844; was but 4,130,000 cwt., the amount had risen in 1852 to upwards of 8,000,000 cwt.

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Sugar unrefined, entered for home consumption.

	Colonial Raw.	Foreign Raw.	Total.
	Cwt.	Cwt.	Cwt.
1848	5,936,355	1,225,866	6,162,221
1849	5,424,248	498,038	5,922,386
1850	5,201,206	911,115	6,112,321
1851	5,872,288	1,383,286	6,255,574
1852	6,241,581	687,269	6,928,850

To the foregoing should be added the following quantities of refined sugar and molasses, entered for home consumption.

	Refined Sugar and Candy.	Molasses.	Total
	Cwt.	Cwt.	Cwt.
1848	46,292	637,050	683,342
1849	75,392	812,330	887,722
1850	116,744	917,588	1,034,362
1851	338,734	773,035	1,111,769
1852	274,781	799,942	1,074,723

The quantity of sugar refined by our bonded refiners, and exported, is shown by the following figures. The increase in 1851, was one-fourth in excess of the previous year.

	Cwt.
1848	248,702
1849	222,900
1850	209,148
1851	258,563
1852	214,299

The following were the imports of sugar into Great Britain, in 1848 and 1851, respectively—and the quarters from whence supplies were derived:—

	1848—Tons.	1851—Tons.
West Indies	121,600	153,300
Mauritius	43,600	50,000

East Indies	65,200	78,286
Java and Manila	11,000	20,850
Havana, Porto Rico, and Brazil	76,900	76,526
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	318,300	378,962

The production of sugar in the last four years, may be stated comparatively as follows:—

CANE SUGAR.	1849.	1850.	1851.	1852.
	Tons.	Tons.	Tons.	Tons.
Cuba	220,000	250,000	252,000	320,000
Porto Rico	43,600	48,200	49,500	50,000
Brazil	106,000	103,000	113,000	100,000
United States	98,200	120,400	103,200	110,000
The West Indies				
1. French Colonies	56,300	47,200	50,000	50,000
2. Danish Do.	7,900	5,000	6,000	5,000
3. Dutch Do.	13,800	14,200	15,000	20,000
4. British Do.	142,200	129,200	148,000	140,000
The East Indies	70,403	67,300	66,000	60,000
Mauritius	50,782	57,800	55,500	65,000
Java	90,000	89,900	99,347	104,542
Manila	20,000	20,000	20,000	20,000

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	919,182	952,200	977,547	1,044,542

BEET ROOT SUGAR.	1849.	1850.	1851.	1852.
	Tons.	Tons.	Tons.	Estmd. Tons.
France	38,000	61,000	75,000	60,000
Belgium	5,000	6,000	8,000	9,000
Zollverein	33,000	38,000	49,000	50,000
Russia	13,000	14,000	15,000	16,000
Austria	6,500	10,000	15,000	18,000
	95,500	129,000	162,000	153,000
Cane Sugar	919,182	952,200	977,547	1,044,542
Total	1,014,682	1,081,200	1,139,547	1,197,542

The price of sugar has, however, fallen considerably, and like many other things—corn, and cotton, and tea—has been lower for a long period than ever was known before.

Average price per London Gazette.

Year ending July 5,	British West India.	Mauritius.
1842	37s. 0d.	-----
1843	34s. 7d.	33s. 10d.
1844	34s. 9d.	34s. 7d.
1845	31s. 3d.	30s. 3d.
1846	35s. 3d.	34s. 2d.
1847	32s. 11d.	32s. 1d.
1848	24s. 3d.	23s. 3d.

1849	24s. 4d.	24s. 0d.
1850	25s. 3d.	28s. 8d.
1851	27s. 3d.	26s. 9d.
Half-year ending Jan. 5,		
1852	27s. 3d.	26s. 9d.

Thus, it is equally clear that the fall in the price has been very considerable since 1845, and that in 1849 and 1850 the price of sugar was about 10s. per cwt., or nearly one-third less than in 1838. The planters complain of the fall of price; and the only question in dispute is whether the fall has been occasioned by the reduction of the duties. Now the reduction of duties subsequent to 1846 and to 1851, was, on brown Muscovado sugar, from 13s. to 10s., or 3s.; and on foreign, from 21s. 7d. to 16s. 4d., or 5s. 3d. At the same time there was a very large increase of consumption, and the price, as of almost all articles, would not have been reduced to the full extent of the reduction of the duties, and certainly not reduced in a much greater degree, had there not been other causes at work to reduce the price. Between 1846 and 1851 freight from the Mauritius fell from L4 1s. 8d. to L2 13s. 9d., or 35 per cent.; and that reduction of price was not made from the planter. In the interval, too, great improvements were made in the manufacture of sugar; and in proportion as the article was produced cheaper, it could be sold cheaper, without any loss to him.

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I shall now take a separate review of the capabilities and progress of the leading sugar producing countries.

Production in the United States.—Sugar cultivation, in the United States, is a subject of increasing interest. The demand is rapidly advancing. Its production in the State of Louisiana, to which it is there principally confined, is a source of much wealth. In 1840, the number of slaves employed in sugar culture was 148,890, and the product, 119,947 hhds. of 1,000 lbs. each; besides 600,000 gallons of molasses. Last year, the crop exceeded 240,000 hhds., worth 12,000,000 of dollars. The capital now employed, is 75,000,000 of dollars. The protection afforded by the American tariff, has greatly increased the production of sugar in the United States. From 1816 to 1850, this increase was from 15,000 hhds. to 250,000 hhds.

In 1843, the State of Louisiana had 700 plantations, 525 in operation, producing about 90,000 hhds. In 1844, the number of hogsheads was 191,324, and of pounds, 204,913,000; but this was exclusive of the molasses, rated at 9,000,000 gallons. In 1845 there were in Louisiana 2,077 sugar plantations, in 25 parishes; 1,240 sugar houses, 630 steam power, 610 working horse power; and the yield of sugar was 186,650 hhds., or 207,337,000 lbs.

The introduction of the sugar cane into Florida, Texas, California, and Louisiana, probably dates back to their earliest settlement by the Spaniards or French. It was not cultivated in the latter, however, as a staple product before the year 1751, when it was introduced, with several negroes, by the Jesuits, from St. Domingo. They commenced a small plantation on the banks of the Mississippi, just above the old city of New Orleans. The year following, others, cultivated the plant and made some rude attempts at the manufacture of sugar. In 1758, M. Dubreuil established a sugar estate on a large scale, and erected the first sugar mill in Louisiana, in what is now the lower part of New Orleans. His success was followed by other plantations, and in the year 1765 there was sugar enough manufactured for home consumption; and in 1770, sugar had become one of the staple products of the colony. Soon after the revolution a large number of enterprising adventurers emigrated from the United States to Lower Louisiana, where, among other objects of industry, they engaged in the cultivation of cane, and by the year 1803 there were no less than eighty-one sugar estates on the Delta alone. Since that period, while the production of cane sugar has been annually increasing at the south, the manufacture of maple sugar has been extending in the north and west.

Hitherto, the amount of sugar and molasses consumed in the United States has exceeded the quantities produced—consequently there has been no direct occasion for their exportation. In the year 1815 it was estimated that the sugar made on the banks of the Mississippi amounted to 10,000,000 lbs.

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According to the census of 1840, the amount of cane and maple sugar produced in the United States was 155,100,089 lbs., of which 119,947,720 lbs. were raised in Louisiana. By the census of 1850, the cane sugar made in the United States was 247,581,000 lbs., besides 12,700,606 gallons of molasses; maple sugar, 34,249,886 lbs., showing an increase, in ten years, of 126,730,077 lbs.

The culture and manufacture of sugar from the cane, with the exception of a small quantity produced in Texas, centres in the State of Louisiana—where the cane is now cultivated and worked into sugar in twenty-four parishes. The extent of sugar lands available in those parishes is sufficient to supply the whole consumption of the United States. Sugar cultivation was carried on in Louisiana to a small extent before its cession to the United States. In 1818 the crop had reached 25,000 hogsheads. In 1834-35 it was 110,000 hogsheads, and in 1844-45 204,913 hogsheads. Each hogshead averaging 1,000 lbs. net, and yielding from 45 to 50 gallons of molasses.

The number of sugar estates in operation in 1830, was 600. The manual power employed on these plantations, was 36,091 slaves, 282 steam-engines, and 406 horse power. The capital invested being estimated at 50 million dollars. In 1844 the estates had increased to 762, employing 50,670 slaves, 468 steam-engines, 354 horse power.

The sugar-cane is now cultivated on both branches of the Mississippi from 57 miles below New Orleans to nearly 190 miles above. The whole number of sugar houses in the State is 1,536, of which 865 employ steam, and the rest horse power.

The crop of 1849-50 was 247,923 hhds. of 1,000 lbs., which, at an average of 31/2 cents., amounted to nearly 91/2 million dollars. The quantity of molasses produced was more than 12 million gallons, worth, at 20 cents the gallon, about 2,400,000 dollars, giving a total value of close upon 12 million dollars, or an average to each of the 1,455 working sugar houses of 8,148 dollars.

The overflow of the Mississippi and Red Rivers in 1850, shortened the crop near 20,000 hhds., and was felt in subsequent years. Since 1846, not less than 355 sugar mills and engines have been erected in this State. The sugar crop of 1851-52 was 236,547 hhds., produced by 1,474 sugar houses, 914 of which were worked by steam, and the rest by horse-power. Texas raises about 8,000 to 10,000 hhds. of sugar, and Florida and Georgia smaller quantities.

In the year ending December, 1851, there were taken for consumption in the United States about 132,832 tons of cane sugar, of which 120,599 were foreign imported. The quantity consumed in 1850 was 104,071 tons, of which 65,089 was foreign.

Production in Cuba.—The average yearly production of sugar in Cuba has been, in the five years from 1846 to 1850, 18,690,560 arrobas, equal to 467,261,500 lbs., or 292,031 hhds. of 1,600 lbs. weight. The crop of 1851 was estimated at twenty-one and a-half million arrobas, equal to about 335,937 West India hhds. Thus, the increase from 1836 to 1841, has been as 29 per cent.; from 1841 to 1846, as 25 per cent.; and from 1846 to 1851, as 45 per cent. A portion of sugar is also smuggled out, to evade the export duty, and by some this is set down as high as a fourth of the foregoing amounts.

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In the three years ending 1841, the exports of the whole island were 2,227,624 boxes; in the three years ending 1844, 2,716,319 boxes; in the three years ending with 1847, 2,805,530 boxes.

Between 1839 and 1847, the exports had risen from 500,000 to 1,000,000 boxes. The following table exhibits the quantity shipped from the leading port of Havana, to different countries:—

Countries.	Sugar boxes of about 400 lbs. each. 1850.	1851.
Spain	81,267	101,762
United States	146,672	199,204
England	25,697	46,615
Cowes and a market	221,385	270,010
The Baltic	45,085	81,866
Hamburgh and Bremen	29,271	33,165
Holland	23,242	26,828
Belgium	62,849	29,814
France	44,947	46,517
Trieste and Venice	38,627	14,832
Italy	2,856	5,243
Other places	13,888	16,601
	-------	-------
Boxes	743,249	872,457

Our West India possessions have, owing to the want of a good supply of labor and available capital to introduce various scientific improvements, somewhat retrograded in the production of sugar; which, from the low price ruling the past year or two, has not been found a remunerative staple.

The two large islands of Jamaica and Cuba, may be fairly compared as to their production of sugar. From 1804 to 1808, Jamaica exported, on the average, annually 135,331 hhds., and from 1844 to 1848, it had decreased to 41,872 hhds. The exports from the single port of Havana, which in the first named period were 165,690 boxes, rose during the latter period to 635,185 boxes; so that the shipments of sugar from Jamaica, which were in 1804 to 1808 double those of Havana—in the period from 1844 to 1848, were five times less!

Cuba will be able to withstand the crisis of the low price of sugars, better than the emancipated British Colonies, for the following reasons:—

1. It will find, in its present prosperity, a power of resistance that no longer exists in the British sugar-growing colonies.

2. Because it enjoys in the Spanish markets a protection for at least 16,955 tons of its sugar, or about eight-tenths of its total exportation.

3. Because it has secured a very strong position in the markets of the United States; and both from its proximity to, and its commercial relations with that country, as also from the better quality of its sugar, will command the sale of at least 33,500 tons, or about 16 per cent. of its total production.

4. Because in 1854, after the duties shall have been equalized, it will be enabled to undersell the British article in its own market.

5. Because, not being an exclusively sugar-growing colony, as are almost all British West India Islands, it may suffer from the present depressed condition of the sugar market, but cannot be entirely ruined, owing to its having commanding resources, and many other valuable staples,—coffee, copper, cotton, &c.

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6. Because, by improving its agriculture and introducing useful machinery, railroads, &c., for which it has large available capital, it can produce sugar at a diminished cost.

7. And lastly, because the proprietors have *continuous* labour at command, until slavery be abolished—of which there seems no present prospect. The slave population numbers about 350,000, and the free coloured population, about 90,000.

The consumption of sugar, during 1847, very singularly tallied with the production of the British Colonies that year—being exactly 289,000 tons; but as 50,000 tons of foreign sugar were consumed, an accumulation of British plantation sugar necessarily remained on hand.

The production of the French colonies was 100,000 tons, of which France received nine-tenths.

In 1836, Jamaica made 1,136,554 cwt. of sugar. In 1840, its produce had fallen off to 545,600 cwt.; but in the same years, Porto Rico had increased its sugar crop, from 498,000 cwt., to 1,000,000 cwt. In 1837, Cuba made 9,060,058 arrobas of sugar, equal to 132,765 hhds.; in 1841, it had increased to 139,000 hhds. The largest crop grown in the West Indies, since 1838, was that of 1847, which amounted to 159,600 tons.

The annexed returns of the sugar crops of Barbados and Jamaica, for a series of years may, be interesting:—

SUGAR CROPS OF THE ISLAND OF BARBADOS, FROM 1827 TO 1846 AND 1851.

1827 18,109 hhds. 1828 28,533 " 1829 23,486 " 1830 26,360 " 1831 28,174 " 1832 19,761 " 1833 28,099 " 1834 28,710 " 1835 25,371 " 1836 26,358 " 1837 31,670 " 1838 33,058 " 1839 28,213 " 1840 13,589 " 1841 17,801 " 1842 21,607 " 1843 24,587 " 1844 23,147 " 1845 24,767 " 1846 21,936 " 1851 48,000 "

SUGAR CROPS OF THE ISLAND OF JAMAICA, FROM 1790 TO 1851.

1790 91,131 " 1791 91,020 " 1792 ... " 1793 82,136 " 1794 97,124 " 1795 95,372 " 1796 96,460 " 1797 85,109 " 1798 95,858 " 1799 110,646 " 1800 105,584 " 1801 139,036 " 1802 140,113 " 1803 115,496 " 1804 112,163 " 1805 150,352 " 1806 146,601 " 1807 135,203 " 1808 132,333 " 1809 114,630 " 1810 112,208 " 1811 138,292 " 1812 113,173 " 1813 109,158 " 1814 104,558 " 1815 127,209 " 1816 100,382 " 1817 123,766 " 1818 121,758 " 1819 116,382 " 1820 122,922 " 1821 119,560 " 1822 94,515 " 1823 101,271 " 1824 106,009 " 1825 72,090 " 1826 106,712 " 1827 87,399 " 1828 101,575 " 1829 97,893 " 1830 100,205 " 1831

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94,381 " 1832 98,686 " 1833 85,161 " 1834 84,756 " 1835 77,970 " 1836 67,094 " 1837 61,505 " 1838 69,613 " 1839 49,243 " 1840 33,066 " 1841 34,491 " 1842 50,295 " 1843 44,169 " 1844 34,444 " 1845 47,926 " 1851 41,678 "

The average of the five years ending 1851, being the first five of Free trade, shows an annual export from Jamaica of 41,678 hhds.

The quantity of unrefined sugar imported from the British West Indies and Guiana in a series of years since the emancipation, is shown by the following abstract:—

Cwts. Sugar.	Cwts. Molasses.	
1831	4,103,800	323,306
1832	3,773,456	553,663
1833	3,646,205	686,794
1834	3,843,976	650,366
1835	3,524,209	507,495
1836	3,601,791	526,535
1837	3,306,775	575,657
1838	3,520,676	638,007
1839	2,824,372	474,307
1840	2,214,764	424,141
1841	2,148,218	430,221
1842	2,508,725	471,759
1843	2,509,701	605,632
1844	2,451,063	579,458
1845	2,853,995	491,083
1846	2,147,347	477,623
1847	3,199,814	531,171
1848	2,794,987	385,484
1849	2,839,888	605,487
1850	2,586,429	470,187

Mauritius.—In the year 1813 the exports of sugar from this island were but 549,465 lbs., and increasing gradually to 128,476,547 lbs. in 1849, or two-hundred fold in thirty-six years.

The equalisation of the duties in 1825, and the admission of Mauritius sugars into England on the same footing as those from the West Indies, had the effect of stimulating the sugar trade of Mauritius, and advancing it to its present remarkable success. Notwithstanding its immense crops, scarcely more than three-fifths of the island is yet under cultivation; but it has the advantage of a cheap and abundant supply of labor, and much improved machinery has been introduced. The planters first commenced introducing Coolies in 1835, and were for some time restricted to the single port of Calcutta for their supply.

The recent advices from Mauritius furnish some interesting information regarding the progress making in the sugar production of that colony. In reference to the cultivation of the cane, it is stated that by the introduction of guano upon several estates in the interior, the production has been very largely increased; but as the value and economy of manure has not been hitherto sufficiently estimated, its introduction has not been so general as could be desired. The importance of free labor to the cultivation of the estates, has now become fully appreciated by the planters; it being found that an equal amount of work can be obtained by this means from a less number of hands, and that at lower rates of wages than were current in previous years, the average of which is shown in the following table:—

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Years.	Number of Coolies employed.	Aggregate amount of wages paid per week.	Average wages per head per week.
		L	s. d.
1846	47,733	33,484	14 0
1847	48,314	35,338	14 9
1848	41,777	26,627	12 9
1849	45,384	27,625	12 2
1850	47,912	31,664	12 3
1851	42,275	27,832	12 2

In 1826, to make from 25 to 30,000,000 lbs. of sugar, it required 30,000 laborers (slaves); at the present time, with less than 45,000 (from which number fully 5,000 must be deducted as absent from work from various causes), 135,000,000 lbs. are produced, or about five times the quantity under slavery. The coolies are found to be an intelligent race, who have become inured to the work required, and by whose labor this small island can produce the fifth part of the consumption of the United Kingdom, and that with only about 70,000 acres under cane cultivation. About 10,000 male immigrants, introduced since 1843, are not now working under engagement, but are following other occupations, and thus become permanent consumers. Some cultivate land on a small scale, on their own account, but very few plant canes, as it requires from eighteen to twenty months before they obtain any return for their labor; but the most important fact established by this and other official statements is, that only a small number of immigrants leave the colony at the expiration of their industrial residence. In the manufacture of sugar from the cane, considerable improvement has been effected by the introduction of new methods of boiling and grinding. The vacuum pan and the system of Wetsell are all tending to economise the cost of production, and to save that loss which for years amounted, in grinding alone, to nearly one-third of the juice of the cane. The planters begin to find that they can increase the value of their sugar 30 to 40 per cent. by these improvements, and that their future prosperity depends upon carrying them out. Unfortunately, however, here, as in many other of our colonies, a very large number of planters do not yet appreciate the advantages to be obtained by the adoption of improved machinery and manufacture, or by improved cultivation, and still struggle on under the old system of waste and negligence, which can only result in the ruin and destruction of their property.

In 1827, the number of sugar estates in operation in Mauritius, were 49 worked by water power, 50 by cattle or horses, and 22 by steam—total 111; in 1836, this number had increased to 186, *viz*.—64 moved by water power, 10 by horse, and 112 by steam. In 1839, the number was 211, of which 138 were worked by steam power—70,292 acres were then under cultivation with sugar. There are now about 490 sugar estates, whereof only 231 have mills—42 are worked by water power, the rest by steam.

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The annual Mauritius crops, as exported, for the last ten years, have been as follows. The shipments frequently extend beyond a year, hence a discrepancy sometimes between the year's crop and the year's export:—

	Tons,
1842-43	24,400
1843-44	28,600
1844-45	37,600
1845-46	49,100
1846-47	64,100
1847-48	59,021
1848-49	50,782
1849-50	51,811
1850-51	55,000
1851-52	65,080

Besides its exports to Great Britain, Mauritius ships large quantities of sugar to the Cape of Good Hope and Australia.

Its local consumption is moreover set down at about 2,500 tons.

The progressive increase in its exports is marked by the following return of imports into Great Britain from the island:—

	Cwt.
1826	93,723
1827	186,782
1828	204,344
1829	361,325
1830	297,958
1831	485,710
1832	517,553
1833	521,904
1834	516,077
1835	553,891
1836	558,237
1837	497,302
1838	537,455
1839	604,671
1840	690,294
1841	545,356

1842	716,009
1843	696,652
1844	545,415
1845	716,173
1846	845,197
1847	1,193,571
1848	886,184
1849	893,524
1850	1,003,296
1851	999,337

East Indies.—Sugar is a very old and extensive cultivation in India. It would probably be within the mark, to estimate the annual produce of the country at a million of tons. An official return shows that the quantity of sugar carried on one road of the interior, for provincial consumption, is about equal to the whole quantity shipped from Calcutta—-some 50,000 or 60,000 tons.

India is fast becoming a great sugar producing country, although its produce and processes of manufacture are rude and imperfect. The Coolies who return from time to time to the Indian ports, bring with them much acquired knowledge and experience from the Mauritius.

In 1825, the import of sugar from the East Indies was but 146,000 cwt., and it fluctuated greatly in succeeding years, being occasionally as low as 76,600 cwt. In 1837 the quantity imported was just double what it was in 1827. In 1841, it had reached as high as 1,239,738 cwt., and subsequently kept steady for a few years at 1,100,000 cwt.—-and for the last four years has averaged 1,400,000 cwt.

Java.—Attention has been withdrawn, in a great measure, from sugar cultivation in Java, owing to coffee being found a more remunerative staple. The following figures serve to show the extent of its exports of sugar:—

Cwt.	
1826	23,565
1827	38,357
1828	31,301
1829	91,227
1830	129,300
1831	144,077
1832	292,705
1833	151,128
1834	443,911
1835	523,162
1836	607,336
1837	820,063

1838	873,056
1839	999,895
1840	1,231,135
1841	1,252,041

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1842	1,105,856
1843	1,162,211
1844	1,260,790
1845	1,812,500
1848	1,798,612
1850	1,797,874
1851	1,987,957
1852	2,090,845

In 1840, we imported from Java 75,533 cwt.; in 1841, 87,342 cwt.; in 1842, 24,922 cwt.; in 1843, 35,161 cwt.; and in 1844, about 72,000 cwt.; but most of this was only sent to Cowes, for orders, to be transhipped to the Continent.

Philippines.—The exports from Manila into this country in 1841, were 133,482 cwt.; in 1842, 63,464 cwt.; and in 1843, 48,977 cwt. In the fifteen years between 1835 and 1850, the export of sugar from the Philippine Islands more than doubled:—

Tons.	
1835	11,542
1836	14,875
1837	12,293
1838	12,375
1839	15,631
1840	16,563
1841	15,321
1842	18,540
1843	22,239
1844	21,528
1845	24,500
1850	28,745

About a third of this is raw sugar, the rest is clayed or refined. It is singular, that though these islands belong to Spain, the export of this staple product to that country should be limited to about 600 tons; America taking about one-sixth, and England and her colonies the remainder. There is now an increased demand for the Australian colonies, consequent upon the large influx of population to that quarter.

Export of sugar from Manila in 1850.

	Piculs.
To Great Britain	146,926
" Continent of Europe	50,830
" Australian Colonies	142,359
" Singapore, Batavia, and Bombay	12,749
" California and the Pacific	29,144
" The United States	77,919

	459,927

The sugar cane occurs in a wild state on many of the islands of the Pacific, but in no part of the American continent, notwithstanding a contrary opinion has been expressed.

The following are the chief varieties cultivated in the West Indies, Louisiana, the East Indies, and Mauritius:—

1. Common or creole cane, so called from being introduced from the New World.

2. Yellow Bourbon.

3. Yellow Otaheite.

4. Otaheite with purple bands.

5. Purple Otaheite.

6. Ribbon cane.

My friend, Mr. L. Wray, in his “Practical Sugar Planter,” considers the Bourbon, and yellow, or straw-coloured Otaheite cane, as identical, but merely altered by change of soil and climate. The yield from these cane-plants seems to be about the same in either Indies, *viz*., in good land about two-and-a-half tons of dry sugar per acre—sometimes three tons.

A very large species of red cane, grown at Gowhatty, in Assam, is made favorable mention of for its strength of growth, early maturity, and juiciness; and Mr. Wray strongly recommends the introduction into the West Indies of another fine variety, generally grown in the Straits’ settlements, where it is known by the name of the Salangore cane. He considers they would ratoon better than any other cane, and the return from it is on the average 3,600 lbs. of dry sugar to the acre.

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“For my own part, I have always reckoned as an average, 3,600 lbs. of dry sugar to the acre as the return this cane will give, on anything like good land, in the Straits, according to the present imperfect mode of expressing and manufacture; but, considering the surpassing richness of land in the West India Islands, Demerara, and Mauritius, I should not be in any way surprised to find that it would there give even three tons an acre.The Salangore cane grows firm and strong; stands upright much better than the Otaheite; gives juice most abundantly, which is sweet and easy of clarification, boils well, and produces a very fine, fair sugar, of a bold and sparkling grain.”

Much discussion has arisen on the subject of raising the sugar cane from seed, and the possibility has been universally denied among the planters and agricultural societies of the West India colonies. Mr. Pritchard, a sugar planter of Louisiana, in the “United States Patent Report for 1850,” however, states:—

“It is an error to suppose that the cane cannot be propagated from the seed. This may be the case when the seed is obtained from plants that have been produced for a number of years from buds, or eyes. All plants that have been produced in this way for a series of years, lose the faculty of forming prolific seeds; and the sugar cane is governed by the same laws which govern the whole vegetable kingdom. It cannot, therefore, be expected to produce seeds after it has been cultivated for a great length of time.”

The sugar cane is composed of water, woody fibre, and soluble matter, or sugar. In round numbers it may be stated that the proportions are 72 per cent. of water, 10 per cent. of woody fibre, and 18 per cent. of sugar.

The fluid contents of a cane, according to Dr. Evans, contain 90 per cent. of the entire structure of the stem.

1,000 grains of sugar cane, being burnt, gave 71/2 grains of ash, which, on analysis, furnished the following components:—

Silica 1.78
Phosphate of lime 3.41
Red oxide of iron and clay .17
Carbonate of potash 1.46
Sulphate of potash .15
Carbonate of magnesia .43
Sulphate of lime 6
——
7.46

The following is the quantative analysis of a portion of soil taken from the surface of a cane field, on the Diamond estate, in St. Vincent, West Indies: —

Alumina soluble in acids 12.87
Organic matter 11.26
Gypsum .23
Carbonate of lime 12.52
—— of magnesia .71
Oxide of iron 8.51
Oxide of manganese .33
Insoluble silicious and aluminous matter 53.57

100.00

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The sugar of the cane and grape sugar are distinguished by the following difference in their elements, as proved by analysis:—

	Cane sugar.	Grape sugar.
Carbon	12	12
Hydrogen	10	12
Oxygen	10	12
Water	1	2

There is a remarkable difference, however, between their fermentable properties. When a solution is made of the same quantities of these two sugars, in equal proportions of distilled water, it will be necessary to add eight times as much of the same ferment to induce alcoholic fermentation in the solution of cane sugar, as in that of grape sugar. Under the action of a larger quantity of ferment, cane sugar is transformed into grape sugar.

If you cut a sugar cane in two, and examine the interior part of it with a magnifying glass, you perceive the crystals of sugar as distinct and as white as those of double-refined sugar. The object of the operator should be then either to extract those crystals without altering their color, or, if that be found impracticable, to separate them from the impurities mixed with them, while the juice is in its natural state, and yet contains but little coloring matter. Instead of this, the juice is limed while all the impurities are in it. In separating the feculencies from the juice and uniting them in large flakes, lime dissolves a portion of them and forms with them coloring matter, which we all know at once discolors the juice, when lime is used in excess. Afterwards heat is applied, either in clarifiers or in the grand copper, but most of the impurities found in the juice will decompose, and burn at a degree of heat far below the boiling point, say at 120 deg. of Fahrenheit. This is shown by the thick scales continually forming in the grande. From that degree of heat the decomposition goes on in the clarifier till the juice is drawn, and continues in the grande so long as there are feculencies left. This decomposition greatly increases the quantity of coloring matter, so that, as the juice is being clarified, it loses in color what it gains in purity. And here let me show the relative value of the "grande" and of clarifiers as agents of clarification. In the grande, if it is well attended to, the scummings are taken up as soon as they rise. A portion of them is removed before they begin to decompose, and the process goes on, so that before the juice reaches the boiling point nearly all the feculencies are removed, and the source of coloring matter is removed with them. Clarifiers reach the boiling point much quicker, and cannot easily be scummed. The general practice is to bring them to that point without scumming, to let the feculencies separate from the juice by cooling and by rest, and to wash out the clarifiers every second or third time they are filled. Heat and alkalies acting in them upon the accumulated feculencies of one, two, or three charges, dissolve a much larger portion of those feculencies than they can possibly do in the grande. The formation of coloring matter continues during the time of rest, and accordingly planters, after repeated trials, generally agree that juice well clarified in the grande, has a lighter and brighter color, and makes better sugar than that obtained from clarifiers.

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The first object of research should be to find means of clarifying the juice without creating coloring matter. It is said that presses something like those used to press cotton, have lately been successfully employed in the West Indies, instead of rollers; that the juice obtained is much purer, and that a much larger quantity of it is extracted from the cane. If so, this will be a great improvement, and the first step of the process I should recommend. From juice thus obtained, I have no doubt that all impurities less soluble than itself may be separated by mechanical means before heat and alkalies are applied, or at least with a very small quantity of alkalies. All other liquids, all fatty substances and oils, except cotton seed oil, are clarified by a very rapid process. Cane juice can no doubt be clarified by similar means, and if this were accomplished the process of sugar making would be very much simplified.

The clarified juice might then be placed in an evaporator, heated by the waste steam of the engine; then be limed and scummed if necessary, and concentrated to fifteen or sixteen of the prese sirop; then purified by filtration through animal charcoal, if white sugar was wanted, or by rest for other qualities; and finally concentrated in vacuum pans of great power, such pans as Mr. Thomas A. Morgan, of Louisiana, now uses, and which, I am informed, are only made in America.

The superiority of the vacuum pan is not universally admitted, and we are told that in France it is superseded by open pans, similar to those called in America “Mape’s Evaporators.” However this may be, I cannot help believing that the vacuum pan has many decided advantages over all others. One is manifest; the sugar may be grained in the pan, and the granulation is completely under the control of the operator. He may accelerate or retard it at pleasure; he may carry it so far that sugar will not run from the pan, and will have to be taken out of it; he may so conduct the operation as to increase, almost at will, the size and hardness of the crystals. This last is an indispensable requisite if the practice of draining sugar in pneumatic pans should be adopted.

The atmospheric pressure is made too powerful for sugars boiled in any other manner; it breaks and destroys the crystals, and in a very few days sets the sugar to fermenting.

The pneumatic draining of sugar has many things to recommend it—the usual loss by drainage is avoided, sugar is got ready for market day by day, as it is made, and it may be bleached by pouring white syrup over it and forcing it through the mass. It is said that the process is attended with considerable loss in weight, but as all that drains from the pan may be boiled over once or twice, it is not easy to conceive how the loss can occur.

Cane juice contains many ingredients besides sugar, the principal of which are albumen, gluten, gum, starch, resin, wax, coloring matter, and certain salts, all of which, either collectively or individually, have the power of preventing granulation, as may be proved by their addition to a syrup of pure sugar, which will then defy all attempts to make it crystallise. If, therefore, we want to make good sugar, we must endeavour to free our cane juice as much as possible from those substances.

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Now, cane juice is no more the sap of the cane, than apple juice is that of the apple tree; it is the natural product of the cane, and, in all probability, would contain but a small proportion of these foreign matters if it could be expressed without being accompanied by the sap, they being the natural constituents of the last-named fluid. A patent has, I believe, been lately taken out for separating the cane juice without the sap. However, in the absence of such an improvement, much may be done by care and attention at the mill; the green bands and trash which usually accompany the canes from the field, should, therefore, be carefully removed before they are passed through, as they contain no saccharine matter, abound in the deleterious substances already mentioned, and communicate a bad color to the juice; therefore, *the ripe cane only should pass through the mill*. There are but few planters who have not had to contend with sour juice, and they attribute the difficulty they experience in making sugar therefrom, to the presence of acetic acid, or vinegar; but this is quite an erroneous idea, as the acetic acid is very volatile, and evaporates quickly on the application of heat, which may be proved by throwing a gallon of strong vinegar into a pan of liquor; it will do no harm, provided it be boiled before tempering; on the contrary, the effect, if it be properly done, will be beneficial, as it will promote the coagulation of the albumen; it is the gum which is always formed during the acetous fermentation of sugar that prevents granulation; hence, then, acidity is strictly to be guarded against, as fermentation once commenced, it will be impossible to make good sugar, it will continue throughout the process, and even in the hogshead; so that canes should be ground as soon as possible after they are cut, and all rat-eaten and broken ones carefully excluded. Canes may, however, be kept some days without fermenting, provided they be not broken or damaged, it being, as we said before, the mixture of the sap and the cane juice that makes the liquid so prone to fermentation; and the mill, gutters, and everything with which the juice is likely to come in contact, should be kept carefully clean, and whitewashed immediately after, and the whitewash removed before use, as acetate of lime being an exceedingly soluble and deliquescent salt, will not improve the quality of the sugar; whilst the gutter should be short, and sheltered from the sun's rays, they having the effect of greatly expediting chemical action.

I shall say no more on this subject, but will proceed to consider the mode of tempering and clarifying cane juice, and the action of lime on the various substances contained therein. The expression "tempering" has, I presume, been, adopted in consequence of the use of tempered lime for the purpose of precipitating the feculencies, held in solution in the cane juice, into a state of suspension; and clarification is the process by which we afterwards clear the liquor of

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these and other foreign matter. Now, as I before observed, “fermentation should be most strictly guarded against;” our first efforts should be directed to free the cane juice from those substances most conducive to that process; and on inquiry we find these to be albumen and gluten; so far, however, from getting rid of them in cold tempering, we adopt a course which retains them permanently in solution, as lime has the power of rendering them permanently soluble, and of forming soapy compounds with resin, wax, and chlorophyle, or the green coloring matter of leaves, forming an insoluble compound with and precipitating only the starch, and converting at the same time the green color of the chlorophyle (which is, in all probability, attached to the resin), into a dark brown, of a greater or less intensity, according to the composition of the cane juice, and, consequently, the quantity of lime required; it follows, therefore, as a matter of course, that if juice be tempered before these substances have been removed, they must be permanently retained, and they have all the power of preventing granulation.

Albumen, and gluten are both coagulable by heat; if, therefore, we raise the liquor to the boiling point prior to applying the lime, taking care to remove the scum as soon as it shows signs of breaking, and continuing the boiling until the scum thrown to the surface becomes inconsiderable, we shall find that the albumen and gluten, in coagulating and rising, have carried with them the small particles of woody fibre, the wax, and a large proportion of the coloring matter, and that the lime will now throw down the starch, and any other little impurities remaining in suspension in the liquor, leaving it perfectly clear and bright. Tempering is an exceedingly delicate chemical operation, and I have no hesitation in saying, that on its proper performance depends the quality of the produce. The following simple experiments, which all have it in their power to try, will, if they give themselves the trouble, fully satisfy them of two important points—the superiority of the hot over the cold mode, and the necessity for great attention to the operation of tempering. Let them take a tumbler of cane-juice and a bottle containing lime water, add the latter to the former by drops, pausing and stirring between each, and they will find that, after the addition of a certain quantity, the opaque gummy appearance of the liquor undergoes a change, and the impurities contained in it separate into flakes, which increase in size with each drop of lime added, until they become extinct, and the supernatant liquor perfectly transparent; this is the precise point at which the liquor is tempered, and each drop of lime added after this, causes the flakes to diminish rapidly in size, at last entirely to disappear (being re-dissolved), and the liquor to resume its former gummy appearance; it is, therefore, evident that there should be no such expressions as tempering high or low.

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The reason why some liquor is so difficult to clean is, that it is either tempered high or low; if it be exactly tempered, the impurities contained in it being entirely separated and thrown out of solution, rise to the surface immediately on the application of heat, and are easily removed; but if there be too little lime, a great portion remains in solution, and if too much, a proportional quantity is re-dissolved; and in either case cannot be removed by any mechanical means. It is, therefore, necessary to have some precise test for the application of lime.

As regards the superiority of the hot over the cold tempering, let any one take, in separate vessels, two gallons of cane-juice, and temper one, adding the lime in small quantities—say, of three grains at a time—and keeping an account of the quantity used; he will find that the first portions produce no effect whatever, and that it is only after the addition of a considerable quantity that the desired precipitation of the impurities manifest itself. Why is this? Because albumen, gluten, resin, and chlorophyle, being soluble in lime, lime is equally so in them, and they must first be saturated before it will produce any other effect. Let the liquor thus tempered, be then placed on one side. Put the other gallon over a fire, and boil it, removing the scum just before, and during, ebullition; let it then be taken off the fire, and tempered in the same way as the other. The very first quantity of lime added causes the appearance of the floccy precipitate; and if the addition of the lime be continued until it be precisely tempered, it will be found that the hot possesses the following advantages over the cold-tempered liquor:—In a quarter of an hour its impurities will have subsided to a sixteenth of its bulk, leaving the supernatant liquor as bright and clear as pale brandy; while those in the other have only sunk to one-quarter of its bulk. The color of the former clear liquor will not be less than one-half the intensity of that of the latter. The lime used in the hot has been less by one-third than the quantity used in the cold tempering.

Of course, on level estates there is little difficulty in tempering liquor, but on hilly properties scarcely two pans will require the same quantity.

It is generally believed that the object of adding lime to cane-juice is for the purpose of neutralising an acid, and it is to the reception of this fallacious idea that it is indebted for its long and continued use, and the present backward state of sugar manufacture is attributable: I unhesitatingly assert that, if there be an acid present in the cane-juice, the addition of lime to it will be injurious instead of beneficial. There are only four acids that we could expect to find in cane juice—mucous, saccholactic or saclactic, oxalic, and acetic acids. The three first named of these, however, have never been traced, even in the most minute quantities; and if the latter be present, which, unfortunately, is

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but too often the case, the addition of lime would only result in the formation of acetate of lime, which is, as I have already observed, an exceedingly difficult crystallisable, very soluble, and deliquescent salt. It has a bitter, saline taste; 100 parts consist of 64.5 acid, 35.5 lime, and it is easily recognisable by its taste in the molasses made from sour cane-juice: so that, supposing the cane-juice sour, every pint of acid present would require nearly half a pound of lime for its neutralisation, independent of the quantity required for the tempering or precipitation of the feculencies contained in it, and would result in the formation of one-and-a-half pound of the above mentioned highly deleterious salt.

Suppose we boil the cane-juice prior to tempering it, we then drive off a great portion of acetic acid, much less lime will be required, and if we could, by filtration or subsidence, get rid of the precipitated feculencies, we should make a tolerably good sugar; but as, under the present plan, we have no means of so doing, the acetic acid, which is forming during the whole process of evaporation (as fermentation still goes on), unites with the lime before it can be dissipated by the heat, and thus not only forms acetate of lime, but causes the re-solution of the precipitated feculencies, thus rendering it necessary to add a fresh portion of lime in the tache, a proceeding always to be avoided, if possible, but generally necessary in boiling down sour liquor. Take a small portion of cane-juice (hot or cold) in a tumbler, and temper it with lime until the feculencies are precipitated and the flakes perfectly visible, then add vinegar by drops, and it will be found that the flakes will speedily disappear and be re-dissolved, showing that lime has a greater affinity for acetic acid than starch, and that, although when added to sour cane-juice, it neutralises the acidity, still that result is a consequence, not the cause, of the application, and is highly injurious. Lime is one of the greatest known solvents of vegetable matter; it dissolves albumen, gluten, gum and lignin, or woody fibre, forming soapy compounds with wax, resin, and, chlorophyle. Ordinary cane-juice contains about three parts of resin to every 100 of sugar, and the projection of a small piece of soap into a tache full of granulating syrup will soon convince any one of the effect likely to result from the presence of that material. Although, by tempering hot, we get rid of a very great quantity of the substances on which lime acts injuriously, a considerable portion of them remain in suspension, the quantity of albumen contained in the cane-juice not being sufficient to carry them all off by coagulation; on the addition of the lime, however, they are entirely dissolved and as the impurities left behind consist chiefly of gluten, the liability of the liquor to ferment is greatly increased by its retention, that being the fermenting principle contained in wheat and other vegetable productions prone to that process.

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One hundred parts of Albumen consist of Carbon, 52.88; Oxygen, 23.88; Hydrogen, 7-54; Nitrogen, 15.70. Gluten, nearly same as Albumen.

100 parts consist of	Carbon.	Oxygen.	Hydro-gen.	Carbon.	Water.	Excess of Oxygen	Excess of Hydrogen
Lignin, or Woody Fibre	51.45	42.73	5.82	or 51.45	48.55		
Starch	43.55	49.63	6.77	43.55	56.45		
Sugar	42.47	50.63	6.90	42.47	57.53		
Gum	42.23	50.84	6.93	42.23	57.77		
Alcohol	51.98	34.32	13.70	51.98	38.99		9.03
Acetic Acid	50.22	44.15	5.63	50.22	46.91	2.87	
Resin	75.94	13.34	10.72	75.94	15.16		8.90
Wax	81.79	5.54	12.76	81.79	6.30		11.01

By a reference to the foregoing table it will be easily understood how slight a change in the proportion of the ingredients of any one of the substances contained therein will convert it into an entirely different one. In chemistry we are able, to a certain extent, to imitate the operations of nature; but we must follow in the same course laid down by her; thus, we can convert woody fibre, or sawdust and starch, into sugar, gum, alcohol, and acetic acid; but we cannot convert alcohol, acetic acid, or gum into sugar, starch or woody fibre; and of such importance is a slight alteration of the proportions of these elements—carbon, oxygen, and hydrogen—that the abstraction of carbon from sugar, and the addition of a portion of the prime support of life, vegetation and combustion, oxygen, changes the harmless sugar into the most violent of poisons, oxalic acid, which consists of 26.57 carbon, 70.69 oxygen, and 2.74 hydrogen.

Let us now examine the action of lime on sugar, and we shall find it equally, if not more, injurious than on the other substances. Sugar is capable of dissolving half its weight of lime, by which its sweet taste is destroyed, and it becomes converted into gum; the lime abstracting carbonic acid from it to form a carbonate of lime or chalk. It will be seen by the above table that—

100 parts of sugar contain 42.47 carbon.
100 parts of gum contain 42.23 ditto.

Difference 24

So that, if we extract 24-100ths of a grain of carbon from 100 grains of sugar, we convert them into gum. Let us suppose that about two ounces of lime, or say 1,000 grains, remain in solution in a pan, (say 200 gallons of liquor,) those 1,000 grains of lime will require 761 of carbonic acid to convert them into carbonate of lime or chalk, 100 grains of which consist of 56.2 lime and 43.8 carbonic acid. So that 1,761 grains of chalk consist of 1,000 lime and 761 carbonic acid. Now 100 grains of carbonic add consist of 27.53 carbon and 72.47 oxygen; therefore 761 grains will consist of 209.50 carbon and 551.53 oxygen.

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Consequently, 1,000 grains of lime will require 209.50 grains of carbon to convert them into carbonate of lime; and as we have seen that the abstraction of 24 from 100 grains of sugar convert them into gum, it follows, that the abstraction of 209.50 grains would have a similar effect on 87,000 grains, or about 15 lbs. of sugar, which, being converted into gum, would prevent the crystallisation of several times its weight of sugar; and this is the cause of the formation of molasses. The loss of sugar is not the only bad consequence of the use of lime, as the greater the quantity of gum in the liquor, the more it must be boiled—the more it is boiled the darker it gets—and the higher the temperature at which the skip is struck, the smaller the grain. The following is a good proof that lime dissolves albumen, and becomes converted into chalk:—Take a spoonful of syrup out of the tache of any estate on which the liquor is tempered cold; it will be found filled with small flakes; these are albumen set free from its solution in the lime by the conversion of the latter into carbonate of lime, and coagulated by heat. It is perfectly possible to temper liquor, so that scarcely any uncrystallisable sugar will remain; but planters do not like this; they must have molasses for the still-house; they could, however, boil low, by which the grain and color would be improved, and plenty of uncrystallised, although not uncrystallisable, syrup would be left to take the place of molasses.

I think I have now fully proved the following facts, *viz*.:—That the use of lime in sugar-making is not to neutralise an acid; that if acidity be present, the application of lime is injurious; that its action on gluten, albumen, wax, resin, and chlorophyle is equally so; that by decomposing the sugar and forming gum, the quantity of molasses or uncrystallisable sugar is much increased, whereby high boiling is rendered necessary, with its consequent heightening of color and injury to the grain of the produce, and that therefore it is perfectly unfit for the purpose of tempering cane-juice.

Messrs. Thomas Begg and Co., of London, have procured from E.F. Telchemacher and J. Denham Smith, an analysis of one gallon of ordinary plantain juice, and one gallon of Ramos' prepared plantain juice "for the purpose of ascertaining whether any substance can be used which, in conjunction with water, will answer as a substitute for the plantain juice in the receipt which accompanied the samples." The chemists say they find that one gallon of ordinary plantain juice holds in solution;—

Extract similar to tannin 25.60 grains
Vegetable extract and fatty matter 57.70 "
Carbonate of potash 150.40 "
Muriate of potash 33.60 "
Muriate of soda 2.00 "
Silica 1.20 "

Contents of one imperial gallon 270.50 grains

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—whilst one gallon of “Ramos’ prepared plantain juice” contains, besides vegetable extract, 226 grains of solid matter, consisting of sulphuret and potash, in the following proportions:—

Sulphur 40 grains
Lime 156 "
Potash 30 "
----
226 grains

They do not think it likely that the potash exists in fresh plantain juice as carbonate, but rather that this salt is the product of decomposition, arising from a compound of potash and a vegetable acid, such as tartaric or oxalic acid present in the fresh juice; be this as it may, any utility derivable from the plantain juice is evidently owing to the potash it contains.

They then give as a substitute for Ramos’ liquid, and to be used in a similar way, the following—

Take of subcarbonate of potash 2 ounces, avoirdupois; sulphur, 21/4 ounces; best British lime slaked, 11/2 lb.; mix them into a paste in an earthen pan or wooden tub, with one quart of water (warm) and when thoroughly mixed, pour in ten gallons of boiling water—rain water is the best to use—and stir from time to time until it has cooled, when it may be drawn off from the sediment and kept for use. If rain water cannot be obtained, the purest water obtainable may be used.

One of the causes most fatal to West Indian prosperity, is that exuberance of advantages which they enjoy from serenity of climate and fertility of soil—causes which, in the absence of proper stimulus to industry and improvement, have led to an improvident system of cultivation, and to a blind and ignorant adherence to wasteful methods of manufacture.

The cane is believed to contain from 90 to 95 per cent. of its own weight of saccharine juice; and yet (as Mr. Fownes, a Professor of Practical Chemistry in University College, London, informs us, in an excellent paper “On the Manufacture of Sugar in Barbados,"[17] from which much of what follows has been borrowed) owing to the defective construction of the mills, hardly so much as 50 per cent. is obtained, although he believes it practicable, by an improvement in the mills, to obtain from 70 to 75 per cent.; and of the remaining 10 or 15 per cent. which he regards it as impossible to extract, much, if not the whole, might, I conceive, be obtained, by macerating the pressed canes or megass, as it issues from the mill, and repassing it through the rollers; and, be it remembered, that from 40 to 45 per cent. of saccharine juice is nearly, if not altogether, equivalent to a similar per centage of sugar; so that by these initiatory improvements alone, and with little additional trouble, the produce of sugar might be nearly doubled from any given quantity of canes.

From the action of lime-water when added in a slight excess to the cane juice or raw liquor, as it is vernacularly termed, immediately on issuing from the mill, as well as from the effect produced by ammonia or potash, this liquid appears to contain a considerable quantity of cane sugar, mixed with much glucose, or that saccharine matter which is found in fruits; gum or dextrine, phosphates, and probably malates of lime and magnesia, with sulphates and chlorides, potash and soda, and a peculiar azotised matter, allied to albumen, which forms an insoluble compound with lime, is not coagulable by heat or acids, and runs readily into putrefactive fermentation.

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To free it from these constituents, and enable it to yield pure and crystallisable sugar, the liquor, on entering the boiling-house, is received into the first of three clarifiers, of the capacity of from three hundred to a thousand gallons each. Here it is subjected to the action of lime-water, which checks the tendency to fermentation, and neutralises any free acid which it may contain. "The common defection process," says Mr. Fownes, "in careful hands, seems susceptible of little improvement. Many other substances than lime have been proposed and tried with more or less success, some of which, in particular states of the cane juice, may prove very useful; but, for general purposes, nothing seems to answer so well as neutralisation by lime, either in the form of lime-water or milk of lime, added until the slightest possible tendency to alkalinity, as ascertained by delicate reddened litmus paper, is perceived. The juice should be somewhat heated before the lime is added, and afterwards raised quite to the boiling point. The fire is then to be withdrawn, and the whole allowed to rest a short time." Such is Mr. Fownes' description of the process of clarification; to which I will venture to add, upon the authority of those who have experienced its good effects, the joint use of the mucilage of the *Guazuma ulmifolia*, or gun-stock tree, as it is popularly termed in Nevis from the use to which its timber has been applied. This is the bastard cedar of Jamaica, or Orme d'Amerique, and Bois d'Orme of the French, which may be found described by Lunan, in the first volume of his "Hortus Jamaicensis," page 59, under the name of *Bubroma Guazuma*.

This tree presents in the interval between its outer bark of sap-wood, a mass of fibrous matter about half an inch in thickness, richly impregnated with mucilage, which is obtained by macerating the fibrous mass, conveniently divided into small shreds, for about twelve hours, in warm water, in the proportion of about two handsful to eight gallons of water. Of this solution, which is of a light, straw color, and somewhat thickened, one gallon is to be added for every hundred gallons of cane juice, after the clarifier has been charged with the proper quantity of lime-water, and has become lukewarm. The mixture should then be stirred, and afterwards allowed to settle till the scum has risen to the surface. The fire must next be cautiously and gradually raised to the point of boiling, when it must again be slackened, and the whole left to stand for about forty minutes, by which time the mass of feculencies will have risen to the surface, when the clear liquor underneath may either be drawn off by a siphon or cock; the whole may be filtered as Mr. Fownes recommends, by which means the liquor would be more effectually clarified, and much, if not all, the subsequent labour of skimming dispensed with. The matter remaining on the filter may be employed, either as a ferment in the still-house, or added to

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the manure heap. Much of the beneficial effect of the mucilage of the *guazuma* arises probably from an admixture of tannin, or some other astringent; for I have often been struck with the peculiar whiteness of the potted sugar in the curing-house, in the immediate vicinity of the Banana stalks, resulting, no doubt, from their powerful astringency; and tannin has already been found useful in the manufacture of sugar from beet-root in France, and is no doubt equally applicable to cane-sugar.

The liquor, when clarified in the manner described, must be concentrated, by regulated evaporation, to the degree requisite for crystallisation. This Mr. Fownes advises to be done by steam of a moderate pressure circulating in a spiral of copper-pipe laid at the bottom of the evaporating vessels, which should be large and shallow, and wholly unlike those in present use. Here it may be rapidly boiled down till the heat rises to about 225 deg., without risk of burning. When cold, it should have a density of about 1.38, and mark the 38th degree of Baume's hydrometer; beyond which point of inspissation it would be dangerous to go. The remaining concentration will be most safely conducted in the vacuum pan, where a scarcity of water does not, as in Barbados, militate against its use.

Mr. Fownes exposes the absurdity of using shallow coolers, exposing a large surface, and producing a rapid evaporation, for the process of crystallisation. By the use of the shallow coolers formerly, and, I believe, yet to be found on most estates, from the rapidity of the evaporation, the sugar is obtained in a mass of confused and imperfectly-formed crystals, entangling in their interstices a considerable quantity of molasses, which impairs the color of the product, and escaping slowly, and with difficulty, is, to a considerable extent, lost on the homeward voyage by drainage into the hold, occasioning much positive loss to the owner, and giving the bilge-water a most offensive odor. He therefore recommends the use of deep vessels, and avoidance of all agitation in this part of the process, so as to enable the crystallisable portion of the syrup to effect a more complete separation from the uncrystallisable portion or the molasses. By this simple method, not only sugar of a finer and whiter quality would be obtained, but a large per centage of loss both of crystallisable and uncrystallisable sugar at present caused by the leakage of the hogshead into the hold, would be prevented, not only to the great advantage of the planter, but to the great comfort of the captain, passengers, and crew of the vessel freighted with it.

It is not improbable that, by re-boiling the molasses in the vacuum-pan, and employing tannin in the manner adopted in the process for making sugar from beet-root, from one to five per cent. of crystallisable sugar could be recovered from it, and this per centage might possibly even be found to admit of increase by the further treatment with lime-water and the gun-stock tree s already suggested, for the first clarification of the liquor received from the mill. With this view, Mr. Fownes recommends the substitution of puncheons, or casks, for the molasses cisterns ordinarily employed in the curing-house, to receive the molasses as it drains from the new sugar, and thus retaining it until after the busy period of crop time has closed.

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Should sugar of a whiter quality than the ordinary muscovado of commerce be desired, this advantage may be readily obtained, as Mr. Fownes judiciously observes, by filtering the thin syrup, ready for the vacuum-pan, through a bed of fine charcoal, as is done by the sugar refiners, and afterwards washing the crystals of sugar with white syrup, when the molasses has thoroughly drained from them. By this process, which, however, is attended with some increase of expense, and may not, in consequence, be always advisable, muscovado sugar may be obtained, of a quality hardly inferior to that of refined sugar. Mr. Fownes thus sums up the principal points to which he is desirous of calling the attention of the intelligent and enterprising planter.

1. “To obtain, by the use of a properly-constructed mill, the greatest possible amount of juice from the cane.”

By this, according to Mr. Fownes, a gain of from 20 to 30 per cent., equivalent to as much marketable sugar, may be obtained without any additional expense; but as, from Mr. Fownes’ own showing, there is a residuum of 10 to 15 per cent of liquor obstinately retained by the megass, or cane trash, after the most powerful pressure to which it can be subjected; much, if not all, even of this loss might be prevented by subjecting the megass, on issuing from between the rollers, to the action of water for a brief time, passing it once more through the mill, and adding the saccharine solution so obtained, or that obtained directly from the cane on its first crushing. The water thus employed would serve for many successive portions of megass, until at length it became so richly loaded with saccharine matter as to be worth attention in the boiling-house; or, at all events, it would be serviceable for the cattle, who would fatten rapidly upon it. By this additional process a further gain of at least five per cent. might be expected, raising the total gain from improvements in this *first* stage of the process, to from 25 to 35 per cent.

2. “To clarify and filter this juice with expedition, and to evaporate it rapidly, either over the open fire or by steam heat, as far as it can be done with safety.”

By the use of steam, not only is a vast economy of fuel effected, but the temperature is maintained at a uniform and sufficient standard, and the liquor effectually guarded against the risks of carelessness or ignorance. Coal may be obtained on far cheaper terms, in exchange for produce, from the United States or from Cape Breton, than from England; and as colliers from those quarters would find it their interest to bring cargoes at their own risk, and take return cargoes of sugar, rum, or molasses, at the market price, the planter will be doubly a gainer by the system, obtaining his fuel at a reduced rate, and having his trash and megass left free as manure for the use of his cane fields.

3. “To complete the concentration in a vacuum pan, or by other means, at a moderate temperature, not hurtful to the sugar, and facilitate the natural process of crystallisation, so as to obtain sugar of a large and distinct grain.”

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4. “To drain and dry the sugar perfectly, and to save all the molasses.”

The advantages to be anticipated from these improvements, superadded to an improvement in cultivation, cannot be estimated at less, upon a moderate calculation, than from 150 to 200 per cent. of increase in the production of sugar, with hardly an appreciable increase of labor or expense; for we have, in the first place, a gain by improved culture of, at least, two hogsheads an acre in sugar, equivalent to 100 per cent.; in the next, by employing improved mills and extracting the residuum, 30 per cent.; by conducting the process of manufacture more judiciously, 10 per cent.; and by the prevention of waste during the transit to market, 10 per cent., making a total of at least 150 per cent.

The common sugar-mill consists of three cylinders, tightened either by wedges, if in a wooden frame, or by screws in a cast-iron frame. If in an iron frame, the above-mentioned noise is obviated, but the friction and loss of power is the same, which is ascertainable by subsequent investigation. The cylinders or rollers, which are moving either horizontally or vertically, are from eighteen to twenty-four inches in diameter, with bearings or shafts of one fourth of their diameter. If the bearings or shafts of the cylinders were of less substance, they could not resist the great strain to which they are subjected when in operation. The whole of the prime mover (steam-engine, water-wheel, or animals), minus the friction of intermediate machinery, is transmitted to the plains of these rollers and resisted by their bearings; hence the action is equal to a weight moving on low wheels of eighteen or twenty-four inches in diameter, on axles of from four to six inches thickness, which weight is equal to the force applied; consequently, if the strain is greater than the resistance of the rollers or the bearings, they must be wrenched off, or if greater than the force applied, the mill will be stopped. The power necessary to move weights upon wheels, on a smooth and level surface, is in proportion to the respective diameters of wheels and axles. The same pull which moves one ton at a given velocity upon a wheel of two feet, with an axle of six inches, will move four tons, if on a wheel of four feet diameter, with an axle of six inches. Consequently, cylinders of small diameter, with strong and substantial bearings, are only admissible as working machines, if no other mechanical means are applicable, as, for instance, in rolling out metals, compressing the surface of various bodies for a glossy appearance, or, generally speaking, to produce a certain and equal form of the substance which is pressed and passed between them. They compress the atoms of bodies, and for this reason alone are ill suited to separate the fibres of the sugar canes, and to express effectively the saccharine matter between them. A practical proof of this demonstration is furnished by every sugar cane which has gone through the mill. Fresh megass is at present better suited for fattening animals than for fuel under the sugar pans.

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The loss of material thus sustained, which is, on an average, equal in every mill, whether driven by steam, water, or animal power, is entirely chargeable to the construction of the mill, and amounts to about ten per cent. of the saccharine matter contained in the sugar canes.

M. Duprez, an agent of the French Government, having experimented on the canes in Guadaloupe, found the quantity of juice in every 100 lbs. crushed—

		lbs.
1	By mills having horizontal rollers; the motive power not stated	61.2
2	By mills, motive power, steam	60.9
3	By mills, motive power, wind and steam	59.3
4	By mills, having vertical rollers	59.2
5	By mills, motive power, cattle	58.5
6	By mills, motive power, wind *	56.4

[* Dr. Evans' "Treatise on Sugar," p. 75.]

The average of all these experiments being 56 per cent. only. The result of M. Avequin, on Louisiana cane, was 50 per cent. Mr. Thompson, of Jamaica, states 50 per cent. as the average throughout the island of Martinique. Dr. Evans ventures 47 per cent. as the lowest, and 61 per cent. as the highest in the West Indies. A mill in Madeira gave 47.5 and 70.2 of juice—the larger yield being obtained by bracing the horizontal rollers more than usually tight, and introducing only a few canes at a time, the motive power being cattle.

The three roller mill has the disadvantage of re-absorbing a part of the cane juice in the spongy megass, (or trash as it is termed in the West Indies), and a loss of power.

Those with five rollers have been used in Cuba, Bourbon and the Mauritius, which gave 70 per cent., but a great increase of motive power is necessary. Four roller mills, two below and two above, requiring little more motive power than three rollers, have given 70 to 75 per cent of juice.

Some years since, the East India Company instituted inquiries relative to the cultivation of the sugar cane in Hindostan, and the information obtained was published in a large folio volume. The Reports furnished by their officers, from almost every district, concur in stating that there were three kinds cultivated:—1. The purple. 2. The white. 3. A variety of the white, requiring a large supply of water. The epitome of the Reports affords this information:—

1. The purple colored cane yields a sweeter, richer juice, than the yellow or light colored, but in less quantity, and is harder to press. Grows on dry lands. Scarce any other sort in Beerbhoom, much in Radnagore, some about Santipore, mixed with light colored cane. Grows also near Calcutta; in some fields separate, in others mixed with pooree or light colored cane. When eaten raw, is more dry and pithy in the mouth, but esteemed better sugar than the pooree, and appears to be the superior sort of cane. Persons who have been West Indian planters do not know it as a West Indian cane.

2. The light colored cane, yellow, inclining to white; deeper yellow when ripe, and on rich ground, it is the same sort as that which grows in the West India Islands; softer, more juicy than the Cadjoolee, but juice less rich, and produces sugar less strong; requires seven maunds of pooree juice to make as much goor or inspissated juice as is produced from six of the Cadjoolee. Much of this kind is brought to the Calcutta markets, and eaten raw.

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3. The white variety, which grows in swampy, lands, is light colored, and grows to a great height. Its juice is more watery, and yields a weaker sugar than the Cadjoolee. However, as much of Bengal consists of low grounds, and as the upland canes are liable to suffer from drought, it may be advisable to encourage the cultivation of it, should the sugar it produces be approved, though in a less degree than other sugars, in order to guard against the effects of dry seasons. Experience alone can determine how far the idea of encouraging this sort may answer.

Besides the foregoing, several kinds are now known to the Indian planter. One of them, the China sugar cane, was considered by Dr. Roxburgh to be a distinct species, and distinguished by him as *Saccharum sinensis*. It was introduced into India in 1796, by Earl Cornwallis, as being superior to the native kinds. It is characterised by a hardness which effectually resists most of the country rude mills; but this hardness is importantly beneficial, inasmuch as that it withstands the attack of the white ants, hogs, and jackals, which destroy annually a large portion of the common cane.[18] Dr. Buchanan found that four kinds are known in Mysore. Two of these are evidently the purple and white generally known; but as this is not distinctly stated, I have retained the form in which he notices them. *Restali*, the native sugar of the Mysore, can only be planted in the last two weeks of March and two first of April. It completes its growth in twelve months, and does not survive for a second crop. Its cultivation has been superseded by the other.

Putta-putti.—This was introduced from Arcot, during the reign of Hyder Ali. It is the only one from which the natives can extract sugar; it also produces the best *Bella* or *Jaggery*. It can be planted at the same season as the other, as well as at the end of July and beginning of August. It is fourteen months in completing its growth; but the stools produce a second crop, like the ratoons of the West Indies, which ripen in twelve months.

Maracabo, *Cuttaycabo*.—These two are very small, seldom exceeding half an inch in diameter; yet in some districts of Mysore, as about Colar, the last-named is the variety usually cultivated; but this arises from its requiring less water than the larger varieties.

The best varieties are those introduced from the Islands of Otaheite and Bourbon. Hindostan is indebted for their introduction to Captain Sleeman, who brought them hither from the Mauritius in 1827. He committed them to Dr. Wallich, under whose care, at the Botanic Garden, they have flourished, and been the source from whence the benefit has been generally diffused. Their superiority over those which have been usually cultivated by the natives has been completely established. The largest of the Hindostan canes, ripe and trimmed ready for the mill, has never been found to exceed five pounds; but it is not uncommon for an Otaheite cane,[19] under similar circumstances, to weigh seven pounds. The extra weight arises proportionately from an increased secretion of superior sap. The sugar is more abundant, granulates more readily, and has less scum. Other superior qualities are, that the canes ripen earlier, and are less injured by the occurrence of protracted dry weather.

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Of the history of the sugar cane a popular tradition obtains amongst the natives, that, in very ancient times, a vessel belonging to their country chanced by accident to leave one of her crew, under a desperate fit of sickness, at a desert island, at a considerable distance in the Eastern Seas, and that, returning by the same route, curiosity prompted them to inquire after the fate of their companion, when, to their utter astonishment, the man presented himself to their view, completely recovered from his sickness, and even in a state of more than common health. With anxiety they inquired for the physic he had so successfully applied, and were conducted by him to the sugar cane, on which he acquainted them he had solely subsisted from the time of their departure. Attracted by such powerful recommendation, every care and attention was bestowed, we may suppose, to convey such an invaluable acquisition to their own lands, where the soil and climate have mutually since contributed to its present prosperity.

Soil.—The soil best suiting the sugar cane is aluminous rather than the contrary, tenacious without being heavy, readily allowing excessive moisture to drain away, yet not light. One gentleman, Mr. Ballard, has endeavoured to make this point clear by describing the most favorable soils about Gazepore as "*light clays*," called there *Mootearee*, or *doansa*, according as there is more or less sand in their composition.—-*Trans. Agri-Hort. Soc.* i. 121.

Mr. Peddington seems to think that calcareous matter, and iron in the state of *peroxide*, are essential to be present in a soil for the production of the superior sugar cane. There can be no doubt that the calcareous matter is necessary, but experience is opposed to his opinion relative to the peroxide.

The soil preferred at Radnagore is there distinguished as the soil of "two qualities," being a mixture of rich clay and sand, and which Mr. Touchet believed to be known in England as a light brick mould.

About Rungpore, Dinajpoor, and other places where the ground is low, they raise the beds where the cane is to be planted four or five feet above the level of the land adjacent.

The experience of Dr. Roxburgh agrees with the preceding statements. He says, "The soil that suits the cane best in this climate is, a rich vegetable earth, which on exposure to the air readily crumbles down into very fine mould. It is also necessary for it to be of such a level as allows of its being watered from the river by simply damming it up (which almost the whole of the land adjoining to this river, the Godavery, admits of), and yet so high as to be easily drained during heavy rains. Such a soil, and in such a situation, having been well meliorated by various crops of leguminous plants, or fallowing, for two or three years, is slightly manured, or has had for some time cattle pent upon it. A favourite manure for the cane with the Hindoo farmer is the rotten straw of green and black pessaloo (*Phaseolus Mungo max*)."[20] Many accordant opinions might be added to the preceding, but it seems only necessary to observe further, that "the sugar cane requires a soil sufficiently elevated to be entirely free from inundation, but not so high as to be deprived of moisture, or as to encourage the production of white ants (*termes*)."

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The sugar cane is an exhausting crop, and it is seldom cultivated by the ryot more frequently than once in three or four years on the same land. During the intermediate period, such plants are grown as are found to improve the soil, of which, says Dr. Tennant, the Indian farmer is a perfect judge. They find the leguminous tribe the best for the purpose. Such long intervals of repose from the cane would not be requisite if a better system of manuring were adopted.

Mr. J. Prinsep has recorded the following analysis of three soils distinguished for producing sugar. They were all a soft, fine-grained alluvium, without pebbles. No. 1 was from a village called Mothe, on the Sarjee, about ten miles north of the Ganges, at Buxar, and the others from the south bank of the Ganges, near the same place. There is a substratum of *kunkar* throughout the whole of that part of the country, and to some mixture of this earth with the surface soil the fertility of the latter is ascribed:—

	1	2	3
Hygrometric moisture, on drying at 212 deg.	2.5	2.1	3.6
Carbonaceous and vegetable matter, on calcination	1.8	2.1	4.0
Carbonate of lime (No. 3 effervesced)	1.6	0.6	3.9
Alkaline salt, soluble	1.0	1.1	0.3
Silex and alumina	94.1	94.1	88.2
	-----	-----	-----
	100.0	100.0	100.0

The earths unfortunately were not separated. Mr. Prinsep says the two first were chiefly of sand, and the third somewhat argillaceous. The former required irrigation, but the other was sufficiently retentive of moisture to render it unnecessary.—(Journ. Asiatic Soc., ii. 435.)

Manures.—The sugar cane being one of the most valued crops of the ryot, he always devotes to it a portion of the fertilising matters he has at command, though in every instance this is too small.

In the Rajahmundry district, previously to planting, the soil is slightly manured, either by having cattle folded upon it, or by a light covering of the rotten straw of the green and black pessalloo, which is here a favourite fertiliser. In some parts of Mysore the mud from the bottom of tanks is employed, and this practice is more generally adopted in other places. Thus the fields being divided by deep ditches in Dinajpoor, the mud from which is enriched by the remains of decayed aquatic plants and animals, forms an excellent manure for the sugar cane, and of this the ryots make use, spreading it over the surface before the ploughing is commenced; and when that operation is completed, the soil is further fertilised by a dressing of oil-cake and ashes.

Crushed bones would unquestionably be of the greatest benefit if applied to the sugar cane crop. Not only would their animal matter serve as food for the plants, but the phosphate of lime of the bones is one of the chief saline constituents of the sugar cane.

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Salt is another valuable manure for this crop. Dr. Nugent, in a Report made to the Agricultural Society of Antigua, observes that salt has been found a valuable auxiliary in cultivating the sugar cane. Many trials of it, he says, have been made during successive seasons, applied generally to the extent of about nine or ten bushels per acre. It destroys grubs and other insects, and gives the canes an increased vigor and ability to resist drought. It is a singular remark of the intelligent traveller, M. de Humboldt, while speaking of the practice adopted in the Missions of the Orinoco, when a coco-nut plantation is made, of throwing a certain quantity of salt into the hole which receives the nut; that of all the plants cultivated by man there are only the sugar cane, the plantain, the mammee, and the Avocado pear, which endure equally irrigation with fresh and salt water.

In the West Indies, when the cane is affected by what is called there the *blast*, which is a withering or drying up of the plants, an unfailing remedy is found to be watering them with an infusion of dung in salt water.[21] *Preparation of soil*.—In the Rajahmundry district, during the months of April and May, the ground is frequently ploughed, until brought into a very fine tilth. About the end of May, or beginning of June, the rains usually commence, and the canes are then to be planted. If the rains do not set in so early, the land is flooded artificially, and when converted into a soft mud, whether by the rain or by flooding, the canes are planted.

In Mysore the ground is watered for three days, and then, after drying for the same period, ploughing commences, this operation being repeated five times during the following eight days. The clods during this time are broken small by an instrument called *colkudali*. The field is then manured and ploughed a sixth time. After fifteen days it is ploughed again, twice in the course of one or two days. After a lapse of eight days it is ploughed a ninth time. Altogether these operations occupy about forty-four days.

For planting, which is done six days, an implement called *yella kudali* is employed.

In Dinajpoor, “the field, from about the middle of October until about the 10th of January, receives ten or twelve double ploughings, and after each is smoothed with the *moyi*. During the last three months of this time it is manured with cow-dung and mud from ponds and ditches. On this account, the land fit for sugar cane is generally divided into fields by wide ditches, into which much mud is washed by the rain, and is again thrown on the fields when the country dries, and leaves it enriched by innumerable aquatic vegetables and animals that have died as the water left them. When the ploughing has been completed, the field is manured with ashes and oil-cake.”

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About Malda, “the land is first ploughed in the month of Cartick, length and breadth ways, and harrowed in like manner; four or five days after it is again ploughed and harrowed, as before, twice. In the month of Aghun, the whole land is covered with fresh earth, again twice ploughed, and harrowed in different directions, and then manured with dung. Fifteen or twenty days afterwards it is to be twice ploughed, as before; eight or ten days after which, it is to be slightly manured with dung, and the refuse of oil, mixed together; then twice ploughed and harrowed in different directions, so that the clods of earth brought be well mixed together with the land. This preparation continues until the 20th or 25th of the month Pows.”

In the vicinity of Dacca, during “Cautic or Augun (October, November) the Ryots begin to prepare their ground. They first dig a trench round their fields, and raise a mound of about three feet in height. If the ground to be cultivated is waste, about nine inches of the surface are taken off, and thrown without the enclosure. The ground is ploughed to the depth of nine inches more. The clods are broken, and the earth made fine. In Maug or Faugun (January, February) the sugar cane is planted; a month afterwards earth is raised about the plants; after another month this is repeated. The crop is cut in Poous and Maug (December, January). If the ground be not waste, but cultivated, the surface is not taken off. After cutting the crop, it is not usual again to grow sugar cane on the same ground for eighteen months, on account of the indifferent produce afforded by a more early planting.

In the Zillah, North Mooradabad, the land is broken up at the end of June. After the rains have ceased it is manured, and has eight or ten ploughings. This clears it of weeds. In February it is again manured and ploughed four or five times, and just before the sets are planted, some dung, four cart-loads to each cutcha beegah of low land, and five cart-loads to high land, are added. The land is well rolled after the four last ploughings, and again after the cuttings are set.

About Benares and the neighbouring districts, Mr. Haines says, that owing to the hot winds which prevail “from March until the setting in of the annual rains in June or July, the lands remain fallow till that period. In the mean time, those fields that are selected for sugar cane are partially manured by throwing upon them all manner of rubbish they can collect, and by herding their buffaloes and cattle upon them at night, though most of the manure from the latter source is again collected and dried for fuel.

When the annual rains have fairly set in, and the Assarree crops sown (in some instances I have seen an Assarree crop taken from the lands intended for sugar cane), they commence ploughing the cane lands, and continue to do so four or five times monthly (as they consider the greater number of times the fields are turned up at this period of the season, the better the crop of cane will be), till the end of October, continuing to throw on the little manure they can collect.

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Towards the end of October, and in November, their ploughs are much engaged in sowing their winter (or rubbee) crops of wheat, barley, grain, &c.; and at this period they make arrangements with the shepherds who have large flocks of sheep, to fold them upon the fields at night, for which they pay so much per beegah in grain.

During the latter part of November, and early in December, the fields are again ploughed well, and all grass, weeds, &c., removed with the hoe; then the surface of the field is made as smooth as possible by putting the hengah (a piece of wood eight to ten feet in length, and five to six inches in breadth, and three or four inches in thickness, drawn by two pairs of bullocks, and the man standing upon the wood to give it weight), over several times for three or four days in succession. This makes the surface of the field very even and somewhat hard, which prevents the sun and dry west wind from abstracting the moisture, which is of great importance at this period of the season, for, should there be no rain, there would not be sufficient moisture at the time of planting the cane to cause vegetation.

In this state the land remains till the time of planting the cane cuttings, which is generally the 1st to the 15th of February; but should there have been a fall of rain in the mean time, or excess of moisture appear, the field is again ploughed, and the hengah put over as before.

A day or two previous to planting the cane, the field is ploughed and the hengah lightly put over."—(Trans. Agri-Hort. Soc. vi. 4, 5.)

Sets.—When the canes are cut at harvest time, twelve or eighteen inches of their tops are usually taken off, and stored, to be employed for sets. Each top has several joints, from each of which a shoot rises, but seldom more than one or two arrive at a proper growth.

When first cut from the stem, the tops intended for plants are tied in bundles of forty or fifty each, and are carefully kept moist. In a few days they put forth new leaves: they are then cleared of the old leaves, and separately dipped into a mixture of cow-dung, pressed mustard seed, and water. A dry spot is prepared, and rich loose mould and a small quantity of pressed mustard-seed; the plants are separately placed therein, a small quantity of earth strewed amongst them, and then covered with leaves and grass to preserve them from heat. Ten or twelve days afterwards they are planted in the fields.

In Burdwan, the tops, before they are planted, are cut into pieces from four to six inches long, so that there are not more than four knots in each. Two or three of these plant tops are put together in the ground, and a beegah requires from 7,500 to 10,240 plants.

In Rungpore and Dinajpoor, about 9,000 plants are required for a beegah, each being about a foot in length.

In Beerbhoom, 3,000 plants are said to be requisite for a beegah, each cane top being about fifteen inches long.

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Near Calcutta, from 3,000 to 8,000 plants are required for a beegah, according to the goodness of the soil, the worst soil needing most plants. In Mysore an acre contains 2,420 stools, and yields about 11,000 ripe canes.

Near Rajahmundry, about 400 cuttings are planted on a cutcha beegah (one-eighth of an acre). In Zilla, North Mooradabad, 4,200 sets, each eight inches long, are inserted upon each cutcha beegah of low land, and 5,250 upon high land.

In the district of Gollagore the Ryots cut a ripe cane into several pieces, preserving two or three joints to each, and put them into a small bed of rich mould, dung, and mustard-seed from which the oil has been expressed. At Radnagore, when the time of cutting the canes arrives, their tops are taken off, and these are placed upright in a bed of mud for thirty or forty days, and covered with leaves or straw. The leaves are then stripped from them, and they are cut into pieces, not having less than two nor more than four joints each. These sets are kept for ten or fifteen days in a bed prepared for them, from whence they are taken and planted in rows two or three together, eighteen inches or two feet intervening between each stool.

Planting.—The time and mode of planting vary. In the Rajahmundry Circar, Dr. Roxburgh says, that "during the months of April and May the land is repeatedly ploughed with the common Hindoo plough, which soon brings the loose rich soil (speaking of the Delta of the Godavery) into very excellent order. About the end of May and beginning of June, the rains generally set in, in frequent heavy showers. Now is the time to plant the cane; but should the rains hold back, the prepared field is watered or flooded from the river, and, while perfectly wet, like soft mud, the cane is planted.

"The method is most simple. Laborers with baskets of the cuttings, of one or two joints each, arrange themselves along one side of the field. They walk side by side, in as straight a line as their eye and judgment enable them, dropping the sets at the distance of about eighteen inches asunder in rows, and about four feet from row to row. Other laborers follow, and with the foot press the set about two inches into the soft, mud-like soil, which, with a sweep or two with the sole of the foot, they most easily and readily cover."—(Roxburgh on the Culture of Sugar.)

About Malda, in the month of Maug (January, February), the land is to be twice ploughed, and harrowed repeatedly, length and breadth ways; after which it is furrowed, the furrows half a cubit apart, in which the plants are to be set at about four fingers' distance from each other, when the furrows are filled up with the land that lay upon its ridges. The plants being thus set, the land is harrowed twice in different directions; fifteen or twenty days afterwards the cane begins to grow, when the weeds which appear with it must be taken up; ten or twelve days after this the weeds will again appear. They must again be taken up, and the earth at the roots of the canes be removed, when all the plants which have grown will appear.

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At Ghazepore the rains set in at the beginning of March, and planting then commences. Near Calcutta the planting takes place in May and June. In Dinajpoor and Rungpore the planting time is February.

About Commercolly it is performed in January. The field is divided into beds six cubits broad, separated from each other by small trenches fourteen inches wide and eight inches deep. In every second trench are small wells, about two feet deep. The irrigating water flowing along the trenches fills the wells, and is taken thence and applied to the canes by hand.

Each bed has five rows of canes. The sets are planted in holes about six inches in diameter, and three deep; two sets, each having three joints, are laid horizontally in every hole, covered slightly with earth, and over this is a little dung.

When, the canes are planted in the spring, the trenches must be filled with water, and some poured into every hole. At the other season of planting the trenches are full, it being rainy weather; but even then the sets must be watered for the first month.

Mr. Haines says that in Mirzapore and the neighbouring districts, “in planting the cane they commence a furrow round the field, in which they drop the cuttings. The second furrow is left empty; cuttings again in the third; so they continue dropping cuttings in every second furrow till the whole field is completed, finishing in the centre of the field. The field remains in this state till the second or third day, when for two or three days in succession it is made even and hard upon the surface with the hengah, as before stated.”—(Trans. Agri-Hort. Soc. vi. 5.)

Mr. Vaupell, in describing the most successful mode of cultivating the Mauritius sugar cane in Bombay, says, that “after the ground is levelled with the small plough, called ‘paur,’ in the manner of the cultivators, pits of two feet in diameter, and two feet in depth, should be dug throughout the field at the distance of five feet apart, and filled with manure and soil to about three inches of the surface. Set in these pits your canes, cut in pieces about a foot and a half long, laying them down in a triangular from, thus /\. Keep as much of the eyes or shoots of the cane uppermost as you can; then cover them with manure and soil; beds should next be formed to retain water, having four pits in each bed, leaving passages for watering them. The cutting should be watered every third day during hot weather, and the field should always be kept in a moist state.”—-(Ibid. iii. 43.)

About Benares, the sets require, after planting, from four to six waterings, until the rains commence, and as many hoeings to loosen the surface, which becomes caked after every watering. The moister nature of the soil renders these operations generally unnecessary in Bengal.

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After-culture.—In Mysore, the surface of the earth in the hollows in which the sets are planted is stirred with a stick as soon as the shoots appear, and a little dung is added. Next month the daily watering is continued, and then the whole field dug over with the hoe, a cavity being made round each stool, and a little dung added. In the third month water is given every second day: at its close, if the canes are luxuriant, the ground is again dug; but if weakly, the watering is continued during the fourth month, before the digging is given. At this time the earth is drawn up about the canes, so as to leave the hollows between the rows at right angles with the trenches. No more water is given to the plants, but the trenches between the beds are kept full for three days. It is then left off for a week, and if rain occurs, no further water is requisite; but if the weather is dry, water is admitted once a week during the next month. The digging is then repeated, and the earth levelled with the hand about the stools.

The stems of each stool are ten or twelve in number, which are reduced to five or six by the most weakly of them being now removed. The healthy canes are to be tied with one of their own leaves, two or three together, to check their spreading; and this binding is repeated as required by their increased growth.

In the absence of rain, the trenches are filled with water once a fortnight.

When the *Putta-putti* is to be kept for a second crop, the dry leaves cut off in the crop season are burnt upon the field, and this is dug over, and trenches filled with water, and during six weeks the plants watered once in every six or eight days (unless rain falls), and the digging repeated three times, dung being added at each digging. The after-culture is the same as for the first crop.

In the Upper Provinces, Dr. Tennant says, if moderate showers occur after planting, nothing more is done until the shoots from the sets have attained a height of two or three inches. The soil immediately around them is then loosened with a small weeding iron, something like a chisel; but if the season should prove dry, the field is occasionally watered; the weeding is also continued, and the soil occasionally loosened about the plants.

In August, small trenches are cut through the field, with small intervals between them, for the purpose of draining off the water, if the season is too wet. This is very requisite, for if the canes are now supplied with too much moisture, the juice is rendered watery and unprofitable. If the season happens to be dry, the same dikes serve to conduct the irrigating water through the field, and to carry off what does not soak into the earth in a few hours. Stagnant water they consider very injurious to the cane, and on the drains being well contrived depends in a great measure the future hope of profit. Immediately after the field is trenched, the canes are propped. They are now about three feet high, and each set has produced from three to six canes. The lower leaves of each are first carefully wrapt up around it, so as to cover it completely in every part; a small strong bamboo, eight or ten feet long, is then inserted firmly in the middle of each stool, and the canes tied to it. This secures them in an erect position, and facilitates the circulation of the air.

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Hoeing cannot be repeated too frequently. This is demonstrated by the practice of the most successful cultivators. In Zilla, N. Mooradabad, in April, about six weeks after planting, the earth on each side of the cane-rows is loosened by a sharp-pointed hoe, shaped somewhat like a bricklayer's trowel. This is repeated six times before the field is laid out in beds and channels for irrigation. There, likewise, if the season is unusually dry, the fields in the low ground are watered in May and June. This supposes there are either nullahs, or ancient pucka wells, otherwise the canes are allowed to take their chance, for the cost of making a well on the uplands is from ten to twenty rupees—an expense too heavy for an individual cultivator, and not many would dig in partnership, for they would fight for the water.

In the vicinity of Benares, as the canes advance in growth, they continue to wrap the leaves as they begin to wither up round the advancing stem, and to tie this to the bamboo higher up. If the weather continue wet, the trenches are carefully kept open; and, on the other hand, if dry weather occurs, water is occasionally supplied. Hoeing is also performed every five or six weeks. Wrapping the leaves around the cane is found to prevent them cracking by the heat of the sun, and hinders their throwing out lateral branches.

In January and February the canes are ready for cutting. The average height of the cane is about nine feet, foliage included, and the naked cane from one inch to one inch and a quarter in diameter.

Near Maduna, the hand-watering is facilitated by cutting a small trench down the centre of each bed. The beds are there a cubit wide, but only four rows of canes are planted in each.

It is deserving of notice, that the eastern and north-eastern parts of Bengal are more subject to rain at every season of the year, but especially in the hot months, than the western; which accounts for the land being prepared and the plants set so much earlier in Rungpore than in Beerbhoom. This latter country has also a dryer soil generally; for this reason, so much is said in the report from thence of the necessity of watering.

The Benares country is also dryer than Bengal, therefore more waterings are requisite.

At Malda, ten or fifteen days after the earth has been removed from the roots of the canes and the plants have appeared, the land is to be slightly manured, well cleared of weeds, and the earth that was removed again laid about the canes; after which, ten or fifteen days, it must be well weeded, and again twenty or twenty-five days afterwards. This mode of cultivation it is necessary to follow until the month of Joystee. The land must be ploughed and manured between the rows of canes in the month of Assaar; after which, fifteen or twenty days, the canes are to be tied two or three together with the leaves, the earth about them well cleaned, and the earth that was ploughed up laid about the roots of the canes something raised. In the month of Saubun, twenty or twenty-five days from the preceding operation, the canes are tied as before, and again ten or fifteen days afterwards; which done, nine or ten clumps are then to be tied together.

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In the Rojahmundry Circar, on the Delta of the Godavery, Dr. Roxburgh states, “that nothing more is done after the cane is planted, if the weather be moderately showery, till the young shoots are some two or three inches high; the earth is then loosened for a few inches round them with the weeding iron. Should the season prove dry, the field is occasionally watered from the river, continuing to weed and to keep the ground loose round the stools. In August, two or three months from the time of planting, small trenches are cut through the field at short distances, and so contrived as to serve to drain off the water, should the season prove too wet for the canes, which is often the case, and would render their juices weak and unprofitable. The farmer, therefore, never fails to have his field plentifully and judiciously intersected with drains while the cane is small, and before the usual time for the violent rains. Immediately after the field is trenched, the canes are all propped; this is an operation which seems peculiar to these parts.

In Dinajpoor, in about a month after planting, “the young plants are two or three inches high; the earth is then raised from the cuttings by means of a spade, and the dry leaves by which they are surrounded are removed. For a day or two they remain exposed to the air, and are then manured with ashes and oil-cake, and covered with earth. Weeds must be removed as they spring; and when the plants are about a cubit high, the field must be ploughed. When they have grown a cubit higher, which is between the 13th of June and 14th of July, they are tied together in bundles of three or four, by wrapping them round with their own leaves. This is done partly to prevent them from being laid down by the wind, and partly to prevent them from being eaten by jackals. During the next month three or four of these bunches are tied together; and about the end of September, when the canes grow rank, they are supported by bamboo stakes driven in the ground. They are cut between the middle of December and the end of March.”

If the canes grow too vigorously, developing a superabundance of leaves, it is a good practice to remove those leaves which are decayed, that the stems may be exposed fully to the sun. In the West Indies, this is called *trashing* the canes. It requires discretion; for in dry soils or seasons, or if the leaves are removed before sufficiently dead, more injury than benefit will be occasioned.

Harvesting.—The season in which the canes become ripe in various districts has already been noticed when considering their cultivation. In addition I may state, that in the Rajahmundry Circar, about the mouth of the Godavery, Dr. Roxburgh adds, “that in January and February the canes begin to be ready to cut, which is about nine months from the time of planting. This operation is the same as in other sugar countries—of course I need not describe it. Their height, when standing on the field, will be from eight to ten feet (foliage included), and the naked cane from an inch to an inch and a quarter in diameter.”

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In Malda, the canes are cut in January and February. In N. Mooradabad, upon the low land, the canes are ripe in October, and upon the high lands a month later. The fitness of the cane for cutting may be ascertained by making an incision across the cane, and observing the internal grain. If it is soft and moist, like a turnip, it is not yet ripe; but if the face of the cut is dry, and white particles appear, it is fit for harvesting.—-(*Fitzmaurice on the Culture of the Sugar Cane*.)

Injuries.—1. *A wet season*, either during the very early or in the concluding period of the cane's vegetation, is one of the worst causes of injury. In such a season, the absence of the usual intensity of light and heat causes the sap to be very materially deficient in saccharine matter. But, on the other hand,

2. *A very dry season*, immediately after the sets are planted, though the want of rain may in some degree be supplied by artificial means, causes the produce to be but indifferent. These inconveniences are of a general nature, and irremediable.

3. *Animals*.—In India not only the incursions of domesticated animals, but in some districts of the wild elephant, buffalo, and hog, are frequent sources of injury. Almost every plantation is liable, also, to the attack of the jackal, and rats are destructive enemies.

4. *White Ants*.—The sets of the sugar cane have to be carefully watched, to preserve them from the white ant (*Termes fatalis*), to attacks from which they are liable until they have begun to shoot. To prevent this injury, the following mixture has been recommended:—

Asafoetida (hing), 8 chittacks.
Mustard-seed cake (sarsum ki khalli), 8 seers.
Putrid fish, 4 seers.
Bruised butch root, 2 seers;
or muddur, 2 seers.

Mix the above together in a large vessel, with water sufficient to make them into the thickness of curds; then steep each slip of cane in it for half an hour after planting; and, lastly, water the lines three times previous to setting the cane, by irrigating the water-course with water mixed up with bruised butch root, or muddur if the former be not procurable.[22] A very effectual mode of destroying the white ant, is by mixing a small quantity of arsenic with a few ounces of burned bread, pulverised flour, or oatmeal, moistened with molasses, and placing pieces of the dough thus made, each about the size of a turkey's egg, on a flat board, and covered over with a wooden bowl, in several parts of the plantation. The ants soon take possession of these, and the poison has a continuous effect, for the ants which die are eaten by those which succeed them.[23] They are said to be driven from a soil by frequently hoeing it. They are found to prevail most upon newly broken-up lands.

In Central India, the penetration of the white ants into the interior of the sets, and the consequent destruction of the latter, is prevented by dipping each end into buttermilk, asafoetida, and powdered mustard-seed, mixed into a thick compound.

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5. *Storms*.—Unless they are very violent, Dr. Roxburgh observes, “they do no great harm, because the canes are propped. However, if they are once laid down, which sometimes happens, they become branchy and thin, yielding a poor, watery juice.”

6. *The Worm* “is another evil, which generally visits them every few years. A beetle deposits its eggs in the young canes; the caterpillars of these remain in the cane, living on its medullary parts, till they are ready to be metamorphosed into the chrysalis state. Sometimes this evil is so great as to injure a sixth or an eighth part of the field; but, what is worse, the disease is commonly general when it happens—few fields escaping.”

7. *The Flowering* “is the last accident they reckon upon, although it scarce deserves the name, for it rarely happens, and never but to a very small proportion of some few fields. Those canes that flower have very little juice left, and it is by no means so sweet as that of the rest.”

In the Brazils, the fact of the slave trade being at an end must influence the future produce of sugar, and attention has been lately chiefly directed to coffee, cotton, and other staples. The exports of that empire in 1842, were 59,000 tons; in 1843, 54,500; in 1844, 76,400; in 1845, 91,000; average of these four years 69,720. The exports in the next four years averaged 96,150 tons, viz:—76,100, in 1846; 96,300, in 1847; 112,500, in 1848; and 99,700, in 1849.

Mode of Cultivation in Brazil.—The lands in Brazil are never grubbed up, either for planting the sugar cane, or for any other agricultural purposes. The inconveniences of this custom are perceivable more particularly in high lands; because all of these that are of any value are naturally covered with thick woods. The cane is planted amongst the numerous stumps of trees, by which means much ground is lost, and as the sprouts from these stumps almost immediately spring forth (such is the rapidity of vegetation) the cleanings are rendered very laborious. These shoots require to be cut down sometimes, even before the cane has found its way to the surface of the ground. The labor likewise is great every time a piece of land is to be put under cultivation, for the wood must be cut down afresh; and although it cannot have reached the same size which the original timber had attained, still as several years are allowed to pass between each period at which the ground is planted, the trees are generally of considerable thickness. The wood is suffered to remain upon the land until the leaves become dry; then it is set on fire, and these are destroyed with the brush wood and the smaller branches of the trees. Heaps are now made of the remaining timber, which is likewise burnt. This process is universally practised in preparing land for the cultivation of any plant. I have often heard the method much censured as being injurious in the main to the soil, though the crop immediately succeeding

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the operation may be rendered more luxuriant by it. I have observed that the canes which grew upon the spots where the heaps of timber and large branches of trees had been burnt, were of a darker and richer green than those around them, and that they likewise over-topped them. After the plant-canes, or those of the first year's growth, are taken from the lands, the field-trash, that is the dried leaves and stems of the canes which remain upon the ground, are set fire to, with the idea that the ratoons,—that is, the sprouts from the old roots of the canes,—spring forth with more luxuriance, and attain a greater size by means of this practice. The ratoons of the first year are called in Brazil, *socas*; those of the second year, *resocas*; those of the third year, *terceiras socas*, and so forth. After the roots are left unencumbered by burning the field-trash, the mould is raised round about them; indeed, if this was neglected, many of those roots would remain too much exposed to the heat of the sun, and would not continue to vegetate.

Some lands will continue to give ratoons for five, or even seven years; but an average may be made at one crop of good ratoons fit for grinding, another of inferior ratoons fit for planting, or for making molasses to be used in the still-house, and a third which affords but a trifling profit, in return for the trouble which the cleanings give.

I have above spoken more particularly of high lands. The low and marshy grounds, called in Brazil, *varzeas*, are, however, those which are the best adapted to the cane; and, indeed, upon the plantations that do not possess some portions of this description of soil the crops are very unequal, and sometimes almost entirely fail, according to the greater or less quantity of rain, which may chance to fall in the course of the year. The *varzeas* are usually covered with short and close brushwood, and as these admit, from their rank nature, of frequent cultivation, they soon become easy to work. The soil of these, when it is new, receives the name of *paul*; it trembles under the pressure of the feet, and easily admits of a pointed stick being thrust into it; and though dry to appearance requires draining. The *macape* marl is often to be met with in all situations; it is of a greenish white color, and if at all wet, it sticks very much to the hoe; it becomes soon dry at the surface, but the canes which have been planted upon it seldom fail to revive after rain, even though a want of it should have been much felt. The white marl, *barro branco*, is less frequently found; it is accounted extremely productive. This clay is used in making bricks and coarse earthenware, and also for claying the sugar. Red earth is occasionally met with upon sides of hills near to the coast; but this description of soil belongs properly to the cotton districts. Black mould is common, and likewise a loose brownish soil, in which a less

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or greater proportion of sand is intermixed. It is, I believe, generally acknowledged that no land can be too rich for the growth of the sugar cane. One disadvantage, however, attends soil that is low and quite new, which is, that the canes run up to a great height without sufficient thickness, and are thus often lodged (or blown down) before the season for cutting them arrives. I have seen rice planted upon lands of this kind on the first year to decrease their rankness, and render them better adapted to the cane on the succeeding season. Some attempts have been made to plant cane upon the lands which reach down to the edge of the mangroves, and in a few instances pieces of land heretofore covered by the salt water at the flow of the tide, have been laid dry by means of draining for the same purpose; but the desired success has not attended the plan, for the canes have been found to be unfit for making sugar; the syrup does not coagulate, or at least does not attain that consistence which is requisite, and therefore it can only be used for the distilleries.

The general mode of preparing the land for the cane is by holing it with hoes. The negroes stand in a row, and each man strikes his hoe into the ground immediately before him, and forms a trench of five or six inches in depth; he then falls back, the whole row doing the same, and they continue this operation from one side of the cleared land to the other, or from the top of a hill to the bottom. The earth which is thrown out of the trench remains on the lower side of it. In the British West India colonies this work is done in a manner nearly similar, but more systematically. The lands in Brazil are not measured, and everything is done by the eye. The quantity of cane which a piece will require for planting is estimated by so many cart-loads; and nothing can be more vague than this mode of computation, for the load which a cart can carry depends upon the condition of the oxen, upon the nature of the road, and upon the length of the cane. Such is the awkward make of these vehicles, that much nicety is necessary in packing them, and if two canes will about fit into a cart lengthways, much more will be conveyed than if the canes are longer and they double over each other.

The plough is sometimes used in low lands, upon which draining has not been found necessary; but such is the clumsy construction of the machine of which they make use, that six oxen are yoked to it. A plough drawn by two oxen, constructed after a model which was brought from Cayenne, has been introduced in one or two instances. Upon high lands the stumps of the trees almost preclude the possibility of thus relieving the laborers. The trenches being prepared, the cuttings are laid longitudinally in the bottom of them, and are covered with the greatest part of the mould which had been taken out of the trench. The shoots begin to rise above the surface of the ground in the course of twelve or fourteen days.

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The canes undergo three cleanings from the weeds and the sprouts proceeding from the stumps of the trees; and when the land is poor, and produces a greater quantity of the former, and contains fewer of the latter, the canes require to be cleaned a fourth time. The cuttings are usually 12 to 18 inches in length, but it is judged that the shorter they are the better. If they are short, and one piece of cane rots, the space which remains vacant is not so large as when the cuttings are long, and they by any accident fail. The canes which are used for planting are generally ratoons, if any exist upon the plantation; but if there are none of these, the inferior plant canes supply their places. It is accounted more economical to make use of the ratoons for this purpose; and many persons say that they are less liable to rot than the plant canes. In the British sugar islands the cuttings for planting are commonly the tops of the canes which have been ground for sugar. But in Brazil the tops of the canes are all thrown to the cattle, for there is usually a want of grass during the season that the mills are at work. In the British colonies, the canes are at first covered with only a small portion of mould, and yet they are as long in forcing their way to the surface as in Brazil, though in the latter a more considerable quantity of earth is laid upon them. I suppose that the superior richness of the Brazilian soil accounts for this. Upon rich soils the cuttings are laid at a greater distance, and the trenches are dug farther from each other, than upon those which have undergone more frequent cultivation, or which are known to possess less power from their natural composition. The canes which are planted upon the former throw out great numbers of sprouts, which spread each way; and, although when they are young, the land may appear to promise but a scanty crop, they soon close, and no opening is to be seen. It is often judged proper to thin the canes, by removing some of the suckers at the time that the last cleaning is given; and some persons recommend that a portion of the dry leaves should also be stripped off at the same period, but on other plantations this is not practised.

The proper season for planting is from the middle of July to the middle of September, upon high lands, and from September to the middle of November in low lands. Occasionally, the great moisture of the soil induces the planter to continue his work until the beginning of December, if his people are sufficiently numerous to answer all the necessary purposes. The first of the canes are ready to be cut for the mill in September of the following year, and the crop is finished usually in January or February. In the British sugar islands the canes are planted from August to November, and are ripe for the mill in the beginning of the second year. Thus this plant in Brazil requires from thirteen to fifteen months to attain its proper state for the mill; and in the West India islands it remains standing sixteen or seventeen months.

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The Otaheitan, or the Bourbon cane, has been brought from Cayenne to Pernambuco since the Portuguese obtained possession of that settlement. I believe the two species of cane are much alike, and I have not been able to discover which of them it is. Its advantages are so apparent, that after one trial on each estate, it has superseded the small cane which was in general use. The Cayenne cane, as it is called in Pernambuco, is of a much larger size than the common cane; it branches so very greatly, that the labor in planting a piece of cane is much decreased, and the returns from it are at the same time much more considerable. It is not planted in trenches, but holes are dug at equal distances from each other, in which these cuttings are laid. This cane bears the dry weather better than the small cane; and when the leaves of the latter begin to turn brown, those of the former still preserve their natural color. A planter in the *Varzea* told me that he had obtained four crops from one piece of land in three years, and that the soil in question had been considered by him as nearly worn out, before he planted the Cayenne cane upon it.—("Koster's Travels in Brazil," vol. 2.)

Mr. E. Morewood, of Compensation, Natal, who has paid much attention to sugar culture in that colony, has favored me with the following details, which will be useful for the guidance of others, as being the results of his own experience:—

&nb
sp; lbs.
Produce of one acre of sugar cane 72,240
Juice expressed, (or 64 per cent.) 46,308
Dry sugar 7,356
Green syrup or molasses 2,829
This syrup carrying with it a good deal of sugar out of the
coolers, contains fully 75 per cent. of crystalizable sugar, or 2,121
Thus the total amount of sugar per acre is 9,477

The average density of the cane juice was 12 degrees Beaume, or 21 per cent. All the improved cane mills are now constructed to give at least 75 per cent. of juice. With such a mill, an acre would yield 11,075 lbs. of sugar. With proper cultivation I have no doubt the produce could be largely increased; for, as the numerous visitors who have seen this place can testify, my cane fields were not attended to.

To enable me to show the cost of producing a crop of canes, you must allow me to go into the expense of cultivating the land first.

To keep one ploughman going, a person requires—

20 Oxen at L3 L60 0 0
1 Plough 7 10 0
1 set Harrows 7 10 0
Yokes, Trektows, Reins, &c. 5 0 0

L80 0 0

Then the expenses per month will be:—

Ploughman's wages L2 10 0
Board 1 10 0
1 Driver, 10s., Leaders, 5s. 0 15 0
Food for two natives 0 10 0
Wear and tear of oxen and gear,
at 25 per cent. per annum 1 10 4

L6 18 4

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These two spans of oxen will comfortably plough and harrow twenty acres per month, and the cost will thus be about 7s. per acre.

Now, let us suppose that a person wishes to put in twenty acres of canes, the expense would be about as follows:—

4 Ploughings and harrowings, 80 acres at 7s. L28 0 0
Drawing canefurrows, 4 acres per day, 5 days at 6s. 1 10 0
2,000 Cane tops per acre, at 50s. 100 0 0
4 Horsehoeings, at 2s. 6d. 10 0 0
4 Handweedings in the rows, at 2s. 6d. 10 0 0
Cutting and carrying out canes, at 30s. 30 0 0
Carriage to Mill, thirty tons per acre, at 2s. 60 0 0

L239 10 0

or L12 per acre. To this must be added the rent of land, say 10s. per acre, with right of grazing cattle, for two years, when the first crop will come in, would bring the expense to L13 per acre. The cane yielding say only three tons of sugar per acre, of which the planter would, most likely, have to give the manufacturer one-third, he will receive forty tons of sugar, costing him L6 10s. per ton, and worth on the spot, according to advices received from England and the Cape, L15 per ton, at the lowest estimate, or L600.The greatest expense, you will perceive, is the article of tops for planting; but this ought not to discourage persons. The plants which I imported from the Mauritius some years ago, cost me, on account of many of them not vegetating, at the rate of L30 per acre. Parties who begin planting now have the great advantage that they can get plants, every one of which, if properly treated, will grow, at one-sixth of that price.How many crops cane will give on good soil in Natal, I am of course unable to state, as the oldest cane I have got has been cut only three times—the last yield (second ratoons) was much finer than the preceding ones, and by adopting the improved manner of cane cultivation, *viz*., returning all but the cane juice to the soil, I am confident that replanting will be found quite unnecessary; the expenses for the second and following years will therefore be very trifling.

Comparative Statement of the ruling Prices at Natal and the Mauritius of Land, Live Stock, Implements, Labor, and other requirements connected with the cultivation of the Sugar Cane.

MAURITIUS NATAL
L s. d. | L s. d.
|
LAND, per acre, L3 10s. to 20 0 0 | LAND, per acre, 10s.
| to 1 0 0

RENT OF LAND. It is not | RENT OF LAND, 6d. to 0 5 0
customary to let land at |
the Mauritius, except on |

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the system of an equal |
division of the produce. |
MANURE. Guano, commonly | CATTLE MANURE in
used in its dry state, | abundance, according to
also other manures or | distance, per load,
composts, per ton, L6 to 7 0 0 | 1s. to 0 2 6
| (None required on
| virgin soil for the
| first three years of
| cultivation.)
|
LIVE STOCK. Mules, 5 of | Oxen, of which 12 are
which are required to each | required to each load,
load of 3,000 to 4,000 | L3 each 36 0 0
lbs., L30 each 150 0 0 | Keep of oxen, on
Keep of Mules each, per | pasturage free.
annum 7 0 0 |
|
LABOR. Drivers, each, per | Colored driver,
month 1 0 0 | each, per month 0 15 0
Coolies, including keep, | Kafir leader, ditto 0 10 0
each 1 0 0 | Kafirs, including
White labor, each 4 0 0 | keep, ditto 0 10 0
| White labor, each
| per month, L3 10s. to 4 0 0
|
FUEL. Cane trash or wood | Cane trash or wood
MILL POWER. Steam or water | The same
|
IMPLEMENTS. All agricultural | All agricultural labor
labor is performed by the | is performed with the
hand-hoe, very expensive | plough, harrows, and
in its nature. | scarifier, with oxen
| so much less expensive
| than the hand labor at
| the Mauritius.
|
PRODUCE of the Cane. Average | From 2 to 3 tons
from 1 to 4 tons. |
CANE. Periodical renewal of | Not yet ascertained,

the cane, according to the | and depending on the soil
quality of the soil, every |
3 to 10 years |
|
L. s. d. | L. s. d.
PROVISIONS, &c. Beef, | PROVISIONS, &c. Beef,
per lb. 6d. to 0 0 8 | per lb., 11/2d. to 0 0 21/2
Bread, per loaf 0 0 6 | Bread, per loaf 0 0 6
Butter, per lb., 1s. 3d. | Butter, per lb., 6d. to 0 0 9
to 0 1 6 |
Rice, the food of the | Indian corn, (maize per
Coolies, per bag of | 180 lbs. 5s.) per 150
150 lbs., 12s. 6d. to 0 15 0 | lbs. 0 4 2
Oats, per bag, of 100 | Oats, per 104 lbs., 10s.
lbs. 12s. 6d. to 0 15 0 | to 1 0 0
Bran, ditto, 100 lbs. | Bran, not used.
12s. to 0 13 9 |
Beans, ditto, 100 lbs. | Beans, per 180 lbs., 13s.
22s. 6d. to 1 5 0 | to 20s.,

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or per 100 lbs.
| 7s. 2d. to 0 11 0
Coal, per ton, 40s. to 2 10 0 | The same
|
CHARGE OF MANUFACTURE. | The Mauritius principle
The manufacturer reaps | may be adopted in this
and carries to the mill | colony, with such
the canes of the grower, | modifications as may be
but the latter provides | called for by local
his own bagging, and | exigencies.
carts away his half of |
the sugar, the other |
half being the |
remuneration of the |
manufacturer |

Analysis of the foregoing Statement, showing the total comparative outlay for sundries connected with the cultivation of Sugar at Natal and Mauritius, computed at the lowest ruling prices.

	MAURITIUS	NATAL	Difference in favor of Natal
Land, 100 acres	70s. 350 0 0	10s. 50 0 0	300 0 0
Manure, Guano 10 loads	L6 60 0 0		
Cattle Manure, 10 loads		1s. 0 10 0	
Live Stock, 10 mules.	L30 300 0 0	L15. 150 0 0	150 0 0
—— 10 oxen	L12 120 0 0	L3. 30 0 0	90 0 0
Two drivers per mouth	L1 2 0 0	1 5 0	0 15 0
Coolies, 10 with keep	10 0 0	}	2 10 0
Kafirs, 10 ditto		15s. 7 10 0}	
White men, 10	L4 40 0 0	L4. 40 0 0	
Beef, 100 lbs.	at 6d. 2 10 0	11/2d. 0 12 6	1 17 6
Bread, 100 loaves	6d. 2 10 0	6d. 2 10 0	
Butter,100 lbs.	1s.3d. 6 5 0	6d. 2 10 0	3 15 0

Rice, 100 lbs., food for Coolies, Indian	0 8 4	}	} 0 5 7
Corn, 100 lbs., food for Kafirs		0 2 9 }	
Oats	0 12 6	0 10 0	0 2 6
Beans, 100 lbs.	1 2 6	0 10 0	0 12 6
Coals	2 0 0	2 0 0	
	L897 8 4	L288 0 3	L554 18 1

The immense saving obtained by ploughing, &c., over the Mauritius hand labor with the hoe, is not shown in the above figures.

Table showing the cost of producing Muscovado sugar, and the quantity produced or available in the several countries mentioned, as made up from the evidence given before the Committee on Sugar and Coffee Plantations; by T. Wilson.

```
-----------------+-------+---------+---------+------+-
------+-------+-----
|      |        |        |       |       |Excess |
|      |        |        |       |       |of cost|
|      |        |        |       |Excess |of free|
|      |        |        |       |of cost| over  |
|      |        |        | Cost  |of free| SLAVE |
|      | Average | Average |of pro-|labour | TRADE |
|      |available|available|ducing | over  | labor,|
|      | produce | produce |  one  | slave |taking |In-
|Average|  under  |  during |cwt. of|or com-|  the  |crease
|cost of| slavery |the last | sugar |pulsory|cost in|of cost
|produc-| or com- |  three  |  at   | labor,|Brazil |in the
| tion  | pulsory |years of |present|  per  |  at   |British
COUNTRY.  | under |  labor, | freedom,| date, | cwt., |7s. 6d.|planta-
|slavery| for the | for the |exclu- |taking |  per  |tions
|or com-|supply of|supply of|sive of|  the  |  cwt. | since
|pulsory|  Europe |  Europe |inter- |average|making |emanci-
| labor.| and the | and the |est on |cost of|  the  |pation.
|      |  United |  United | capi- |  the  |average|
|      |  States,|  States.|  tal, |latter |  of   |
|      |        |        | etc. |at 11s.| slave |
|      |        |        |       |  per  | trade |
|      |        |        |       |  cwt. | labor |
|      |        |        |       |       |8s. per|
|      |        |        |       |       |  cwt. |
-----------------+-------+---------+---------+------+------
-+-------+-----
```

British Plantations.	*s. d.*	*Tons.*	*Tons.*	*s d.*	*s. d.*	*s. d.*	*s. d.*
Antigua	7 6	7,767	8,963	16 6	5 6	8 6	9 0
Barbados	6 0	17,174	16,378	15 6	4 6	7 6	9 6
Grenada	11 0	9,634	3,779	17 6	6 6	9 6	6 6
St. Kitts	5 0	4,382	5,558	19 0	8 0	11 0	14 0
St. Vincent	5 6	10,056	6,636	19 6	8 6	11 6	14 0
Tobago	5 6	5,321	2,514	19 6	8 6	11 6	14 0
St. Lucia, *etc.*	5 6	9,600	8,650	19 6	8 6	11 6	14 0
Jamaica	10 0	68,626	30,807	22 6	11 6	14 6	12 6
Guiana	6 8	44,178	24,817	25 10	14 10	17 10	19 2
Trinidad A*	3 0	15,428	16,539	20 10	9 10	12 10	17 10
Mauritius		35,000	50,000	20 0	9 0	12 0	
Bengal			62,000	23 0	12 0	15 0	

Madras			7,000	20 0	9 0	12 0
Foreign						
Free Labor						
Country.						
Europe						
(Beet-root) B*			100,000	24 4	13 4	16 4

Foreign Slave, or Compulsory Labor Countries.						
Java C*	15 0	88,000		15 0		
French Colonies	15 0	90,000		15 0	Slave	
Cuba (Muscovado)	8 0	220,000		8 0	or com-	
Porto Rico	8 6	40,000		8 6	pulsory	
Louisiana	12 6	100,000		12 6	labor	
Brazils D*	11 11	90,000		11 11		

[A* This cost, as taken from the averages given in Lord Harris's despatches, is lower than the averages given by the witnesses before the Committee.]

[B* This beet-root sugar sells, in the continental markets, on account of its inferior quality, at about 4s. to 6s. per cwt. below Colonial Muscovado, so that Colonial Muscovado must be about 33s. per cwt. to enable beet sugar to sell in this market for cost and charges, and allowing no profit to the beet sugar maker.]

[C* The cost of producing sugar in Java is taken at the average between the Government contract sugar, and the free sugar, as given by Mr. San Martin.]

[D* The cost of producing sugar in Brazil is taken from the Consular return: this return has given no credit for rum or molasses, and has charged 6s. 5d. for manufacturing, fully 3s. 5d. more than the cost in Cuba,—allowance for these two items would give 7s. 6d. as the nett cost per cwt.]

BEET ROOT SUGAR.

The rapid progress of the production of beet root sugar on the continent, especially in France, Belgium, Germany, Austria, and Russia, and its recent introduction and cultivation as an article of commerce in Ireland, renders the detail of its culture and manufacture on the continent interesting. I have, therefore, been induced to bestow some pains on an investigation of the rise and progress of its production and consumption in those countries.

During the past three years, the smallest estimate which can be formed of the quantity of cane sugar that has been replaced by beet root sugar in the chief European countries, is about 80,000 tons annually, with the certainty that, year after year, the consumption will become exclusively confined to the former, to the greater exclusion of the latter; unless some great change shall take place in the relative perfection and manufacture of the two different descriptions of produce.

Although, observes the *Economist*, the beet root sugar produced in France, Belgium, Germany, and other parts of the continent is not brought into competition in our own markets with the produce of the British colonies, yet it must be plain that the exclusion of so much foreign cane sugar from the continent, which was formerly consumed there, must throw a much larger quantity of Cuba and Brazilian sugar upon this market; and by this means the increased production of beet root sugar, even in those countries where it is highly protected, does indirectly increase the competition among the producers of cane sugar in our market.

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So early as 1747, a chemist of Berlin, named Margraf, discovered that beet root contained a certain quantity of sugar, but it was not until 1796 that the discovery was properly brought under the attention of the scientific in Europe by Achard, who was also a chemist and resident of Berlin, and who published a circumstantial account of the progress by which he extracted from 3 to 4 per cent. of sugar from beet root.

Several attempts have been made, from time to time, to manufacture beet root sugar in England, but never, hitherto, on a large and systematic scale. Some years ago a company was established for the purpose, but they did not proceed in their operations.

A refinery of sugar from the beet root was erected at Thames Bank, Chelsea, in the early part of 1837. During the summer of 1839 a great many acres of land were put into cultivation with the root, at Wandsworth and other places in the vicinity of the metropolis. The machinery used in the manufacture was principally on the plan of the vacuum pans, and a fine refined sugar was produced from the juice by the first process of evaporation, after it had undergone discolorization. Another part of the premises was appropriated to the manufacture of coarse brown paper from the refuse, for which it is extensively used in France.

A refinery was also established about this period at Belfast, in the vicinity of which town upwards of 200 acres of land were put into cultivation with beet root for the manufacture of sugar.

The experience of France ought to be a sufficient guarantee that the manufacture of beet root sugar is not a speculative but a great staple trade, in which the supply can be regulated by the demand, with a precision scarcely attainable in any other ease, and when, in addition, this demand tends rather to increase than to diminish. That the trade is profitable there can also be no doubt from the large capital embarked in it on the Continent—a capital which is steadily increasing even in France, where protection has been gradually withdrawn, and where, since 1848, it has competed upon equal terms with colonial sugars.

The produce of France in 1851 was nearly 60,000 tons. The beet root sugar made in the Zollverein in 1851 was about 45,000 tons. Probably half as much more as is made in France and the Zollverein, is made in all the other parts of the Continent. In Belgium, the quantity made is said to be 7,000 tons; in Russia, 35,000; making a total of beet root sugar now manufactured in Europe of at least 150,000 and probably more, or nearly one-sixth part of the present consumption of Europe, America, and our various colonies. In 1847 this was estimated at upwards of 1,000,000 tons; and, as the production has increased considerably since that period, it is now not less than 1,100,000 tons. The soil of the Continent, it is said, will give 16 tons to the acre, and that of Ireland, 26 tons to the acre. The former yields from 6 to

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7 per cent.—the latter from 7 to 8 per cent. as the extreme maximum strength of saccharine matter. The cost of the root in Ireland—for it is with that, and not with the cost of the Continental root, with which the West Indies will have to contend—is said to be at the rate of 16s. per ton this; but will probably be 13s. next season. The cost of manufacture is set down at L7 5s. per ton. Calculating the yield of the root to be 71/2 lbs. to every 100 lbs., for 26 tons the yield would be nearly 2 tons of sugar, which would give about L9 10s. per ton, putting down the raw material to cost 14s, 6d. per ton, the medium between 16s. and 13s. Thus a ton of Irish-grown and manufactured beet root sugar, would cost L16 15s. per ton. Mr. Sullivan, the scientific guide to those who are undertaking to make beet root sugar at Mountmellick, Queen’s County, Ireland, estimates the cost of obtaining pure sugar at from L16 17s. to L19 18s. per ton, according to the quantity of sugar in the root.

Beet root is a vegetable of large circumference, at the upper end nine to eleven inches in diameter. There are several kinds. That which is considered to yield the most sugar is the white or Silesian beet (*Beta alba*). It is smaller than the mangel wurzel, and more compact, and appears in its texture to be more like the Swedish turnip. For the manufacture of sugar, the smaller beets, of which the roots weigh only one or two pounds, were preferred by Chaptal, who, besides being a celebrated chemist, was also a practical agriculturist and a manufacturer of sugar from beet root. After the white beet follows the yellow (*beta major*), then the red (*beta romana*), and lastly the common or field beet root (*Beta sylvestris*). Margraf, as we have seen, was the first chemist who discovered the saccharine principle in beet root; and Achard, the first manufacturer who fitted up an establishment (in Silesia) for the extraction of sugar from the root. It was not before 1809 that this manufacture was introduced into France.

The manufacture sprung up there in consequence of Bonaparte’s scheme for destroying the colonial prosperity of Great Britain by excluding British colonial produce. It having been found that from the juice of the beet root a crystallizable sugar could be obtained, he encouraged the establishment of the manufacture by every advantage which monopoly and premiums could give it. Colonial sugar was at the enormous price of four and five francs a pound, and the use of it was become so habitual, that no Frenchman could do without it. Several large manufactories of beet root were established, some of which only served as pretexts for selling smuggled colonial sugar as the produce of their own works. Count Chaptal, however, established one on his own farm, raising the beet root, as well as extracting the sugar. The roots are first cleaned by washing or scraping, and then placed in a machine to be rasped and reduced to a

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pulp. This pulp is put into a strong canvas bag and placed under a powerful press to squeeze out the juice. It is then put into coppers and boiled, undergoing certain other processes. Most of the operations are nearly the same as those by which the juice of the sugar cane is prepared for use; but much greater skill and nicety are required in rendering the juice of the beet root crystallizable, on account of its greater rawness and the smaller quantity of sugar it contains. But when this sugar is refined, it is impossible for the most experienced judge to distinguish it from the other, either by the taste or appearance; and from this arose the facility with which smuggled colonial sugar was sold in France, under the name of sugar from beet root. Five tons of clean roots produce about 41/2 cwt. of coarse sugar, which give about 160 lbs. of double refined sugar, and 60 lbs. of inferior lump sugar. The rest is molasses, from which a good spirit is distilled. The dry residue of the roots, after expressing the juice, consists chiefly of fibre and mucilage, and amounts to about one-fourth of the weight of the clean roots used. It contains all the nutritive part of the root, with the exception of 41/2 per cent. of sugar, which has been extracted from the juice, the rest being water.

As the expense of this manufacture greatly exceeded the value of the sugar produced, according to the price of colonial sugar, it was only by the artificial encouragement of a monopoly and premiums that it could be carried on to advantage. The process is one of mere curiosity as long as sugar from the sugar cane can be obtained cheaper, and the import duties laid upon it are not so excessive as to amount to a prohibition; and in this case it is almost impossible to prevent its clandestine introduction.

Another mode of making sugar from beet root, practised in some parts of Germany, is as follows, and is said to make better sugar than the other process:—The roots having been washed, are sliced lengthways, strung on packthread, and hung up to dry. The object of this is to let the watery juice evaporate, and the sweet juice, being concentrated, is taken up by macerating the dry slices in water. It is managed so that all the juice shall be extracted by a very small quantity of water, which saves much of the trouble of evaporation. Professor Lampadius obtained from 110 lbs. of roots 4 lbs. of well-grained white powder-sugar, and the residuum afforded 7 pints of spirit. Achard says that about a ton of roots produced 100 lbs. of raw sugar, which gave 55 lbs. of refined sugar, and 15 lbs. of treacle. This result is not very different from that of Chaptal. 6,000 tons of beet root it is said will produce 400 tons of sugar and 100 tons of molasses.

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Beet root sugar in the raw state contains an essential oil, the taste and smell of which are disagreeable. Thus the treacle of beet root cannot be used in a direct way, whereas the treacle of cane sugar is of an agreeable flavor, for the essential oil which it contains is aromatic, and has some resemblance in taste to vanilla. But beet root sugar, when it is completely refined, differs in no sensible degree from refined cane sugar. In appearance it is quite equal to cane sugar, and the process of refining it is more easy than for the latter. Samples made in Belgium were exhibited at a late meeting of the Dublin Society. It was of the finest appearance, of strong sweetening quality, and in color resembling the species of sugar known as crushed lump. The most singular part of the matter is, that it was manufactured in the space of forty-five minutes—the entire time occupied from the taking of the root out of the ground and putting it into the machine, to the production of the perfect article. It was said that it could be produced for 3d. per lb. An acre of ground is calculated to yield 50 tons of Silesian beet, which, in France and Belgium, give three tons of sugar, worth about L50; the refuse being applied in those countries to feeding cattle. But from the superior fitness of the Irish soil, as shown by experience to be the case, it is confidently affirmed by persons competent to form an opinion, that 8 per cent. of sugar could be obtained there on the raw bulk.

The following figures are given as illustrative of the expense of the cultivation of one acre of beet-root in Ireland:—

Two ploughings and harrowing L1 1 0
Expense of manure and carting 5 0 0
Hoeing and seed 0 6 0
Drilling and sowing 0 5 0
Rent 2 0 0

L8 12 0

An average produce of 20 tons, at L15 per ton, would leave a profit of L6 8s. per acre, leaving the land in a state fit for the reception, at little expense, of a crop of wheat, barley, or oats for the next year, and of hay for the year ensuing; a consideration of no small importance to the farmer. The following estimates, recently given, are not by any means exaggerated:—

61,607 tons of beet, at 10s. L30,803 10 0
Cost of manufacture, at 11s. per ton. 33,883 17 0

64,687 7 0
Produce 7 per cent of sugar, at 28s. per cwt. 136,767 10 0

Estimated profit L72,080 3 0

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The quantity of sugar made from beet-root in France in 1828, was about 2,650 tons; in 1830, its weight was estimated at 6 million kilogrammes[24] (5,820 tons); in 1834, at 26 million kilogrammes (24,000 tons); in 1835, 36,000 tons; in 1836, 49,000 tons. At the commencement of the year 1837, the number of refineries at work or being built was 543; on an average 20 kilogrammes of beet-root are required for the production of one kilogramme of sugar. The sugar manufactured from the beet-root in France a few years ago was stated to amount to 55,000 tons, or one half of the entire consumption of the kingdom. The *Courrier Francais* calculated that the beet-root sugar made in France in 1838 amounted to 110 million lbs., and the journal added, there is no doubt that, in a few years, the produce will be equal to the entire demand. The cultivation then extended over 150,000 acres, and in the environs of Lille and Valenciennes it has sometimes been as high as 28,000 lbs. per acre.

From returns of the produce and consumption of beet-root sugar published in the *Moniteur*, it appears that on the 1st Dec. 1851, there were 335 manufactories in operation, or 81 more than in the corresponding period of 1850. The quantity of sugar made, including the portion lying over from the previous year, amounted to 19,625,386 kilogrammes, and that stored in the public bonding warehouse to 10,556,847. At the end of June, 1852, 329 manufactories were at work, or two more than at the same period in 1851. The quantity sold was 62,211,663 kilogrammes, or 9,167,018 less, as compared with the corresponding period of the previous year. There remained in stock in the manufactories 91,434,070 kilogrammes, and in the entrepot 4,597,829 kilogrammes, being an increase of 2,568,662 kilogrammes in the manufactories, and a decrease of 1,292,962 in the entrepots. The manufacture of beet-root sugar is every year assuming in France increased importance, and attracts more and more the attention of political economists as a source of national wealth, and of government, as affording matter of taxation. Thirty new factories, got up upon a very extensive scale, are enumerated as going into operation this year. They are located, with but two exceptions, in the north of France; fifteen of them are in the single department of Nord. Indeed, the manufacture of beet-root sugar is confined, almost exclusively, to the five northern adjacent departments of Nord, Pas de Calais, Somme, Aisne, and Oise. The best quality retails at 16 cents the pound.

I take from a table in the *Moniteur* the following statement of the number of factories and their location, with the amount of production up to the 31st May, 1851. At that date the season is supposed to end. A separate column gives the total production in the season of 1842, showing an increase in ten years of more than double, *viz*., of 41,582,113 kilogrammes, or, in our weight, of 93,559,754 pounds.

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Departments.	Number of Factories.	Kilogrammes Prod. 1850-1.	Kilogrammes Prod. 1843.
Aisne	30	5,307,754	3,103,178
Nord	155	44,142,224	15,334,063
Oise	8	1,589,939	751,746
Pas-de-Calais	70	16,665,084	5,856,944
Somme	23	3,404,776	2,683,421
Scattered about	18	2,707,190	3,505,602
	------	------------	------------
	304	73,817,607	30,234,954

This information was given by M. Fould, Minister of Finance, upon the introduction of a bill making an appropriation for the purchase of 455 *saccharometers*, which had become necessary by reason of the late law ordering that from and after the 1st of January, 1852, the beet sugars were to be taxed according to their saccharine richness. The Minister declared that at that date there would be in active operation in France 334 sugar factories and 84 refining establishments.

The *Moniteur Parisien* has the following:—

"Notwithstanding the advantages accorded to colonial sugar, and the duties which weigh on beet-root sugar, the latter article has acquired such a regular extension that it has reached the quantity of 60,000 tons—that is to say, the half of our consumption. France (deducting the refined sugar exported under favour of the drawback) consumes 120,000 tons, of which 60,000 are home made, 50,000 colonial, and 10,000 foreign. The two sugars have been placed on the same conditions as to duties, but it is only from the 1st inst. (Jan. 1852), that the beet-root sugar will pay a heavier duty than our colonial sugar. In spite of this difference we are convinced that the manufacture of beet-root sugar, which is every day, improved by new processes, will be always very advantageous, and will attain in some years the total quantity of the consumption. In Belgium the produce of the beet-root follows the same progress. The consumption of sugar there was, in 1850, 14,000 tons, of which 7,000 was beet-root, made in 22 manufactories. This year there are 18 new ones, and although their organisation does not allow of their manufacturing in the same proportion as the 22 old ones, they will furnish at least 3,000 tons. The quantity of foreign sugar in that market does not reckon more than 4,000 tons. This conclusion is the more certain, as in 1848-1849, the beet-root only stood at 4,500 tons in the general account. It may therefore be seen from these figures what progress has been made. The same progressive movement is going on in Germany. In 1848 it produced 26,000 tons, and in 1861, 43,000. The following table shows the importance of this improvement. It comprises the Zollverein, Hanover, and the Hanse Towns:—

	Cane Sugar.	Beet-root.	Totals.
	Tons.	Tons.	Tons.
1848	60,500	26,000	86,500

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1849	54,000	34,000	88,000
1851	45,000	43,000	88,000

Thus we find that in the period of four years cane sugar has lost 15,000 tons and it will lose still more when new manufactories shall have been established. The consumption of Russia is estimated at 85,000 tons, of which 35,000 is beet-root, and what proves that the latter every day gains ground is, that the orders to the Havana are constantly decreasing, and prices are getting lower. In 1848 Austria consumed 40,000 tons, of which 8,000 were beet-root. Last year (1851,) she produced 15,000 tons. The production of the continent rising to 200,000 tons, and the consumption remaining nearly stationary, it is evident that Brazilian and Cuban sugars will encumber the English market, independently of the refined sugar of Java, which Holland sends to Great Britain. When the continental system was established by the decrees of Milan and Berlin, the Emperor Napoleon asked the savans to point out the means of replacing the productions which he proscribed: it is to the active and useful impulse which his genius impressed on all minds, that France and Europe owe this fresh manufacture—a creation the more valuable as its fortunate development required the co-operation of chemical science and agricultural improvement.”

The quantity of sugar extracted from beet-root in the commencement of the process, amounted to only 2 per cent.; but it was afterwards made to yield 5 per cent., and it was then supposed possible to extract 6 per cent. On this calculation the fiscal regulations for the protection of colonial sugars in France were founded; but recent experiments have been made, by means of which as much as ten and a half per cent. of sugar has been obtained. The following notice of the improved process is given in a number of the *Constitutionnel*:—

“It appears that a great improvement is likely to be made in the manufacture of beet-root sugar. Those who are acquainted with the process of this manufacture, are aware that M. de Dombasle has the last six years exclusively devoted himself to bring to perfection the process of maceration, of which he is the inventor. Adopting recent improvements, this process is materially altered, and has now arrived at such a point of perfection that it could scarcely be exceeded. The Society for the Encouragement of National Industry recently appointed committees to examine the effect produced in the manufactory of Roville. They witnessed the entire progress of the work, every part of which was subjected to minute investigation. Similar experiments have been made in the presence of many distinguished manufacturers. We have not the least intention to prejudge the decision which may be made on this subject by the society we have alluded to; but we believe we are able to mention the principal results that have regularly attended the works of the manufactory this year. The

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produce in coarse sugar has been more than eight per cent. of the first quality, and more than two per cent. of the second quality, in all nearly ten and a half per cent. of the weight of beet-root used; and the quality of these sugars has been considered by all the manufacturers superior to anything of the kind that has hitherto been made, and admits of its being converted into loaf-sugar of the first quality. The progress of these operations is as simple as possible, and the expenses attending the manufacture are considerably less than that of the process hitherto adopted."

The cultivation of the beet in France appears likely to prove still more advantageous, in consequence of the discovery that the molasses drawn from the root may be, after serving for the manufacture of sugar, turned to farther advantage. It appears that potash may be made from it, of a quality equal to foreign potash. A Monsieur Dubranfaut has discovered a method of extracting this substance from the residue of the molasses after distillation, and which residue, having served for the production of alcohol, was formerly thrown away. To give some idea of the importance of the creation of this new source of national wealth (remarks the *Journal des Debats*), it will be sufficient to say that the quantity of potash furnished by M. Dubranfaut's process is equal to l/6th of the quantity of sugar extracted from the beet. Thus, taking the amount of indigenous sugar manufactured each year at seventy million kilogrammes (each kil. equal to 2 lbs. 2 oz. avoird.), there may besides be extracted from this root, which has served for that production, twelve million kilogrammes of saline matter, comparable to the best potash of commerce; and this, too, without, the loss of the alcohol and the other produce, the fabrication of which may be continued simultaneously. According to the present prices, the twelve millions of kilogrammes represent a value of from fourteen to fifteen million francs.

The States composing the German Union possessed towards the close of 1838, 87 manufactories of beet-root sugar in full operation, *viz*., Prussia, 63; Bavaria, 5; Wurtemburg, 3; Darmstadt, 1; other states, 15; besides 66 which were then constructing.

The only returns given for Prussia and Central Germany are 1836 to 1838, and the annual production of sugar was then estimated at eleven million pounds. The quantity now made is, of course, much greater.

At the close of 1888, Austria produced nine million pounds; she now makes fifteen thousand tons.

The growth of beet-root in Hungary, during the years 1837 and 1838, was extremely favorable, and the manufacture of sugar from it has become very extensive. It has been greatly encouraged by the Austrian government. It was estimated that fifty millions of pounds were manufactured in Prussia and Germany in 1839. In Bohemia there were, in

1840, fifty-two factories of beet-root sugar, and nine for the making of syrup out of potato meal. In 1838, the number was as high as eighty-seven.

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The Dutch papers state that in a single establishment in Voster Vick, in Guilderland, about five million pounds' weight of the beet-root are consumed in the manufacture of sugar.

The following is a Comparative Statement of the number of Sugar Manufactories, and the Quantity of Beet-root upon which duty was paid for the Manufacture of Sugar in the Zollverein during the years ending the 31st of August, 1846 and 1847:—

Name of the State of the Zollverein	Number of Manufactories 1845-6	Number of Manufactories 1846-7	Quantity of Beet-root upon which duty was paid for the Manufacture of Sugar. 1845-6	1846-7	Comparison in 1846-7 with the preceding year. More in 1846-7	Less in 1846-7
Prussia			Cwts. **	Cwts.	Cwts.	Cwts.
Eastern Prussia	2	2	12,393	29,941	17,548	—
Western Prussia	—	—	—	—	——	—
Posen	7	8	101,422	121,914	20,492	—
Pomerania	5	4	89,865	121,061	31,196	—
Silesia	16	22	590,545	711,632	121,087	—
Brandenburg	3	3	140,421	148,066	7,645	—
Prussian Saxony	38	42	2,676,084	3,547,891	871,817	—
Duchies of Anhalt	4	5	266,345	288,082	21,737	—
Westphalia	—	—	—	—	—	—
Rhenish Provinces	2	—	2,479	—	—	2,479
Total in Prussia	77	86	3,879,554	4,968,587	1,079,043	
Luxemburg	—	—	—	—	—	—
Bavaria, Kingdom of	8	7	50,952	46,142	—	4,810
Saxony, "	1	2	20,887	34,230	13,343	—
Wurtemburg, "	2	2	59,521	141,366	81,845	—
Baden, Grand Duchy	2	2	316,968	328,608	11,640	—

Hesse, Electorate	2	3	25,376	23,529	—	1,847
Hesse, Grand Duchy	—	—	—	—	—	—
Thuringia	2	3	36,127	38,218	2,091	—
Brunswick, Dukedom	2	2	65,707	52,796	—	12,911
Nassau, Dukedom	—	—	—	—	—	—
Frankfort, FreeCity	—	—	—	—	—	—
Total, exclusively of Prussia	19	21	575,538	664,889	89,351	

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Total in the Zollverein	96	107	4,455,092	5,633,476	1,168,394

[** Prussian cwts. are equal to 80 English cwts.]

This statement proves that the cultivation of the beet-root, and the subsequent manufacture into sugar, has greatly increased in the Zollverein. Eleven manufactories had been added to the number in the previous year, and an increase of 26 per cent. took place in the quantity of beet-root which was manufactured into sugar. Each manufactory used, upon an average, the following quantity during the undermentioned years:—

	1841-2	1844-5	1846-7
	Cwts.	Cwts.	Cwts.
In Prussia generally	38,161	50,384	57,774
In the province of Saxony	55,412	70,423	84,473
In the province of Silesia	33,595	36,909	32,347
In the Zollverein, on an average in each manufactory	27,237	46,407	52,634

The increase is chiefly evident in the province of Saxony, where, in 1846-7, an augmentation of 1,087,851 cwt. of beet-root; in comparison to the preceding year, took place. If we compare the quantity of beet-root employed in Saxony with that of the whole Zollverein, we find that the former province requires 63 per cent, of the whole quantity used for the manufacture of sugar. The great activity in that province (chiefly in the district of Magdeburg) is rendered more apparent by the following table:—

Comparative Statement of the Number of Manufactories, and their Machinery and Utensils, employed for the Manufacture of Beet-root Sugar in the Prussian Province of Saxony during the years 1841-2 and 1846-7 respectively.

Province of Saxony		In the neighbourhood of Magdeburg	
1841-2	1846-7	1841-2	1846-7

	No.	No.	No.	No.
Manufactories	40	39	15	15
Apparatus for grating	58	65	27	32
Hydraulic presses	136	209	72	93
Clarifying pans, with open firing	81	68	24	24
Ditto, by steam	50	76	33	42
Evaporating pans, with open firing	130	123	55	54
Ditto, by steam	46	71	28	32
Clarifiers, with open firing	23	21	14	10
Ditto, by steam	23	28	19	21
Boiling pans, with open firing	76	61	33	24
Ditto, by steam	20	35	12	17

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Of which there are vacuum pans	8	21	3	9
Steam-engines	19	40	12	20
Horse-power	210	457	153	267
Cattle mills	19	9	4	2
Cattle employed	79	38	19	12
	Cwt.	Cwt.	Cwt.	Cwt.
Quantity of beet-root used for manufacture	2,349,774	3,387,280	1,433,293	1,889,463
Or on an average in each manufactory	58,744	86,853	95,553	125,964

The increase of power by machinery is surprising, chiefly by steam and hydraulic presses, which has not only effected a greater produce, but likewise a much larger increase of the quantity of beet-root required for manufacture. The works where draught cattle are employed have decreased, and are only in use where the manufacture of beet root sugar is combined with a farm.

In Russia, in 1832, there existed only 20 manufacturers of beet root sugar, but this number subsequently increased to 100, and they annually produced the twelfth of the total quantity of sugar which Russia receives from foreign parts. The number of those manufactories in 1840, was 140, and the importation of sugar, which reached to 1,555,357 lbs. in 1837, amounted to only 1,269,209 lbs. in 1839. The production of indigenous sugar is now set down at 35,000 tons.

In France, for many years past, the production of beet-root sugar has been rapidly increasing, in spite of a gradual reduction of the protection which it enjoyed against colonial and foreign sugar, until it has reached a quantity of 60,000 tons, or fully one half of the entire consumption. Independent of the refined sugar exported under drawback, the consumption of France may be now estimated at 120,000 tons, of which 60,000 tons are of beet-root, 60,000 tons of French colonial, and 10,000 tons at the outside of foreign sugar. The beet-root and the French colonial sugars are now placed on the same footing as regards duty, and a law was recently passed, subjecting beet-root sugar, from the 1st of January, 1852, to even a higher duty than French colonial sugar. Nevertheless, it is admitted that the manufacture of beet-root sugar is highly profitable and rapidly increasing, so that it is likely in a very short time to exclude foreign sugar from French consumption altogether.

In Belgium, the production of beet-root sugar is also rapidly increasing; in 1851 the entire consumption of sugar was estimated at 14,000 tons, of which 7,000 tons were of beet-root, and 7,000 tons of foreign cane sugar. The number of beet-root factories to supply that quantity was *twenty-two*, but this number has, already increased in the present year to *forty*. Many of these will be but

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imperfectly at work during this season, but it is estimated that of the entire consumption of 14,000 tons, at least 10,000 tons will consist of beet-root, and only 4,000 tons of foreign cane sugar. And from present appearances the manufacture of beet-root is likely to increase so much as to constitute nearly the entire consumption. So lately as 1848 and 1849 the production of beet-root sugar was only 4,500 tons.

In Austria, the consumption of sugar in 1841 was 40,000 tons, of which 8,000 tons were of beet-root, and 32,000 tons of foreign cane sugar. But the production of beet-root has increased so fast that it is estimated to produce in the present year 15,000 tons; and as no increase has taken place in the entire consumption, the portion of foreign cane sugar required in the present year will be reduced from 32,000 tons to 25,000 tons.

The following information, with regard to the state of the manufacture of beet-root sugar on the Continent last year, has been furnished by Mr. C.J. Ramsay, of Trinidad.

"My first start was for Paris, where I remained a week, procuring the necessary letters of introduction, to enable me to see some of the sugar works in the provinces. Whilst there I called upon Messrs. Cail and Co., the principal machine makers in France, mentioned the subject of my visit, and requested their assistance. Nothing could have been more liberal than the way in which they treated me. I was at once asked to look over their establishment and requested to call the next day, when letters of introduction to their branch establishments at Valenciennes and Brussels would be ready for me. This I of course did, and received not only these letters but some others, to sugar manufacturers in the neighbourhood of Valenciennes. Thus provided, and with letters from Mr. D'Eickthal, a banker in Paris, to Mr. Dubranfaut, the chemist, to Mr. Grar, a refiner of Valenciennes, to Mr. Melsens of Brussels, and to another sugar maker near Valenciennes, whose name I forget, and who was the only man from whom I did not receive the greatest politeness, I started for Valenciennes. My first essay was upon the latter personage, who evidently with a considerable grudge showed me a simple room in his works where four centrifugal machines were at work—raised the cry of ruin, if the French improvements were introduced in the West Indies, and informed me he had nothing else worth seeing. I returned to Valenciennes, thinking if this is the way I was to be treated, I might as well have stayed at home. That this was a solitary instance of illiberality, you will presently see. I next called upon Mr. Grar, by whom I was received in a very different manner; he at once offered to show me over his works, and especially that part of them where a new process, discovered by Mr. Dubranfaut, was carried on, every part of which was fully explained, Mr. Dubranfaut's laboratory is connected with these works, and having inspected

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the working part of the establishment Mr. G. then took me there, and introduced me to that gentleman, with whom I passed the remainder of the afternoon, receiving a full explanation of his new process, which is this:—a solution of hydrate of barytes is made in boiling water—the saccharine solution to be treated is heated to the same degree, and the two mixed together in the proportions of 46 parts of hydrate of barytes to every 100 parts of sugar contained in the solution, which has previously been ascertained by polariscopic examination. A saccharate of barytes is immediately formed in the shape of a copious precipitate; this, after being thoroughly washed and thus freed from all soluble impurities, is transferred into large, deep vats, and a stream of carbonic acid gas forced into it, which decomposes the saccharate of barytes, forming carbonate of barytes, and liberating the sugar in the shape of a perfectly pure solution of sugar in water, of the density of 20 to 23 degrees Baume; the carbonate of barytes being thoroughly washed is again converted into caustic barytes by burning, so that there is little loss in the operation. The whole process is certainly very beautiful, and its economic working has been tried for a year, on a sufficiently large scale to leave no doubt as to the economy of the process in refining molasses, which is the only purpose it has yet been applied to.The Messrs. Grar were so thoroughly satisfied with it, that when I was there they had taken down their original apparatus, and were re-erecting it on such a scale as to work up all the molasses by it, equal to almost five tons of sugar daily. Owing to this circumstance, I had not an opportunity of seeing the process on a working scale, but was shown the whole proceedings in the laboratory.The only difficulties I see in applying this process at once to the cane juice, are the large quantity of barytes required, the expense of re-burning it and the entire change in works that would be necessary before it could be introduced. The advantage would be, the obtaining the whole sugar contained in the juice, free from all impurities, consequently white, and in the shape of a syrup marking 20 to 23 degrees instead of 8 or 10 degrees, thus saving fully half the evaporation now required. The sugar made in this way, I was told, contains no trace of barytes.To show you the degree of economy practised in such establishments in France, I may mention that the washings of the saccharate of barytes are sold to the makers of potash and soda, who make a profit by boiling them down to obtain what salts they contain.The carbonic acid is obtained by the combustion of charcoal in a closed iron furnace into which air is forced by an air pump, requiring, I believe, about one horse power. From the top of the furnace a pipe leads into a washing vessel, from which the gas is led into the bottom of the

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vats by pipes.At Valenciennes I met with Mr. Cail, who, beside being an engineer and machine-maker, is interested in sugar-making, both in France and in the West Indies, and most thoroughly understands the subject. He invited me to accompany him to Douai, to see a new set of works which had been set agoing this month. I was of course too glad to accept his invitation, and started with him at six next morning, reached Douai at eight, and then proceeded to the works, which are a few miles out of town. In this work a new process is also employed; it is that of Mr. Rouseau, and is said to answer well. The beet root juice, as soon as possible after expression, is thrown up by a montjus into copper clarifiers with double bottoms, heated by steam at a pressure of five atmospheres. To every hundred litres of juice (=22 gals.) two kilogrammes of lime are added (about four and a half pounds English weight). The lime is most carefully prepared and mixed with large quantities of hot water till it forms a milk perfectly free from lumps. The steam is turned off, and the juice heated to 90 deg. A complete defecation has taken place, the steam is shut off, and the juice left a short time, to allow the heavier impurities to subside. It is then run off in the usual manner, undergoes a slight filtration through a cotton cloth placed over a layer of about four inches thick of animal charcoal, and runs into a second set of copper vessels placed on a lower level than the clarifiers; these vessels are heated by means of a coil of steam piping sufficient to make them boil. A second pipe passes into them, making a single turn at the bottom of the vessel; this is pierced on the lower side with small holes, through which a stream of carbonic acid gas is forced.

> This decomposes the saccharate of lime, which has been formed in consequence of the large excess of lime added to the clarifiers.

The lime is precipitated as carbonate. When precipitation has ceased, steam is turned on, and the whole made to boil; this expels any excess of carbonic acid; the liquor is then run off, undergoes a similar partial filtration to that mentioned above, and is then passed through the charcoal filters to be decomposed. The sugar made by this process, directly from the beet-root juice, is nearly white. The molasses is re-boiled as often as six times; each time undergoing a clarification and filtration through animal charcoal. And the proceeds of the last re-boiling is certainly in appearance not worse than a great deal of muscovado I have seen shipped from Trinidad.In this work there are about 150 people employed. The work goes on night and day, one gang replacing the other. The whole evaporation is done by two vacuum pans, each 61/2 feet in diameter, 80,000 kilogrammes of beet-root are used daily, from which about 6,000 kilogrammes of sugar are obtained, equal to about 6 tons English weight.

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In these and every other works I visited—eight in all—the centrifugal machines were in use, and had in most cases been so for two years; those lately made have been much simplified in construction, and work admirably. Cail & Co., of Paris, are the makers; their charge is 3,000 francs for each machine (L120 stg.). They require about one and a half horse power each. As they are wrought in France, one machine is about equal to work off a ton and a half of sugar daily, working all the 24 hours. Mr. Cail recommends a separate engine for those machines; so that they can be used at any time, independent of the other machinery. The charge put into a machine is about 80 kilogrammes, from which about 30 to 35 kilogrammes of dry sugar is obtained; the calculation is, I believe, 40 per cent. I weighed some of the baskets of sugar taken out after drying, and found them 35 kilogrammes. Sugar intended for the machine is never concentrated beyond 41 degrees Baume; that made from the juice direct is allowed 18 to 34 hours to crystallize, and is put into the machine in a semi-liquid state; the motion at first is comparatively slow; in about three minutes the sugar appears nearly dry; about three-fourths of a gallon of brown syrup is then poured into the machine whilst in motion, and the speed brought up to its highest, about 1200 revolutions a minute; in 3 or 4 minutes more the machine is stopped, the sugar scooped out and thrown into baskets, the inside of the revolving part, and especially the wire cloth, carefully washed with a brush and water, and a fresh charge put in. The whole time betwixt each charge is about 15 minutes. From the large proportion of molasses you will see very plainly that those who do not intend to re-boil, need not think of centrifugal machines. The sugar dried in this way is not altogether white, but has a slight greyish yellow tinge.Of the other sugar works which I visited, the only one of peculiar interest was that of Mr. Dequesne, near Valenciennes. Here the roots are first cut into small pieces by an instrument similar to a turnip slicer, then dried in a species of kiln, and stored up till required. In this way I was told beet-root could be preserved with very little deterioration for a full year, and this enables Mr. Dequesne to go on making sugar all the year round. When the sugar is to be extracted, the dried cuttings are put into a series of closed vessels connected by pipes, and by a system of continuous filtration of warm water through these vessels the solution of sugar is obtained, of a density equal, I believe, to 25 degrees Baume; it is a good deal colored, and requires filtration through animal charcoal. Mr. Dequesne informed me that for five years he had been unable to make this mode of sugar-making cover its expenses, owing to the loss occasioned by fermentation taking place in the beet-root; but that he has now entirely overcome that difficulty; by what means I was not told.

> The number of macerating vessels is fourteen, ten of which are working at a time, the other four filling and emptying.

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A greater number of vessels, Mr. Dequesne thinks, would be advantageous, as cold instead of hot water could then be employed. He thinks a similar plan might be introduced in the West Indies with great advantage, and that by employing the proper means to prevent fermentation the sun's heat would be quite sufficient to dry the cane slices.Mr. Dubranfaut and Mr. Rouseau's processes are patented in England. The terms for the use of the former would, I was told, be made so moderate, as to offer no obstruction to its being used in the colonies. What Mr. Rouseau's terms are I could not learn.There are now 288 works making beet root sugar in France, and over 30 in Belgium. The same manufacture is rapidly spreading in Germany and Russia, and is now being introduced in Italy. Whilst at Valenciennes, I learned that two English gentlemen had just preceded me in visiting the works in that neighbourhood, mentioning that they had in view introducing the beet root sugar manufacture in Ireland.The sugar crop of France was last year over 60,000,000 of kilogrammes (60,000 tons). For two years *Belgium has been exporting* to the Mediterranean. One maker told me that he had last year exported a considerable part of his crop. It would therefore appear, that even beet root sugar can compete in *other than the producing country* with the sugar of the tropics—a most significant hint that, unless the cane can be made to yield more and better sugar than is now generally got from it, there is some risk of its being ultimately beaten by the beet root, the cultivation of which is now carried on with so much profit that new works are springing up every year, in almost every country of the continent.In going through the French works, I made inquiries as to how far the procede Melsens had been adopted, and was everywhere told it was a total failure. I, however, determined to see Mr. Melsens and judge for myself how far it might be applicable to the cane, even if a failure with regard to the beet root. I, therefore, went on to Brussels, enclosed my letters of introduction and card, and received in return a note, appointing to meet me next morning. I found him one of the best and most obliging of men. He immediately offered to go over some experiments on beet root juice with me at his laboratory, where I accordingly spent the greater part of two days with him, and went over a variety of experiments; and from what I saw and assisted in doing, I feel strongly inclined to think that, notwithstanding the French commission at Martinique report otherwise, some modification of Mr. Melsens' process may be most advantageously employed in making cane sugar if not as a defecator, at least to prevent fermentation, and, probably, also as a decolorising agent.Mr. Melsens showed me letters he had received from Java from a person with whom he

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had no acquaintance, stating that he had used the bisulphate of lime with complete success; and whilst I was with him he again received letters from the same person, stating that by its use he had not only improved the quality of sugar, but had raised the return to 9 per cent. of the weight of cane. From the letters which I saw, the process appears to have been tried on a very large scale, with the advantage of filters and a vacuum pan. Where the old mode of leaving half the dirt with the sugar, and boiling up to a temperature of 340 degrees or thereby, is continued, I fear there is not much chance of either bisulphate or anything else making any very great improvement.

> The use of bisulphate of lime is patented in England and the colonies, but I believe I may state the charge for the right of using it will be made extremely moderate.

The points which appeared to me worthy of remark in visiting the beet-root sugar works are, the extreme care that nothing shall be lost—the great attention paid to cleanliness in every part of the process, besides the particular care given to defecation. No vessel is ever used twice without being thoroughly washed. Such a thing as the employment of an open fire in any part of the manufacture is quite unknown. Everything is done by steam, of a pressure of from 4 to 5 atmospheres. In the more recently started works, the evaporation is entirely carried on in vacuum. In some of the older works copper evaporators, heated by coils of steam piping, and having covers, with chimneys to carry off the vapor, are still used; but of the eight works I visited I only saw them in use in one of them, and they are nowhere used excepting to evaporate to the point when the second filtration takes place.The coolers I saw were invariably made of iron, and varied in depth from 2 to over 6 feet. These very deep vessels are used for the crystallization of sugar, made of the fourth, fifth and sixth re-boilings of molasses, which requires from three to six months.One thing struck me forcibly in going over the French and Belgian works; it was the extreme liberality with which I was allowed to go over every part of them; to remain in them as long as I pleased; had all my inquiries answered, and every explanation given; in most striking contrast to the grudging manner in which I have been trotted over some of the refineries in England, as if those who showed them were afraid I should gain any information on the subject of their trade.

Mr. H. Colman, speaking of the agriculture of the Continent, gives some information he obtained on the comparative cost of producing beet and cane sugar. A hectare (two and a half acres) produces, in the Isle of Bourbon, about 76,000 kilogrammes (a kilogramme is nearly two and one-fifth pounds) of cane, which will give 2,200 kilogrammes of sugar, and the cost for labor is 2,500 francs. A hectare of beet root produces 40,000 kilogrammes of roots, which yield 2,400 kilogrammes of sugar, and the expense of the culture is 354 francs. The cost of the cane sugar in this case is 27 centimes, and of the beet sugar 14 centimes only, per kilogramme.

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These are extraordinary statements, and will be looked at by the political economist and the philanthropist with great interest. There are few of the northern states of Europe, or of the United States, which might not produce their own sugar; and when we take into account the value of this product, even in its remains after the sugar is extracted, for the fattening of cattle and sheep, and of course for the enrichment of the land for the succeeding crops, its important bearing upon agricultural improvement cannot be exaggerated.

According to M. Peligot, the average amount of sugar in beets is 12 per cent.; but, by extraction, they obtain only 6 per cent. The cane contains about 18 per cent. of saccharine matter, but they get only about 71/2. The expense of cultivating a hectare of beets, according to Dombasle, is 354 francs. An hectare of cane, which produces 2,200 kilogrammes of sugar, in the Island of Bourbon, and only 2,000 in French Guiana, demands the labor of twelve negroes, the annual expense of each of whom is 250 francs, according to M. Labran.—(Commission of Inquiry in 1840.)

Sugar has become not only an article of luxury, but of utility, to such a degree, that a supply of it constitutes an important article of importation, and is of national consequence. For sugar the world has hitherto relied on the cane, with the exception of some parts of India, where the sugar palm yields it much more cheaply. The sugar cane is, however, a tropical plant, and, of course, its cultivation must of necessity be limited to such hot countries. France, during the wars of Napoleon, shut out from her Indian possessions or deprived of them, commenced making sugar from beets, and it proving unexpectedly successful and profitable, it has as we have just seen, extended not only over that empire, but nearly the whole of continental Europe, where it forms an important item in their system of cultivation and profit. The manufacture has been attempted in the United States; but though the facts of the ease and certainty with which the beets may be grown and their great value for stock has been fully ascertained, still little progress in the production of sugar from them has been made there.

MAPLE SUGAR.

There are few trees in the American forest of more value than the maple (*Acer saccharinum*). As an ornamental tree, it is exceeded by few; its ashes abound in alkali, and from it a large proportion of the potash of commerce is produced; and its sap furnishes a sugar of the best quality, and in abundance. It likewise affords molasses and an excellent vinegar. In the maple the sugar amounts to five per cent. of the whole sap. There is no tree whose shape and whose foliage is more beautiful, and whose presence indicates a more generous, fertile, and permanent soil than the rock maple: in various cabinet-work its timber vies with black walnut and mahogany for

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durability and beauty; and as an article of fuel its wood equals the solid hickory. Its height is sometimes 100 feet, but it usually grows to a height varying from forty to eighty feet. It is bushy, therefore an elegant shade tree. The maple is indigenous to the forests of America, and wherever there has been opportunity for a second growth, this tree attains to a considerable size much sooner than might be imagined. In the course of ten or fifteen years the maple becomes of a size to produce sugar. The trees which have come up since the first clearing, produce sap that yields much more saccharine than the original forest maples.

The whole interior of the northern part of the United States have relied, and still rely, more on their maple woodlands for sugar than on any other source; and as a branch of domestic manufacture and home production, the business is of no little consequence. The time occupied too in the manufacture is very limited, and occurs at a season when very little other labor can be performed.

Hitherto but comparatively little attention has been bestowed upon this important branch of industry in Canada. The inhabitants of that province might doubtless manufacture a sufficient quantity of maple sugar to supply the demand or consumption in this article for the whole population of the country. This variety of sugar may be refined, and made as valuable for table use as the finest qualities of West India sugar. On the south shore of Lake Huron, and the islands of that inland sea, there are forests of sugar

maple unsurveyed capable of producing a supply for the whole population. The Indians upon those islands have lately turned their attention pretty largely to the manufacture of sugar from the maple; and many tons have been exported from this source. If the Indians could obtain a fair value for their sugar, say seven or eight dollars per 100 lbs., they would extend their operations upon a large scale. Upon these islands alone, there are upwards of a million of full-grown maple trees, capable of yielding each from two and a half to three pounds of excellent sugar per annum; and if proper attention were given to this branch of production in that quarter, I see no reason why a most profitable business could not be carried on. Every farmer who has a grove of sugar maple, should endeavour to manufacture at least sufficient for the consumption of his own family. In most cases 150 trees of medium growth would yield an amount of sap that would make 300 lbs. of sugar, twenty-five gallons of molasses, and a barrel of vinegar. The labor required to manufacture this amount of sugar, molasses, and vinegar, would scarcely be felt by the well-organised cultivator, as the season for the business is at the close of the winter, and opening spring, when no labor can be done upon the land. In proportion to the amount of labor and money expended in the production of maple sugar, it is as capable of yielding as large

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a return of profits as any other branch of farm business. It is certainly an object of great national interest to the inhabitants of our North American Colonies, that they should supply their own market with such products as their highly-favored country is capable of producing. Sugar is an article which will ever find a ready sale at highly-remunerating prices, provided that it be properly manufactured and brought into market in good condition. It requires a little outlay at first to purchase buckets, cisterns, and boilers, to stock a sugar bush; but by carefully using the above necessary apparatus, they will last for a very long period. A farmer can supply himself with the suitable materials for performing the sugar business without any cost further than his own labor. The spring is the season of the year that everything should be put in readiness,—even the wood should be chopped and drawn to the spot, so that when the sap commences to run, there may be no impediments in the way to hinder the complete success of the business.

Large tracts of land in the Ottawa district are covered with the true sugar maple. It is found in great numbers in the eastern townships of Lower Canada, where considerable forests of miles in extent contain nothing else, and in other places it is mixed with various trees. There is scarcely a spot in Lower Canada where it is not to be met with. Capt. Marryatt has stated that there were trees enough on the shores of Lakes Huron and Superior, to supply the whole world with sugar. In the United States, the manufacture of the sugar was first attempted about the year 1752, by some farmers of New England, as a branch of rural economy. This gradually spread wherever the tree was known. Now it forms an article of food throughout a large portion of the country. Almost every farmer prepares sugar enough from the trees in his neighbourhood for the consumption of his family during the year, and has often a surplus for sale. It is much cheaper than muscovado, being sold at from 2d. to 31/2d. per pound, whilst common muscovado cannot be bought for less than 41/2d. to 5d. per pound.

The province of Canada produced nearly ten million pounds in 1852, 6,190,694 being made in Lower Canada, and 3,581,505 in Upper Canada. The quantity made in Lower Canada in 1849 was only about 1,537,093 lbs. The maple sugar product of the Canadas in 1848 was officially stated as follows:—

	lbs.
Upper Canada	4,160,667
Lower Canada	2,303,158

	6,463,835

This product is therefore of immense importance to the British North American provinces, all of which, under a judicious system, might be made to produce vastly increased quantities of this wholesome and valuable commodity.

The importation of sugar in Canada may very safely be computed at L40,000 per annum, and the whole of this amount of money could be retained in the country if the people would only look well to the matter.

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In tapping the tree, the gouge is the best implement that can be used, provided it is an object to save the timber. It is usual, when using the gouge, to take out a chip about an inch and a half in diameter; but this system is objectionable where the maple is not abundant, as it subjects the timber to decay; it is a better course to make an incision by holding the gouge obliquely upwards an inch or more in the wood. A spout, or spile, as it is termed, about a foot long, to conduct off the sap, is inserted about two inches below this incision with the same gouge. By this mode of tapping, the wound in the tree is so small that it will be perfectly healed or grown over in two years. A boiler, of thick sheet-iron, made to rest on the top of an arch, by which the sides would be free from heat, and only the bottom is exposed, is doubtless a secure and rapid process of evaporation. The sides and ends of the boiler may be made of well-seasoned boards, which will answer the same purpose as if made solely of sheet-iron. When the sap is boiled down into syrup or thin molasses, it must be taken out of the boiler and strained through a flannel cloth into a tub, where it should settle about twenty-four hours. The clear syrup should be separated from the sediment, which will be found in the bottom of the tub. The pure syrup must be boiled down into sugar over a slow fire. A short time, however, before the syrup is brought to a boiling heat, to complete the clarifying process, the whites of five eggs well beaten, about one quart of new milk, and a spoonful of saleratus, should be all well mixed with a sufficient amount of syrup, to make 100 lbs. of sugar. The scum which would rise on the top must be skimmed off. Caution is to be observed in not allowing the syrup to boil until the skimming process is completed. To secure a good article, the greatest attention must be bestowed in granulating the syrup. The boxes or tubs for draining should be large at the top and small at the bottom. The bottom of the tubs should be bored full of small holes, to let the molasses drain through. After it has nearly done draining, the sugar may be dissolved, and the process of clarifying, granulating, and draining repeated, which will give as pure a quality of sugar as the best refined West India article.

The greatest objections that are advanced against maple sugar are, that the processes made use of in preparing the sugar for market are so rude and imperfect that it is too generally acid, and besides charged with salts of the oxide of iron, insomuch that it ordinarily strikes a black color with tea. These objections may be removed without any comparative difficulty, as it has been proved to demonstration, by the application of one ounce of clear lime-water to a gallon of maple sap, that the acidity will be completely neutralised, and the danger of the syrup adhering to the sides of the boiler totally removed. The acid so peculiar to the maple sugar, when combined with lime in the

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above proportion, is found to be excessively soluble in alcohol; so much so, that yellow sugar can be rendered white in a few minutes by placing it in an inverted cone, open at the top, with small holes at the bottom, and by pouring on the base of the cone a quantity of alcohol. This should filtrate through until the sugar is white; it should then be dried and re-dissolved in boiling water, and again evaporated until it becomes dense enough to crystallise. Then pour it into the cones again, and let it harden. By this process a very white sample of sugar may be made, and both the alcohol and acids will be thoroughly dispelled with the vapor.

The process of making maple sugar it will be seen is very simple and easily performed. The trees must be of suitable size, and within a convenient distance of the place where the operations of boiling, &c., are to be performed. When gathered, the sap should be boiled as early as possible, as the quality of the sugar is in a great degree dependent on the newness or freshness of the sap. There is a tendency to acidity in this fluid which produces a quick effect in preventing the making of sugar; and which, when the sap is obliged to be kept for many hours in the reservoirs, must be counteracted by throwing into them a few quarts of slaked lime. During the time of sugar making, warm weather, in which the trees will not discharge their sap, sometimes occurs, and the buckets become white and slimy, from the souring of the little sap they contain. In this case they should be brought to the boiler and washed out carefully with hot water, and a handful of lime to each.

In reducing the sap, the great danger to be apprehended is from burning the liquid after it is made to the consistence of molasses, since, when this is done, it is impossible to convert it into sugar; a tough, black, sticky mass, of little value, being the result. Indeed, constant care and attention is required to produce a first-rate article: for though sugar may be made in almost any way where the sap can be procured, yet unless the strictest care is observed in the processes, in gathering and boiling the sap, clarifying the syrup, and in converting the syrup to sugar, a dirty inferior article will be made, instead of the beautiful and delicious sweet which the maple, properly treated, is sure to yield.

The quantity of sugar produced in a year varies considerably from the same trees. The cause of this difference is to be found in the depth of snow, continued cold, or a sudden transition from cold to warm, thus abridging the period of sugar-making. A sharp frost at night, with clear warm days, is the most favorable to the sugar-maker. Perhaps four pounds of sugar from a tree may be a pretty fair average of seasons generally, although we have known the growth to exceed six pounds, and sink as low as three. A man will take care of one hundred trees easily, during the season of sugar, which usually lasts from about the middle of March into April, perhaps employing him twenty days in the whole. Dr. Jackson, in his Report of the Maine Geological Survey, gives the following instances of the production of sugar in that State:—

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	Lbs. of Sugar.
At the Forks of the Kennebec, twelve persons made	3,605
On No. 1, 2d range, one man and a boy made	1,000
In Farmington, Mr. Titcomb made	1,500
In Moscow, thirty families made	10,500
In Bingham, twenty-five families made	9,000
In Concord, thirty families made	11,000

A cold and dry winter is followed with a greater yield of sugar from the maple than a season very moist and variable. Trees growing in wet places will yield more sap, but much less sugar from the same quantity, than trees on more elevated and drier ground. The red and white maple will yield sap, but it has much less of the saccharine quality than the rock or sugar maple.

The work begins usually about the first of March. The tree will yield its sap long before vegetation appears from the bud: frequently the most copious flow is before the snow disappears from the ground.

Some persons have a camp in their maple orchards, where large cauldrons are set in which to boil down the sap to the consistency of a thick syrup: others take the liquid to their houses, and there boil down and make the sugar.

The process begins by the preparation of spouts and troughs or tubs for the trees: the spouts or tubes are made of elder, sumach, or pine, sharpened to fit an auger hole of about three-fourths of an inch in diameter. The hole is bored a little upward, at the distance horizontally of five or six inches apart, and about twenty inches from the ground on the south or sunny side of the tree. The trough, cut from white maple, pine, ash, or bass wood, is set directly under the spouts, the points of which are so constructed as completely to fill the hole in the tree, and prevent the loss of the sap at the edges, having a small gimlet or pitch hole in the centre, through which the entire juice discharged from the tree runs, and is all saved in the vessels below. The distance bored into the tree is only about one-half an inch to give the best run of sap. The method of boring is far better for the preservation of the tree than boxing, or cutting a hole with an axe, from the lower edge of which the juice is directed by a spout to the trough or tub prepared to receive it. The tub should be of ash or other wood that will communicate no vicious taste to the liquid or sugar.

The sap is gathered daily from the trees and put in larger tubs for the purpose of boiling down. This is done by the process of a steady hot fire. The surface of the boiling kettle is from time to time cleansed by a skimmer. The liquid is prevented from boiling over by the suspension of a small piece of fat pork at the proper point. Fresh additions of sap are made as the volume boils away. When boiled down to a syrup, the liquor is set away in some earthen or metal vessel till it becomes cool and settled. Again the purest part is drawn off or poured into a kettle until the vessel is two-thirds

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full. By a brisk and continual fire, the syrup is further reduced in volume to a degree of consistence best taught by a little experience, when it is either put into moulds to become hard as it is cooled, or stirred until it shall be grained into sugar. The right point of time to take it away from the fire may be ascertained by cooling and graining a small quantity. The sediment is strained off and boiled down to make molasses.

The following is from a Massachusetts paper:—

The maple produces the best sugar that we have from any plant. Almost every one admires its taste. It usually sells in this market (Boston) nearly twice as high as other brown sugar. Had care been taken from the first settlement of the country to preserve the sugar maple, and proper attention been given to the cultivation of this tree, so valuable for fuel, timber, and ornament, besides the abundant yield of saccharine juice, we could now produce in New England sugar enough for our own consumption, and not be dependent on the labour of those who toil and suffer in a tropical sun for this luxury or necessary of life. But, for want of this friendly admonition,

“Axeman, spare that tree,”

the sturdy blows were dealt around without mercy or discretion; and the very generation that committed devastation in the first settlements in different sections of our country, generally lived to witness a scarcity of fuel; and means were resorted to for the purchase of sugar, that were far more expensive than would have been its manufacture, under a proper mode of economy in the preservation of the maple, and the production of sugar from its sap.Those who have trees of the sugar maple, should prepare in season for making sugar. In many localities, wood is no object, and a rude method of boiling is followed; but where fuel is very scarce, a cheap apparatus should be prepared that will require but little fuel. In some sections, broad pans or kettles have been made of sheet-iron bottoms, and sides of plank or boards, care being taken (continued) to allow the fire to come into contact with the iron only. These pans cost but a trifle, and, owing to their large surface, the evaporation is rapid.Another cheap construction for boiling with economy is, to make a tight box of plank, some four or five feet square—the width of a wide plank will answer, and then put into it, almost at the bottom, a piece of large copper funnel, say ten or twelve inches at the outer part, and then smaller. This funnel, beginning near one end, should run back nearly to the opposite side, then turn and come put at the opposite end, or at the side near the end, as most convenient, being in only two straight parts, that the soot may be cleared out. Each end should be made tight, with a flange nailed to the box. At the mouth of the large part there should be a door, to reduce the draught; here make the fire, and at the other end have a funnel to carry off the smoke. In this case, there is only sheet copper between the fire and the sap which surrounds the funnel, so that the heat is readily taken up by the liquid, and very little escapes. This is an economical plan for cooking food for stock, steaming timber, &c.For catching the sap, various kinds of vessels are used. The cheapest are made of white birch, which last one season, or less. Troughs of pine, or linden or bass wood, may be made for a few cents each, and they will last for a number of years, if inverted in the shade of trees. But these are inconvenient; and, after the first year, they become dirty, and clog the sap. Pails with iron hoops are the best, and, eventually, the cheapest. By painting and carefully preserving them, they will cost, for a course of years, about one cent each for a year.

Mr. Alfred Fitch, in the "Genesee Farmer," says:—

In clarifying, I use for 50 lbs. of sugar one pint of skimmed milk, put into the syrup when cold, and place it over a moderate fire until it rises, which should occupy thirty or forty minutes; then skim and boil until it will grain; after which I put it into a tub, and turn on a little cold water, and in a few days the molasses will drain out, and leave the sugar dry, light, and white.

Mr. E.W. Clark, of Oswego, furnishes the following:—

On Fining Maple Sugar.—The sweet obtained from the maple tree is undoubtedly the purest known; but from mismanagement in the manufacture it frequently becomes very impure. Its value is lessened, while the expense of making it increases. I am sensible that the method which I shall recommend is not altogether a new one, and that it is more by attending to some apparently minute and trivial circumstances, than to any new plan, that my sugar is so good. Much has been written upon, and many useful improvements been made in, that part of the process which relates to tapping the trees, and gathering and evaporating the sap, &c.; but still, if the final operation is not understood, there will be a deficiency in the quality of the sugar. I shall confine myself to that part of the operation which relates to reducing the syrup to sugar, as it is of the first importance. My process is this:—When the syrup is reduced to the consistence of West India molasses, I set it away till it is perfectly cold, and then mix with it the clarifying matter, which is milk or eggs. I prefer eggs to milk, because when heated the whole of it curdles; whereas milk produces only a small portion of curd. The eggs should be thoroughly beaten and effectually mixed with the syrup while cold. The syrup should then be heated till just before it would boil, when the curd rises, bringing with it every impurity, even the coloring matter, or a great portion of that which it had received from the smoke, kettles, buckets, or reservoirs. The boiling should be checked, and the scum carefully removed, when the syrup should be slowly turned into a thick woollen strainer, and left to run through at leisure. I would remark, that a great proportion of the sugar that is made in our country is not strained after cleansing. This is an error. If examined in a wine-glass, innumerable minute and almost imperceptible particles of curd will be seen floating in it, which, if not removed, render it liable to burn, and otherwise injure the taste and color of it.A flannel strainer does this much better than a linen one. It is, indeed, *indispensable*. As to the quantity of eggs necessary, one pint to a pailful of syrup is amply sufficient, and half as much will do very well. I now put my syrup into another kettle, which has been made perfectly clean and *bright*, when it is placed over a quick but solid fire, and soon rises, but is kept from overflowing by being ladled with a long dipper. When it is sufficiently reduced, (I ascertain this by dropping it from the point of a knife, while hot, into one inch of cold water—if done, it will not immediately mix with the water, but lies at the bottom in a round flat drop,) it is taken from the fire, and the foaming allowed to subside. A thick white scum, which is useable, is removed, and the sugar turned into a cask, placed on an inclined platform, and left undisturbed for six weeks or longer, when it should be tapped in the bottom and the molasses drawn off. It will drain perfectly dry in a few days.The sugar made in this manner is very nearly as white as lump sugar, and beautifully grained. We have always sold ours at the highest price of Muscovadoes; and even when these sugars have sold at eighteen cents, ours found a ready market at twenty. Two hands will sugar off 250 lbs. in a day. From the scum taken off in cleansing, I usually make, by diluting and recleansing, one-sixth as much as I had at first, and of an equal quality.It is not of much consequence as regards the quality of the sugar, whether care be taken to keep the sap clean or not. The points in which the greatest error is committed, are, neglecting to use a flannel strainer, or to strain after cleansing—to have the sugar kettle properly cleaned—and to remove the white scum from the sugar.

An important process of manufacturing maple sugar, which produces a most beautiful article, is also thus described in a communication by the gentleman who gained the first premium at the State Fair at Rochester in 1843, to the Committee on Maple Sugar of the New York State Agricultural Society.

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In the first place, I make my buckets, tubs, and kettles all perfectly clean. I boil the sap in a potash kettle, set in an arch in such a manner that the edge of the kettle is defended all around from the fire. I boil through the day, taking care not to have anything in the kettle that will give color to the sap, and to keep it well skimmed. At night I leave fire enough under the kettle to boil the sap nearly or quite to syrup by the next morning. I then take it out of the kettle, and strain it through a flannel cloth into a tub, if it is sweet enough; if not, I put it in a cauldron kettle, which I have hung on a pole in such a manner that I can swing it on or off the fire at pleasure, and boil it till it is sweet enough, and then strain it into the tub, and let it stand till the next morning. I then take it and the syrup in the kettle, and put it altogether into the cauldron, and sugar it off. I use, to clarify say 100 lbs. of sugar, the whites of five or six eggs well beaten, about one quart of new milk, and a spoonful of saleratus, all we'll mixed with the syrup before it is scalding hot. I then make a moderate fire directly under the cauldron, until the scum is all raised; then skim it off clean, taking care not to let it boil so as to rise in the kettle before I have done skimming it. I then sugar it off, leaving it so damp that it will drain a little. I let it remain in the kettle until it is well granulated. I then put it into boxes made smallest at the bottom, that will hold from fifty to seventy lbs., having a thin piece of board fitted in, two or three inches above the bottom, which is bored full of small holes, to let the molasses drain through, which I keep drawn off by a tap through the bottom. I put on the top of the sugar, in the box, a clean damp cloth; and over that, a board, well fitted in, so as to exclude the air from the sugar. After it has done draining, or nearly so, I dissolve it, and sugar it off again; going through with the same process in clarifying and draining as before.

The following remarks from Dr. Jackson, of Boston, may be of interest to the sections of the country where maple sugar is made:—

The northern parts of Maine, New Hampshire, Vermont, and New York, have dense forests of the sugar maple, and at present only very rude processes are made use of in preparing the sugar for market, so that it is too generally acid and deliquescent, besides being charged with salts of the oxide of iron, insomuch that it ordinarily strikes a black color with tea. To remedy these difficulties was the object of my researches; while, at the same time, I was engaged in ascertaining the true composition of the sap, with a view to the theory of vegetable nutrition.I received several gallons of freshly-drawn maple sap from Northampton, Warner, and Canterbury, and made analyses of each lot, separating the acids, salts, and the sugar. I also analysed the

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sap of the yellow and white birch, which do not give any crystallisable sugar, but an astringent molasses.I shall now communicate to you the process by which I manufactured sugar maple sap, received from the Shakers of Canterbury, who collected it with care in a clear glass demijohn, and sent it forthwith, so that it came to me without any change of composition, the weather being cold at the time. The evaporation was carried on in glass vessels until the sap was reduced to about one-eighth its original bulk, and then it was treated with a sufficient quantity of clear lime-water to render it neutral, and the evaporation was completed in a shallow porcelain basin. The result was, that a beautiful yellow granular sugar was obtained, from which not a single drop of molasses drained, and it did not deliquesce by exposure to the air. Another lot of the sap, reduced to sugar without lime-water, granulated, but not so well, was sour to the taste, deliquesced by exposure, and gave a considerable quantity of molasses.Having studied the nature of the peculiar acid of the maple, I found that its combinations with lime were excessively soluble in alcohol, so that the yellow sugar first described could be rendered white in a few minutes, by placing it in an inverted cone open at the bottom, and pouring a fresh quantity of alcohol upon it, and allowing it to filtrate through the sugar. The whitened sugar was then taken and re-dissolved in boiling water and crystallised, by which all the alcoholic flavour was entirely removed, and a perfectly fine crystallised and pure sugar resulted. Now, in the large way, I advise the following method of manufacturing maple sugar. Obtain several large copper or brass kettles, and set them up in a row, either by tripods with iron rings, or by hanging them on a cross-bar; clean them well, then collect the sap in buckets, if possible, so that but little rain-water will be mixed with the sap, and take care not to have any dead leaves in it. For every gallon of the maple sap *add one measured ounce* of clear lime-water, pass the sap into the first kettle and evaporate; then, when it is reduced to about one-half, dip it out into the second kettle, and skim it each time; then into the next, and so on, until it has reached the last, where it is reduced to syrup, and then may be thrown into a trough, and granulated by beating it up with an oar.As soon as the first kettle is nearly empty, pour in a new lot of the sap, and so continue working it forward exactly after the manner of the West India sugar-boilers. The crude sugar may be refined subsequently, or at the time of casting it into the cones made of sheet iron, well painted with white lead and boiled linseed oil, and thoroughly dried, so that no paint can come off. These cones are to be stopped at first, until the sugar is cold; then remove the stopper and pour on the base of the cone a quantity of strong

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whiskey, or fourth proof rum. Allow this to nitrate through, until the sugar is white; dry the loaf, and redissolve it in boiling hot water, and evaporate it until it becomes dense enough to crystallise. Now pour it into the cones again, and let it harden. If any color remains, pour a saturated solution of refined white sugar on the base of the cone, and this syrup will remove all traces of color from the loaf.One gallon of pasture maple sap yielded 3,451 grains of pure sugar. One gallon of the juice of the sugar cane yields, on an average, in Jamaica, 7,000 grains of sugar. Hence, it will appear that maple sap is very nearly half as sweet as cane juice; and since the maple requires no outlay for its cultivation, and the process may be carried on when there is little else to be done, the manufacture of maple sugar is destined to become an important department of rural economy. It is well known, by the Report of the Statistics of the United States, that Vermont ranks next to Louisiana as a sugar state, producing (if I recollect correctly) 6,000,000 of pounds in some seasons, though the business is now carried on in a very rude way, without any apparatus, and with no great chemical skill; so that only a very impure kind of sugar is made, which, on account of its peculiar flavor, has not found its way into common use, for sweetening tea and coffee. It would appear worth while, then, to improve this manufacture, and to make the maple sugar equal to any now in use. This can be readily accomplished, if the farmers in the back country will study the process of sugar-making, for cane and maple sugar are, when pure, absolutely identical. It should be remarked, that forest maples do not produce so much sugar as those grown in open fields or in groves, where they have more light, the under-brush being cleared away.In Farmington, on the Sandy River, in Maine, I have seen a very fine grove of maples, but thirty years old, which produced a large yield of very good sugar. A man and two boys made 1,500 lbs. of sugar from the sap of these trees in a single season. The sap was boiled down in potash kettles, which were scoured bright with vinegar and sand. The sugar was of a fine yellow color, and well crystallised. It was drained of its molasses in casks, with a false bottom perforated with small holes—the cask having a hole bored at the bottom, with a tow plug placed loosely in it, to conduct off the molasses. This method is a good one, but the sap ought to be limed in boiling, as I have described; then it will not attach to the iron or copper boilers. The latter metal must not be used with acid syrup, for copper salts are poisonous.

There are several towns in the northern sections of Maine, New Hampshire, and Vermont, that produce more than sufficient sugar for the consumption of their inhabitants. A lot of good sugar trees will average four pounds to the tree, in a favorable season. Many farmers have orchards that will yield five hundred to a thousand pounds of sugar in a year. As this is made at a season interfering very little with the general business of the farm, the sugar that the farmer makes is so much clear gain.

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There is, on almost every hill-farm, some place favorable for the growth of a maple orchard—some rocky spots yielding little grass, and impervious for the plough. Such spots may be favorably chosen for the growth of a maple orchard; and whether the increase be used for manufacturing sugar or molasses, or for timber or fuel, the proprietor of the land will find a profit better than money at interest in the growth of this beautiful tree, which will spontaneously propagate itself in many positions.

Its great excellence consists in yielding sap for the manufacture of vast quantities of maple sugar in the country during the months of spring. An open winter, constantly freezing and thawing, is a forerunner of a bountiful crop of sugar. The orchard of maple trees is almost equal to a field of sugar cane of the same area, in the production of sugar. This tree reaches an age of 200 years.

Vermont is the second sugar-producing State in the Union. The amount of maple sugar produced there in 1840 was over 2,550 tons, being more than 173/4 pounds to each inhabitant, allowing a population of 291,948. At five cents a pound, this is worth. 255,963 dols. 20 cents.

The Statistics of the United States census for 1850, show that about thirty-five millions of pounds (15,250 tons) of maple sugar were manufactured in that year:—

Maine	97,541
New Hampshire	1,392,489
Massachusetts	768,596
Vermont	5,159,641
Connecticut	37,781
New York	10,310,764
New Jersey	5,886
Pennsylvania	2,218,641
Maryland	47,740
Virginia	1,223,908
North Carolina	27,448
South Carolina	200
Georgia	50
Alabama	473
Mississippi	110
Louisiana	260
Arkansas	8,825
Tennessee	159,647
Kentucky	388,525
Ohio	4,528,548
Michigan	2,423,897

Indiana	2,921,638
Illinois	246,078
Missouri	171,942
Iowa	70,684
Missouri	661,969
Minnesota	2,950

Total	32,776,671

There is a balance of about two million pounds produced by Rhode Island, Texas, Oregon, California, Utah, New Mexico, Delaware, and Florida. The above statement does not include the sugar made by the Indians, east of the Mississippi river, which may be set down at 10,000,000 lbs., and west of that river 2,000,000 lbs.

Besides the above sugar crop, there was a yield by the sugar maple in the United States in 1850, of 40,000,000 gallons of maple molasses.

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Maize Sugar.—The stem and branches of Indian corn, during the time that its grain is filling, abounds with sugar, even when grown in this country; so much so, that it might be turned to account by those of the peasantry who have small plots of ground attached to their cottages; and I applied a simple method by which a rich syrup may be obtained from it, equal in sweetness to treacle, and superior to it in flavor. The proper time for cutting down the plant (which should be done within an inch of the ground), is when the corn in the ear is small and full of a milky juice. All the large and old leaves should be stripped off, leaving only the young and tender ones; they should then be cut into short lengths, thoroughly bruised, and the juice entirely pressed out from them. Where the means cannot be obtained for expressing the juice by this method, the following may be employed:—After the plants have been cut into small pieces, put them into a large pot or copper, with only just sufficient water to extract the juice; boil for one hour, and then strain off the liquor; to each gallon of this liquor add a wine-glass full of lime-water whilst warm; but if it be the expressed juice, obtained as above mentioned, add double the quantity of lime-water. When the liquor is cold, for every three gallons beat up an egg with some of the liquor; put altogether into a boiler, and boil gently till the syrup acquires the consistence of treacle. Whilst this is going on, the liquor should every now and then be well stirred, and the scum which rises to the surface taken off. This syrup, which will be found a better substitute for sugar than treacle, and more wholesome, should be kept in lightly-covered vessels, in a dry place.

My own observations, twelve years ago, acquainted me with the fact, that when the grain in the ear has acquired one half of the full size, the quantity of sugar in the sap has passed its maximum, or begun to decrease, and continues to do so until it disappears entirely. Lopping off the young ears makes shorter work of it. It is like taking the young from an animal giving suck, in which case the milk soon ceases to flow into the breast, and that which produced it is elaborated into other fluids necessary to the nourishment of the different parts of the body of the parent. In the corn-stalk, when deprived of its ears, the elements of sugar are dissipated by increasing the size of the plant.

Sugar may also be obtained from the carrot and the parsnip, as well as from all sweet fruits. It is abundant throughout the vegetable kingdom; it forms the first food of plants when they germinate in the seed; when the first little sprout is projected from a grain of corn, a portion of the farina, or starch, is changed into sugar, which may be called the blood of the plant, and from it is drawn the nourishment necessary to its expansion and appearance above the surface of the earth. In the latter growth of many plants an inverse process is carried on, as in the Indian corn, which I have just spoken of. In this instance, as also numberless others, sugar is formed in large quantities in the body of the plant, and elaborated into farina, or starch, in the ear. The elements of which sugar and starch are composed are the same; the only difference is in their proportions. Chemists, being aware of this, have converted starch into sugar; and could do it with certainty to any extent, were any advantage to be gained by it; but hitherto starch has been higher in price than sugar.

SECTION II.

THE GRAIN CROPS, EDIBLE ROOTS, AND FARINACEOUS PLANTS FORMING THE BREAD STUFFS OF COMMERCE.

The vegetable substances, from which man derives his principal sustenance, such as the nutritious cereal grains, the tuberous rooted plants and the trees yielding farina, are very widely diffused, and necessarily occupy the main attention of the cultivator; their products forming the most important staples of domestic and foreign commerce. The cereal grasses and roots, cultivated in temperate regions, such as wheat, barley, oats, rye, and the potato, are so well known, and have been so fully described by agricultural writers that I shall not go much into details as to their varieties, culture, &c., but confine myself chiefly to their distribution, produce, statistics, and commercial importance. The food plants may be most conveniently arranged under three heads. Firstly—the Grain crops and legumes, which comprises the European cultivated grasses, wheat, barley, oats, &c.; and the tropical ones of rice, maize, millet, Guinea corn, &c. Secondly—-Palms and other trees yielding farina, including the sago palms, plantain and banana, and the bread fruit tree. And Thirdly—the edible Root crops and Starch producing plants, which are a somewhat extensive class, the chief of which, however, are the common potato, yams, cocos or eddoes, sweet potatoes, the bitter and sweet cassava or manioc, the arrowroot and other plants yielding starch in more or less purity.

There is a great diversity of food, from the humble oak bark bread of the Norwegian peasant, or the Brahmin, whose appetite is satisfied with vegetables, to the luxurious diet of a Hungarian Magnate at Vienna.

The bread stuffs, as they are popularly termed, particularly wheat and wheat flour, maize, and rice, form very important articles of commerce, and enter largely into cultivation in various countries for home consumption and export. Russia, India, and the United States, carry on a very considerable trade in grain with other countries. Our local production being insufficient for food and manufactures, we import yearly immense quantities of grain and flour. In the four years ending 1852, the annual quantity of corn, of various, kinds, imported into the United Kingdom, exclusive of flour and meal, rice, sago, &c., averaged 8,085,903 quarters.

The flour and meal imported, omitting sago, arrowroot and other starches, averaged in the same period 4,143,603 cwts. annually.

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The annual imports of breadstuffs for food, taking the average of the four years ending with 1852, may be thus summed up—

	Tons.
Corn and grain, 8,085,903 quarters, at 60 lb. the bushel	173,270
Flour and meal	207,180
Rice	40,817
Potatoes	42,440
Sago, arrowroot, &c.	5,000

Total	468,707

Some portion of this quantity is doubtless consumed in the arts—as starch for stiffening linens, &c., and for other purposes not coming under the term of food, but I have purposely left out in the calculation about 30,000 to 40,000 quarters of rice in the husk annually imported.

Ireland took, in 1849, of foreign grain 2,115,129 quarters; 1,683,687 quarters in 1850; and 2,504,229 in 1851; as well as 256,837 cwts. of various kinds of meal and flour in 1849; 220,107 cwts. in 1850; and 341,680 cwts. in 1851. England also supplied her with about 500,000 quarters of grain and 350,000 cwts. of meal in each of those years.

The comparative returns of the importations of grain into the United Kingdom for the last four years, are as follows, in quarters:—

	1852.	1851.	1850.	1849.
Wheat	3,068,892	3,812,009	3,738,995	3,845,378
Barley	656,737	829,564	1,035,903	1,381,008
Oats	995,480	1,198,529	1,154,473	1,267,106
Rye	10,023	24,609	98,836	240,566
Beans	371,250	318,502	443,306	457,933
Peas	107,017	99,399	181,419	234,366
Maize	1,479,891	1,807,636	1,277,071	2,224,459
Other sorts	8,085	3,432	868	1,150
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Quarters	6,667,375	8,124,280	7,930,871	9,651,966

The meal and flour imported in the same years, in cwts., were as follows:—

	1852.	1851.	1850.	1849.
Wheat	3,889,583	5,314,414	3,819,440	3,349,839
Barley	212	34	108	224
Oats	521	2,525	5,999	40,230
Rye	92	6,493	964	18,468

Indian corn 742 9,561 11,334 101,683
Other sorts 54 343 163 1,396
--------- --------- --------- ---------
Cwts. 3,891,195 5,323,370 3,838,008 3,511,840

Before the famine in Ireland the imports seldom reached 20 millions of bushels of grain and meal of all kinds. In 1848 our imports were about 60 millions; in 1849, 85 millions; in 1850, 68 millions; in 1851, 751/2 millions; in 1852, 69 millions, with good wheat harvests; showing the great shock received and the slowness of recovery.

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With a rapidly increasing population in all parts of the civilized world, the production of bread is obviously the first object to be sought after, alike by the statesman and the peasant. I scarcely dare give the calculation of the immense amount which would be realised in any great country, by the single saving of a bushel to an acre, in the quantity of seed ordinarily sown. The same result would follow if an additional bushel could be produced in the annual average yield of the wheat crop.

According to Mr. H. Colman, the annual amount of seed for wheat sown in France is estimated at 32,491,978 bushels. If we could suppose a third of this saved, the saving would amount to 10,863,959 bushels per year. Suppose an annual increase of the crops of five bushels per acre, this would give an increase of production of 54,319,795 bushels. Add this, under improved cultivation, to the amount of seed saved, and the result would be 65,183,754 bushels—I believe under an improved agriculture this is quite practicable.

An eminent agricultural writer placed the average yield in England at eighteen bushels per acre; some years since a man of sanguine temperament rated it at over thirty bushels. In France it is stated, in the best districts, to average twenty-two bushels. These evidently are wholly conjectural estimates. In England Mr. Colman states that fifty bushels per acre were reported to him on the best authority, as the yield upon a large farm in a very favorable season. More than eighty bushels have been returned, upon what is deemed ample testimony, to the Royal Agricultural Society of England, as the product of a single acre. In France Mr. Colman had, upon credible authority, reports of forty, forty-four and seventy-two bushels. It would be of immense importance to any government to know the exact produce grown in any county, or district, or in the whole country; and this might be obtained by compelling, on the part of the owner or cultivator, an actual return of his crop; but it is of little use to found such returns on estimates purely conjectural.

From the best statistical accounts that can be obtained, the wheat annually produced in the United Kingdom.

England, Scotland, Ireland is	111,681,320 bushels.
In France it is	198,660,000 "
United States	100,503,899 "

The amount of seed ordinarily sown to the acre in France is from two to three bushels. The return of crop for the seed sown is represented as in the best districts averaging 6.25 for one; in the least productive 5.40 for one. My readers may be curious to know the calculations which have been made in some other countries in regard to this matter.

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CENTRAL EUROPE

Countries.	Year.	Increase for seed sown.
Spain	1828	6 for one
Portugal	1786	10 "
Tuscany		10 "
Plains of Lucca		15 "
Piedmont—Plains of Marengo		4 to five
Bologna		15 "
Roman States—Pontine marshes		20 "
Ordinary lands		8 "
Kingdom of Naples—best districts		20 "
Ordinary lands		8 "
Malta—the best lands		38 to 64 "
Ordinary lands		22, 25, 30 "

NORTHERN EUROPE.

Sweden and Norway 1838 4.50 for one Denmark 1827 6 " Russia, a good harvest 1819 5 " —— province of Tambof 1821 4.50 " —— provinces north of 50 deg. latitude 1821 3 " Poland 1826 8 " England 1830 9 " Scotland 1830 8 " Ireland 1825 10 " Holland 1828 7.50 " Belgium 1828 11 " Bavaria 1827 7 to 8 " Prussia 1817 6 " Austria 1812 7.05 " Hungary 1812 4 " Switzerland, lands of an inferior quality 1825 3 "
Of a good quality, 8; of the best quality 12 "
France, inferior lands, 3; best lands 6 "

(Statistique des Cereales de la France par Moreau de Jonnes.)

STATISTICS OF WHEAT CULTURE.

As wheat forms the principal nutritious food of the world, claiming the industrious application of labor over the greater part of Europe, throughout the temperate regions of Asia, along the northern kingdoms of Africa, and extending far into the northern and southern regions of the American continents; as it has been cultivated from time immemorial, and has produced in various climates and soils many varieties; it is surprising that so little is generally known of the distinct varieties best adapted to particular climates—and that in Great Britain and the United States we have yet to learn the variety which will yield the largest and best amount of human food!

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At the Industrial Exhibition in 1851, twenty-six premiums only were distributed for specimens of wheat; of these, five were awarded to British farmers, three to France, three to Russia, three to Australia, three to the United States, and one each or severally to other nations. Some beautiful specimens of wheat were exhibited from South Australia, weighing seventy pounds a bushel; which were eagerly sought after for seed wheat by our farmers and the colonists of Canada and the United States. But as is well observed by Professor Lindley, it has no peculiar constitutional characteristics by which it may be distinguished from other wheats. Its superior quality is entirely owing to local conditions; to the peculiar temperature, the brilliant light, the soil, and those other circumstances which characterise the climate of South Australia.

All kinds of wheat contain water in greater or lesser quantities. Its amount is greater in cold countries than in warm. In Alsace from 16 to 20 per cent.; England from 14 to 17 per cent.; United States from 12 to 14 per cent.; Africa and Sicily from 9 to 11 per cent. This accounts for the fact, that the same weight of southern flour yields more bread than northern, English wheat yields 13 lbs. more to the quarter than Scotch. Alabama flour, it is said, yields 20 per cent. more than that of Cincinnati. And in general American flour, according to one of the most extensive London bakers, absorbs 8 or 10 per cent. more of its own weight of water in being made into bread than the English. The English grain is fuller and rounder than the American, being puffed up with moisture.

Every year the total loss in the United States from moisture in wheat and flour is estimated at four to five million dollars. To remedy this great evil, the grain should be well ripened before harvesting, and well dried before being stored in a good dry granary. Afterwards, in grinding and in transporting, it should be carefully protected from wet, and the flour be kept from exposure to the atmosphere. The best precaution is kiln-drying. By this process the wheat and flour are passed over iron plates heated by steam to the boiling point. From each barrel of flour 16 or 17 pounds of water are thus expelled, leaving still four or five per cent. in the flour, an amount too small to do injury. If all the water be expelled, the quality of the flour is deteriorated.

The mode of ascertaining the amount of water in flour is this; take a small sample, say five ounces, and weigh it carefully; put it into a dry vessel, which should be heated by boiling water; after six or seven hours, weigh it; its loss of weight shows the original amount of water.

The next object is to ascertain the amount of gluten. Gluten is an adhesive, pasty mass, and consists of several different principles, though its constitution has not yet been satisfactorily determined. It is chiefly the nutritious portion of the flour. The remaining principles are mostly starch, sugar and gum. On an average their relative amount in 100 parts are about as follows:—

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Average.	Kobanga wheat, the best.	
Water	13	12
Gluten	12	16
Starch	67	60
Sugar and Gum	8	8
——	——	
100	97	

Professor Beck examined thirty-three different samples from various parts of the United States and Europe, and he gives the preference to the Kobanga variety from the south of Russia. There would probably be a prejudice against it in this country, from the natural yellowish hue of its flour and bread.

The value of the vegetable food, grain, potatoes, rice and apples exported from the United States within the past few years is thus set down:—

	Dollars.
1847	57,970,356
1848	25,185,647
1849	25,642,362
1850	15,822,273

To this has to be added nine or ten million dollars more for tobacco, 72 million dollars for cotton, and 180,000 dollars for hops and other minor agricultural staples—making the value of the raw vegetable exports about 98 million dollars. There is further the value of the products of the forest, timber, ashes and bark, tar, &c., which are equal to nearly seven millions more, as shown by the following figures:—

	Dollars.
1847	5,248,928
1848	6,415,297
1849	5,261,766
1850	6,590,037

It appears from an official document of the American Treasury Department, that the average value of the breadstuffs and provisions annually exported from the United States from 1821 to 1836 inclusive, was 12,792,000 dolls.; in 1837 and 1838, about

9,600,000 dolls.; from 1839 to 1846, 16,176,000 dolls.; and for the last seven years as follows:—

	Dollars.
1846	27,701,121
1847	68,701,921
1848	37,472,751
1849	38,155,507
1850	26,051,373
1851	21,948,651
1852	25,857,027

Out of the wheat crop in the United States in 1846 of 110 million bushels raised, 10 millions were used for seed, starch, &c.; 72 consumed for food, and 28 million exported. The 460 million bushels of Indian corn raised, were thus disposed of; exported to foreign countries 22 million bushels; sold to and consumed by non-producers, 100 million; consumed on the farms and plantations of the producers for human and animal food, seed, &c., 338 million bushels.

The United States now produce about 120 million bushels of wheat, and nearly 600 million bushels of corn. Their surplus of wheat, for export, may be taken at 20 million bushels, and of Indian corn an almost unlimited quantity. They export about one and a quarter million barrels of flour, and about one million of bushels of wheat to other markets besides those of Great Britain or her North American colonies, *viz*., to Europe, Asia, Africa, the West Indies and South America, California and Australia, manufactured flour being the article required for these latter markets. Nearly four million bushels of Indian corn, and 300,000 barrels of corn meal, are exported from the United States to the West Indies and other foreign markets.

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From the abstracts of statistical returns prepared at the American Census office, it appears that Pennsylvania, in 1850, was the largest wheat producing State of the Union. I have had the curiosity to compare the most prominent States in respect to this crop, and give them below, with the crop of each, as shown by the returns:—

	Bushels.
Pennsylvania	15,482,191
Ohio	14,967,056
Virginia	14,516,900
New York	13,073,000
Michigan	4,918,000
Maryland	4,494,680

That the United States could export 6,000,000 bushels of wheat, and its equivalent in flour in 1845; 13,000,000 in 1846, 26,000,000 in 1847, and then fell back to 13,000,000 in 1848, and 6,000,000 in 1849, with their production of wheat constantly increasing throughout this period, shows a wonderful elasticity, and extensive home market. If the price of wheat is higher in proportion than for corn, the Americans export the former and consume the latter; if the demand for corn be also great, they kill their hogs and export corn, for the pork will keep. If there be no great demand for either, they eat their surplus wheat, feed their hogs with the corn, and export pork as having the greatest value in the least bulk.

DESTINATION OF FLOUR SHIPPED FROM THE UNITED STATES.

WHERE TO.	1847	1849	1850	1851
Swedish West Indies	7,366	7,573	8,757	5,315
Danish ditto	52,150	49,568	44,802	60,102
Dutch East Indies	1,150	4,625	1,600	1,873
Dutch West Indies	11,387	17,221	18,354	19,217
Holland and Belgium	73,871	727	1,177	594
England	2,475,076	953,815	369,777	1,004,783
Gibraltar	23,974	6,265	2,543	195
British East Indies	3,034	791	1,646	1,600
British West Indies	320,363	303,551	250,776	294,731
British American Colonies	272,299	294,891	244,072	252,380
France	612,641	—	—	—

French West Indies	28,966	5,554	5,480	7,902
Hayti	40,257	10,903	31,504	43,867
Cuba	50,046	7,154	5,584	5,611
Spanish West Indies	17,780	6,429	7,074	2,285
Madeira	4,856	4,358	6,321	7,006
Cape de Verds	1,634	501	455	838
Mexico	5,928	11,633	9,736	14,964
Honduras	10,686	4,125	4,725	5,912
Central America	550	4,180	746	2,573
Columbia	39,403	32,251	41,072	47,477
Brazil	270,473	328,129	295,415	374,711
Argentine Republic	10,684	6,599	4,901	22,612

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Chili	5,977	5,129	2,848	4,327
South America	2,128	—	40	200
West Indies	4,902	3,984	1,702	4,079
Africa	25,728	4,617	5,524	5,430
North-west Coast	764	1,180	858	2,593
Other ports	29,866	35,017	18,949	19,158
Total—Barrels	4,382,496	2,108,013	1,385,448	2,202,335
Average price	5.95	5.35	5.00	4.77

Wheat, where the soil and the climate are adapted to its growth, and the requisite progress has been made in its culture, is decidedly preferred to all other grains, and, next to maize, is the most important crop in the United States, not only on account of its general use for bread, but for its safety and convenience for exportation. It is not known to what country it is indigenous, any more than any other cultivated cereals, all of which, no doubt, have been essentially improved by man. By some, wheat is considered to have been coeval with the creation, as it is known that upwards of a thousand years before our era it was cultivated, and a superior variety had been attained. It has steadily followed the progress of civilisation from the earliest times, in all countries where it would grow. In 1776 there was entailed upon America an enduring calamity, in consequence of the introduction of the Hessian or wheat fly, which was supposed to have been brought from Germany in some straw, employed in the debarkation of Howe's troops on the west end of Long Island. From that point the insect gradually spread in various directions, at the rate of twenty or thirty miles a year, and the wheat of the entire regions east of the Alleghanies is now more or less infested with the larva, as well as in large portions of the States bordering on the Ohio and Mississippi, and on the great Lakes; and so great have been the ravages of these insects that the cultivation of this grain has in many places been abandoned.

The geographical range of the wheat region in the Eastern Continent and Australia, lies principally between the 30th and 60th parallels of north latitude, and the 30th and 40th degrees south, being chiefly confined to France, Spain, Portugal, Italy, Sicily, Greece, Turkey, Russia, Denmark, Norway, Sweden, Poland, Prussia, Netherlands, Belgium, Great Britain, Ireland, Northern and Southern Africa, Tartary, India, China, Australia, Van Diemen's Land, and Japan. Along the Atlantic portions of the Western Continent, it embraces the tract lying between the 30th and 50th parallels, and in the country westward of the Rocky Mountains, one or two more degrees further north. Along the west coast of South America, as well as in situations within the torrid zone, sufficiently elevated above the level of the sea, and properly irrigated by natural or artificial means, abundant crops are often produced.

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The principal districts of the United States in which this important grain is produced in the greatest abundance, and where it forms a leading article of commerce, embrace the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, Ohio, Kentucky, Michigan, Indiana, Illinois, Missouri, Wisconsin, and Iowa. The chief varieties cultivated in the Northern and Eastern States are the white flint, tea, Siberian, bald, Black Sea, and the Italian spring wheat. In the middle and Western States, the Mediterranean, the Virginia white May, the blue stem, the Indiana, the Kentucky white bearded, the old red chafet, and the Talavera. The yield varies from ten to forty bushels and upwards per acre, weighing, per bushel, from fifty-eight to sixty-seven pounds.

It appears that on the whole crop of the United States there was a gain during the ten years ending 1850, of 15,645,373 bushels. The crop of New England decreased from 2,014,000 to 1,078,000 bushels, exhibiting a decline of 936,000 bushels, and indicating the attention of farmers has been much withdrawn from the culture of wheat. Grouping the States from the Hudson to the Potomac, including the district of Columbia, it appears that they produced, in 1849, 35,085,000 bushels, against 29,936,000 in 1839. In Virginia there was an increase of 1,123,000 bushels. These States embrace the oldest wheat-growing region of the country, and that in which the soil and climate seem to be adapted to promote the permanent culture of the grain. The increase of production in the ten years has been 6,272,000 bushels, equal to 15.6 per cent. The area tilled in these States is 36,000,000 acres, only thirty per cent. of the whole amount returned, while the proportion of wheat produced is forty-six per cent. In North Carolina there has been an increase of 170,000 bushels, but in the Southern States generally there was a considerable decrease. Indiana, Illinois, Michigan, and Wisconsin contributed to the general aggregate under the sixth census only 9,800,000 bushels; under the last they are shown to have produced upwards of 25,000,000 bushels, an amount equal to the whole increase in the United States for the period.

When we see the growth of wheat keeping pace with the progress of population in the oldest States of the Union, we need have no apprehension of a decline in the cultivation of this important crop.

The amount of flour exported from New Jersey in 1751, was 6,424 barrels. From Philadelphia in 1752,125,960 barrels, besides 85,500 bushels of wheat; in 1767, 198,816 barrels, besides 367,500 bushels of wheat; in 1771, 252,744 barrels. From Savannah, in 1771, 7,200 lbs. From Virginia, for some years annually preceding the revolution, 800,000 bushels of wheat. The total exports of flour from the United States:

in 1791 were 619,681 barrels, besides 1,018,339 bushels of wheat; in 1800, 653,052 barrels, besides 26,853 bushels of wheat; in 1810, 798,431 barrels, besides 325,924 bushels of wheat; in 1820-21, 1,056,119 barrels, besides 25,821 bushels of wheat; in 1830-31, 1,806,529 barrels, besides 408,910 bushels of wheat; in 1840-41, 1,515,817 barrels, besides 868,585 bushels of wheat; in 1845-46, 2,289,476 barrels, besides

1,613,795 bushels of wheat; in 1846-47, 4,382,496 barrels, besides 4,399,951 bushels of wheat; in 1850-51, 2,202,335 barrels, besides 1,026,725 bushels of wheat.

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In the London Exhibition very little wheat was exhibited equal to that from the United States, especially that from Genessee county, in the State of New York—a soft white variety, to the exhibitor of which a prize medal was awarded by the Royal Commissioners. The red Mediterranean wheat exhibited from the United States attracted much attention. The wheat from South Australia was probably superior to any exhibited, while much from the United States fell but little behind, and was unquestionably next in quality.

From the Second Report on the Breadstuffs of the United States, made to the Commissioner of Patents, by Lewis C. Beck, M.D., I am induced to make some extracts. He states:—

The analyses of several samples, the growth of various foreign countries, have afforded me an opportunity of comparing the American and foreign wheats and flours. With a few exceptions of peculiar varieties, it will be seen from the results that with ordinary care the wheat of this country will compare advantageously with that of any other. Indeed, on reviewing my analyses, I question whether there is any part of the world where this grain is generally of a finer quality than it is in the United States. But all the advantages which we possess in this respect will be of little avail so long as inferior and damaged breadstuffs are shipped from our ports.In addition to the analyses which I have executed of the various samples of wheat and wheat flour according to the mode heretofore pursued, I have performed a series of experiments for the purpose of settling the important question in regard to the relative value of the fine flour of wheat, and the "whole meal." I have also consulted every work within my reach which could throw any light upon the different points that have presented themselves during the progress of the investigation.

> The large number of samples of wheat and wheat flour which have been placed in my hands for examination, have left me no time for the analysis of our other breadstuffs.

It cannot be denied that the amount shipped to foreign ports during 1849 is considerably less than for the two preceding years. In the meantime, however, a new and important market has been opened in our territories on the Pacific. It may also be safely affirmed that the causes for foreign demand, and which must hereafter operate, still remain. These are the cheapness of land in this country, and the peculiar adaptation of our soil and climate to the growth of the two important cereals, wheat and maize.Another fact, it seems to me, is of sufficient interest in connection with this subject, to be here noticed. The failure of the potato crop in various parts of the world for several years past has engaged the attention of scientific and practical men. Unfortunately, the nature of the blight which has seized upon this tuber

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has eluded the most careful inquiries; but it has been shown by well-conducted analyses that potatoes at their late prices are the most expensive kind of farinaceous food. This will be evident from the following statement:—“Potatoes contain from about seventy to seventy-nine per cent. of water, while the proportion in wheat flour is from twelve to fourteen per cent; and while the gluten and albumen in potatoes scarcely rise to one per cent., in wheat flour the range may be set down at from nine to thirteen per cent. Again, the non-nitrogenous principles are as about seventy-five per cent. in wheat flour against fifteen or sixteen in potatoes. In short, whilst potatoes supply only twenty per cent. of heat-forming and nutritious principles, taken together, wheat supplies more than seventy per cent. of the former, and more than tea of the latter. The value of wheat to potatoes, therefore, is at least four to one; or, if wheat sells at fifteen shillings sterling per cwt., potatoes to be equally cheap, ought to sell at between three and four shillings.”The preceding results, for which I am principally indebted to Dr. Daubeny, Professor of Chemistry at Oxford,[25] show that unless a great change occurs in the culture of the potato, there must be an increased demand for other kinds of farinaceous food. And it is worthy of notice that while this blight is one of the causes which bring to our shores the starving population of Europe, the raising of the cereals not only furnishes profitable employment to the emigrant, but enables him to make the best return to those who are still obliged to remain.*Adaptation of the soil and climate of the United States to the culture of the cereals*.—That the soil and climate of many portions of the United States are well adapted to the cultivation of the more important cereals, is fully shown by the results of all the researches which have thus far been prosecuted. I have indeed seen it asserted that the climate of England is the best for the cultivation of wheat, and preferable to any in our country; its humidity being the peculiarity to which this superiority is ascribed.[26] But this is undoubtedly the testimony of a too partial witness. A recent statement by an English author is the result of a more correct knowledge of the facts. He acknowledges that there is no ground for the expectation which has been entertained concerning the advantageous growth of maize in England. “Nor is ours,” says he, “the most favorable country for wheat, but skill in husbandry has overcome great difficulties."[27] The mistake on this subject may have originated from the occurrence of a larger and plumper grain in the more humid climate; but analysis shows that the small grain raised in the hotter and drier air oftentimes greatly surpasses the former in its nutritious value.Russia is said to be the great rival of this country in the growth of wheat, but I

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think it doubtful whether she possesses superior natural advantages; and I am sure she will find it difficult to compete with the industry and skill which here characterize the operations of husbandry, and the manufacture and shipment of breadstuffs.*Export of sophisticated and damaged flour*.—It is a matter of deep regret that circumstances have occurred which must have a most injurious influence upon the trade in breadstuffs between this country and Great Britain. I refer to the mixtures of damaged, inferior, and good kinds of flour, which it appears on authentic testimony have been largely exported during the past year. Whether this fraudulent operation, which is said to have been principally confined to New York, is the result of the change in the inspection laws, as some assert, I am unable to say. But it requires no great foresight to predict that, if continued, it will create a distrust of our breadstuffs in foreign ports which it will be very difficult to remove. It cannot but excite the indignation of the many honorable dealers, that the unworthy cupidity of a few individuals should lead to such disastrous consequences.I have as yet been unable to obtain samples of these sophisticated flours, and the only information which I have in regard to them is the general fact above stated, and concerning the truth of which there can be little doubt. No means should be left untried to devise some mode by which these frauds can be easily and certainly detected.*Injury sustained by breadstuffs during their transport and shipment.*—During the past year, I have had abundant means of determining the nature of the injuries which are often sustained by our breadstuffs in their transport from the particular districts in which they are grown and manufactured to our commercial depots, and in their shipment to foreign ports. As this is one of the most important points connected with these researches, I have devoted much time to its investigation. From the results of numerous analyses, I think it may be safely asserted, that of the wheat flour which arrives in England from various ports of the United States, a large proportion is more or less injured during the voyage. The same remark may be made in regard to many of the samples sent from the Western States to the city of New York. Their nutritive value is considerably impaired, and without more care than is usually exercised, they are entirely unfit for export.In my former report, I adverted to one of the great causes of the deterioration which our breadstuffs often suffer during their transport and shipment. This was the undue proportion of the great disorganizing substance, water, under the influence of what usually occurs, *viz*., an elevation of temperature above the ordinary standard. My recent investigations have served only to strengthen these views. There is no doubt that these

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are the conditions which cause the change of the non-nitrogenous principles into acids (the lactic or acetic), while a portion of the gluten is thus also consumed.I have tried a series of experiments in reference to the action of moisture upon various samples of wheat and wheat flour. The samples were placed for twelve hours in the oven of a bath with a double casing, containing a boiling saturated solution of common salt, the temperature of which was about 220 deg. Fahr. Subjected to this test,

100 grains of	Milwaukie wheat lost		12.10 grains.
" "	Guilderland (Holland) wheat lost		9.35	"
" "	Polish Odessa red wheat	"	10.55	"
" "	Soft Russian wheat	"	8.55	"
" "	Kobanga wheat	"	8.15	"

> After an exposure of the dried samples to the air for two or three days, they increased in weight from one to three grains in the hundred originally employed.

Nineteen different samples of wheat flour, which lost by exposure to the above heat from ten to fourteen grains in the one hundred, when similarly exposed to the air for eighteen hours, again increased in weight from 8.40 to 11.60 in the hundred grains originally employed.These experiments show, what might indeed have been predicted as to the general result, that wheat in grain, if not less liable to injury than flour, yet if once properly dried, suffers much less from a subsequent exposure to air and moisture.It is now ascertained that in presence of a considerable proportion of water, wheat flour under the influence of heat undergoes a low degree at least of lactic fermentation, which will account for the *souring* of the ordinary samples when exposed to warm or humid climates. The same result will inevitably follow from their careless exposure in the holds of vessels. That this is particularly the case with many of the cargoes of wheat flour shipped to Great Britain, there is little reason to doubt. This may be partly owing to the great humidity of the English climate, as the deterioration is observed as well in the flour which is the produce of that country as in that which is received from abroad.It is stated by Mr. Edlin, quoted in an article on Baking, in the *Encyclopaedia Britannica*, that, “as a general rule, the London flour” is decidedly bad. The gluten generally wants the adhesiveness which characterizes the gluten of good wheat.”I have observed that, in the analyses of some of the samples of damaged flour, the proportions of what is set down under the head of glucose and dextrine are unusually large. This is perhaps due to the change produced in the starch by the action of diastase, and which may under certain circumstances be formed in wheat flour. It would seem, according to M. Guerin, that starch may thus

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be acted on even at slightly elevated temperatures. In one of his experiments, at a temperature no higher than 68 deg. Fahr., a quantity of starch, at the end of twenty-four hours, was converted into syrup, which yielded seventy-seven per cent. of saccharine matter.[28] It may be thought that I have overrated the importance of this subject, but it is believed that a careful examination of the facts will relieve me from this charge. I am now satisfied that, if the proportion of water in our exported breadstuffs could be reduced to about five or six per cent., one of the great causes of complaint in regard to them would be completely removed.*Kiln-drying of breadstuffs, and exclusion of air*.—-The injury which our breadstuffs sustain by the large proportion of water can of course be prevented only by careful drying before shipment, and by the employment of barrels rendered as impervious as possible to the influence of atmospheric moisture.In my first report, I have spoken favorably of the process of drying by steam, according to the plan patented by Mr. J.R. Stafford. I still think this mode possesses great advantages over those previously followed, and which almost always injured the quality of the grain or flour: but from some trials which I have made during the past year, it is inferred that the exposure to the heat is perhaps usually not sufficiently prolonged to answer the purpose intended by the operation. I have often observed that samples of wheat flour, after being exposed to the heat of the salt water-bath oven (220 deg. Fahr.) for two or three hours, lost weight by a further continuance of the heat. An apparatus has been patented by Mr. J.H. Tower, of Clinton, N.Y., consisting of a cylinder of square apartments or tubes, into which the grain or flour is introduced, and subjected to heat while in rapid revolution. I examined samples which had been subjected to this operation, and ascertained that wheat flour, originally containing 14.80 per cent. of water, had the proportion reduced to 10.25 per cent., while in wheat the proportion of water was reduced from 14.75 to 8.55 per cent.Now it is probable that by either of the above modes, and perhaps by many others, the various kinds of breadstuffs may be brought to that degree of dryness which, with ordinary care, shall protect them from subsequent injury; but in order to secure this advantage, the operation must be carefully performed, and experiments must be made to ascertain how long an exposure to heat is necessary to bring the sample to the proper degree of dryness, and to determine whether in any respect its quality is impaired. It has already been stated that absolute desiccation is not necessary, even were it attainable; but any process in order to be effective should reduce the proportion of water to about six, or at most seven per cent.

I have heretofore adverted to the great care employed in the drying of grain in various foreign countries, and to which the preservation of it for a great number of years is to be ascribed.

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The operation is not conducted in the hurried manner which is here thought to be so essential, but is continued long enough to effect the intended object. Thorough ventilation, as well as the proper degree of drying, and which is equally important, is thus secured.It is said that in Russia the sheaves of wheat, carried into the huts, are suspended upon poles and dried by the heat of the oven. The grain shrinks very much during this process, but it is supposed to be less liable to the attacks of insects, and preserves its nutritive qualities for many years. During the winter, it is sent to market.—-("The Czar, his Court and People." By John S. Maxwell, p. 272.)With all the necessary attention which may be paid to the proper drying of our breadstuffs intended for export, another point is of equal importance, *viz*., the shipment in vessels rendered as impervious as possible to the influence of atmospheric moisture. For however carefully and thoroughly the drying, especially of wheat flour or maize meal, may have been performed, it will be nearly useless if the shipment is afterwards made in the barrels commonly employed.[29] And it is very certain that the transport and shipment of grain in bulk, as usually conducted, are attended with great loss. This difficulty might be removed at a trifling expense by adopting the plan suggested in the preceding report, and to which I would again respectfully call the attention of those who are engaged in this branch of trade.I might here adduce a mass of testimony showing the importance of the matters just referred to, but will only advert to the following statements, which although made in allusion principally to maize, are equally applicable to our other breadstuffs. Maize meal, if kept too long, "is liable to become rancid, and it is then more or less unfit for use. In the shipments made to the West Indies, the meal is commonly kiln-dried, to obviate as much as possible this tendency to rancidity." "When ground very fine, maize meal suffers a change by exposure to the air. It is oxygenated. It is upon the same principle that the juice of an apple, after a little exposure to the air, is oxygenated, and changes its character and taste. If the flour could be bolted *in vacuo*, it would not be changed." "Intelligent writers speak of the necessity of preparing corn for exportation by kiln-drying as indispensable. Without that process, corn is very liable to become heated and musty, so as to be unfit for food for either man or beast. The kiln-dried maize meal from the Brandywine Mills, &c., made from the yellow corn, has almost monopolized the West India trade. This process is indispensable, if we export maize to Europe. James Candy says that from fifty years experience he has learned the necessity of this process with corn intended for exportation." "I have often found the corn from our country

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when it reached its destination, ruined by heating on the voyage. It had become musty and of little or no value. Kiln-drying is absolutely necessary to preserve it for exportation. We must learn and practice the best mode of kiln-drying it.[30]"*The nutritious value of the "whole meal" of Wheat, as compared with that of the fine flour*.—-The question whether what is called the whole meal of wheat, or that which is obtained by the mixture of the bran, contains more nutritious matter than the fine flour, is one of great importance. In my former report, I adverted to the statement made in regard to it by Professor J.F.W. Johnston, and which seemed to be almost conclusive in favor of the value of the whole meal. During the past year, however (1849), M. Eug. Peligot, an eminent French chemist, in an elaborate article "On the Composition of Wheat," to which more particular reference will be made hereafter, combats the opinion that the bran is an alimentary substance. He observes that "the difficulty of keeping the bran in flour intended for the manufacture of bread of good quality appears to result much less from the presence of the cellulose (one of the constituents of woody matter) contained in wheat than that of the fatty matter. This is found in the bran in a quantity at least triple of that which remains in the flour, and the bolting separates it from the ground wheat not less usefully than the cellulose itself."[31] M. Millon objects entirely to the views of M. Peligot on this point, and states some facts which are especially worthy of consideration. He asserts that, according to the views of the last named chemist, the separation at most of one part of fatty matter sacrifices fifteen, twenty, and even twenty-five per cent. of substances which are of the highest nutritive value. This abstracts from wheat, for the whole amount raised in France, the enormous sum of about two hundred millions of pounds annually.It seems that in France the question whether the bolting of flour is advantageous has always been decided in the most arbitrary manner. An ordinance of Louis XIV., issued in 1658, prohibited, under a very heavy penalty, the regrinding of the bran and its mixture with the flour; this, with the mode of grinding then in use, caused a loss of more than forty per cent.—(Comptes Rendus, February 19th, 1849.)In large cities and elsewhere, there seems for some time to have been a growing prejudice against the use of brown bread; and it is said that now nearly all the peasantry of France bolt their flour. The increase of this practice, according to M. Millon, threatens the nation with an annual loss of from two to three hundred millions of francs. If the bran was entirely valueless, there would be a loss of more than one million a day.It is quite difficult to determine the precise amount of bran which may have been removed from wheat, for various samples contain such a different proportion of bran that in the one case a removal of ten per cent, leaves more bran in the flour than a bolting of five per cent. in another.

The following is an analysis of bran by M. Millon; the sample being a soft French wheat grown in 1848:—

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Starch, dextrine and sugar 53.00
Sugar of liquorice 1.00
Gluten 14.90
Fatty matter 3.60
Woody matter 9.70
Salts .50
Water 13.90
Incrusting matter and aromatic principles (by difference) 3.40

100.

The conclusion to be drawn from this analysis is, that bran is an alimentary substance. If it contains six per cent. more of woody matter than the rough, flour, it has also more gluten, double that of fatty matter, besides two aromatic principles which have the perfume of honey, and both of which are wanting in the fine flour. Thus by bolting, wheat is impoverished in its most valuable principles, merely to remove a few hundredths of woody matter.The economical suggestion which springs from these views is, that the bran and coarse flour should be reground and then mixed with the fine flour. Millon states that he has ascertained, by repeated experiments, that bread thus made is of superior quality, easily worked, and not subject to the inconvenience of bread manufactured from the rough flour, such as is made in some places, and especially in Belgium.Opinions similar to those above noticed are entertained by Professor Daubeny. “The great importance attached to having bread perfectly white is a prejudice,” he says, “which leads to the rejection of a very wholesome part of the food, and one which, although not digestible alone, is sufficiently so in that state of admixture with the flour in which nature has prepared it for our use.” After quoting the remarks of Professor Johnston on the same side of the question, he adds, “that according to the experiments of Magendie, animals fed upon fine flour died in a few weeks, whilst they thrived upon the whole meal bread.” Brown bread, therefore, should be adopted, not merely on a principle of economy, but also as providing more of those ingredients which are perhaps deficient in the finer parts of the flour.—("Gardeners’ Chronicle,” January 27th, 1849, p. 53.)The remarks of Dr. Robertson may also be here introduced. “The advantage,” he observes, “of using more or less of the coverings of the grain in the preparation of bread has often been urged on economical principles. There can be no doubt that a very large proportion of nutritive matter is contained in the bran and the pollard; and these are estimated to contain about one-fifth part of the entire weight of the wheat grain. It is, unquestionably, so far wasteful to remove these altogether from the flour; and in the case of the majority of people, this waste may be unnecessary, even on the score of digestibility."[32]

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This subject can also be rendered apparent to the eye. If we make a cross section of a grain of wheat, or rye, and place it under the microscope, we perceive very distinct layers in it as we examine from without inwards. The outer of them belong to the husk of the fruit and seed, and are separated as bran, in grinding. But the millstone does not separate so exactly as the eye may by means of the microscope, not even as accurately as the knife of the vegetable anatomist, and thus with the bran is removed also the whole outer layer of the cells of the nucleus, and even some of the subjacent layers. Thus the anatomical investigations of one of these corn grains at once explains why bread is so much the less nutritious the more carefully the bran has been separated from the meal.[33] There can therefore be little doubt that the removal of the bran is a serious injury to the flour; and I have presented the above array of evidence on this point in the hope of directing public attention to it here, as has been done in various foreign countries.After this, it will easily be inferred that I am not disposed to look with much favor upon the plan proposed by Mr. Bentz for taking the outer coating or bran from wheat and other grains previously to grinding.[34] Independently of the considerations which have already been presented, it is far from being proved, as this gentlemen asserts, that the mixture of the bran with the meal which results from the common mode of grinding is the chief cause of the *souring* of the flour in hot climates. On the contrary, the bran is perhaps as little liable to undergo change as the fine flour, and then the moistening to which, as I am informed, the grain is subjected previously to the removal of the husk, is still further objectionable, and must be followed by a most carefully-conducted process of kiln-drying.*Nutritious properties of various articles of food*.—There seems to be some difference of opinion in regard to the nutritious properties of various kinds of food. It is generally, however, agreed that those which contain the largest proportion of nitrogenous matters are the most nutritious. It is on this account that haricots, peas, and beans, form, in some sort, substitutes for animal food. Tubers, roots, and even the seeds of the cereal grasses, are but moderately nutritious. If we see herbivorous animals fattening upon such articles, it is because, from their peculiar organisation, they can consume them in large quantities. It is quite doubtful whether a man doing hard work could exist on bread exclusively. The instances which are given of countries where rice and potatoes form the sole articles of food of the inhabitants, are believed to be incomplete. Boussingault states that in Alsace, for example, the peasantry always associate their potato dish with a large quantity of sour or curdled milk; in Ireland with buttermilk. “The Indians of the Upper Andes do not by

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any means live on potatoes alone, as some travellers have said they do: at Quito, the daily food of the inhabitants is *lorco*, a compound of potatoes and a large quantity of cheese. Rice is often cited as one of the most nourishing articles of diet. I am satisfied, however, after having lived in countries where rice is largely consumed, that it is anything but a substantial, or, for its bulk, nutritious article of sustenance."—("Rural Economy," Amer. edition, p. 409.) These statements are further confirmed by the observations of M. Lequerri, who, during a long residence in India, paid particular attention to the manners and customs of the inhabitants of Pondicherry. "Their food," he states, "is almost entirely vegetable, and rice is the staple; the inferior castes only ever eat meat. But all eat *kari* (curry), an article prepared with meat, fish, or vegetable, which is mixed with the rice, boiled in very little water. It is requisite to have seen the Indians at their meals to have any idea of the enormous quantity of rice which they will put into their stomachs. No European could cram so much at a time; and they very commonly allow that rice alone will not nourish them. They very generally still eat a quantity of bread."[35] In regard to the proportion of nutritious matter contained in grains of various kinds, it may be remarked that the tables which have been constructed as the results of various experiments are liable to an objection, which will be more particularly adverted to under another head. For example, two substances, by the process of ultimate analysis, may exhibit the same proportion of nitrogenous matter, and still differ very materially in their value as articles of food. Much depends on the digestibility of the form in which this matter is presented to the digestive organs. A strong illustration is afforded in the case of hay, the proportion of nutritive matter of which, about 9.71, would certainly not represent its power of affording nourishment to the human system. It is in truth quite impossible to arrive at any other than approximate results from the operations of chemistry, as to the amount of nutriment contained in a given quantity or weight of any article of food.[36] It is perhaps not irrelevant to notice in this place some of the researches which have recently been made upon fermentation, and particularly its effects in the manufacture of bread. It appears that when this process is brought about by the addition of yeast or leaven to the paste or dough, the character of the mass is materially altered. A larger or smaller proportion of the flour is virtually lost. According to Dr. William Gregory the loss amounts to the very large proportion of one-sixteenth part of the whole of the flour. He says, "To avoid this loss, bread is now raised by means of carbonate of soda, or ammonia and a diluted acid, which are added to the dough, and the effect is perfectly satisfactory. Equally good or better bread

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is obtained, and the quantity of flour which will yield fifteen hundred loaves by fermentation, furnishes sixteen hundred by the new method, the sugar and fibrin (gluten) being saved."—("Outlines of Chemistry," p. 352.)Another author, Dr. R.D. Thomson, states, as the results of his experiments upon bread produced by the action of hydrochloric acid upon carbonate of soda, "that in a sack of flour there was a difference in favor of the unfermented bread to the amount of thirty pounds thirteen ounces, or in round numbers, a sack of flour would produce one hundred and seven loaves of unfermented bread, and only one hundred loaves of fermented bread of the game weight. Hence it appears that in the sack of flour by the common process of baking, seven loaves, or six-and-a-half per cent, of the flour are driven into the air and lost."—("Experimental Researches on the Food of Animals," &c., p. 183.)The only objection to the general introduction of this process seems to be the degree of care and accuracy required in properly adjusting the respective qualities and quantities of acid and alkali, and which could seldom be attained even by those who are largely engaged in the manufacture of bread.I cannot leave this subject without adverting to a practice which has prevailed in England and France, and perhaps also in this country, of steeping wheat before sowing it in solutions of arsenic, sulphate of copper, and other poisonous preparations.The result has been that injurious effects have often followed, both to those who are employed in sowing such grain, and to those who have used the bread manufactured from it. The great importance of the subject led to the appointment of a commission at Rouen, in France, in December, 1842, having for its object to determine the best process of preventing the smut in wheat, and to ascertain whether other means less dangerous than those above noticed were productive of equally good results. The labors of this commission extended over the years 1843-'44-'45, and the experiments were repeated two years following on the farm of Mr. Fauchet, one of the commission, at Boisquilaume, in the department of the Seine Inferieure.The results arrived at by this commission are—1st. That it is not best to sow seed without steeping. 2nd. That it is best to make use of the sulphate of soda and lime process, inasmuch as it is more simple and economical, in no way injurious to the health, and yields the soundest and most productive wheat. 3rd. That the use of arsenic, sulphate of copper, verdigris, and other poisonous preparations, should be interdicted by the government. —("Gardeners' Chronicle," January 6th, 1849, pp. 10 and 11.)*Composition of wheat and wheat flour, and the various modes of determining their nutritive value*.—In my former report it was stated that the analyses of the various samples of wheat,

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the results of which were there given, had been chiefly directed to the determining the amount of rough *gluten* which they contained. My reasons for adopting this plan, and the arguments in favor of its general accuracy, as compared with other modes of analysis, and especially that by which the ultimate composition is ascertained, were also detailed. A more full examination of this subject has served only to strengthen the opinion already expressed, that for the great purpose to be answered by these researches, the process which I have adopted is, to say the least, as free from objection as any other, and if carefully and uniformly carried out, will truly represent the relative values of the several samples of wheat flour. As this is a matter of much consequence in a practical point of view, I trust I shall be excused for introducing some additional facts in regard to it.The term *gluten* was originally applied to the gray, viscid, tenacious, and elastic matter, which is obtained by subjecting wheat flour to the continuous action of a current of water. But it appears that this is a mixture of fibrine and caseine, with what is now called *glutine*, and a peculiar oily or fatty matter. Now these substances may be separated from each other, but the processes employed for this purpose are tedious, and to insure accuracy the various solvents must be entirely pure—a point which, especially in the case of alcohol and ether, is not ordinarily easy to be attained. This will be rendered still more evident by a reference to a French process, which will hereafter be noticed.But were it much less difficult in every case accurately to separate the constituents of gluten, it would not, in my opinion, be of the least practical utility. It is to the peculiar mechanical property of this gluten that wheat flour owes its superior power of detaining the carbonic acid engendered by fermentation, and thus communicating to it the vesicular spongy structure so characteristic of good bread.[37] It may also be added, that the results of more than one hundred trials have satisfied me that a diminution or loss of elasticity in the gluten is the surest index of the amount of injury which the sample of flour has sustained. Whether, therefore, the sample contains a certain proportion of nitrogen, or whether it contains albumen, fibrine, and caseine in sufficient quantity, it may still want the very condition which is essential to the manufacture of good bread. My objection, therefore, to the mere determination, however accurate, of the proportion of nitrogen contained in wheat flour, or of the various principles which form the gluten, is, that it does not represent the value of the various samples for the only use to which they are applied, *viz*., the making of bread. The remarks of Mulder, the celebrated Dutch chemist, upon the subject of manures, are so applicable to this point that I cannot refrain

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from quoting them. “It has,” he says, “become almost a regular custom to determine the value of manures by the quantity of nitrogen they yield by ultimate analysis. This method is entirely erroneous; for it is based upon the false principle, that by putrefaction all nitrogeneous substances are immediately converted into ammonia, carbonic acid, and water! But these changes sometimes require a number of years. Morphine, for example, is prepared by allowing opium to putrefy; and the process for preparing leucin, a substance which contains 10.72 of nitrogen, is to bring cheese into putrefaction. Cheese, therefore, does not perhaps in a number of years resolve itself into carbonic acid, ammonia, and water, but produces a crystalline substance, which contains no ammonia. Hence the proportion of nitrogen yielded by manures is not a proper measure of their value, and therefore this mode of estimating that value ought to be discontinued."[38] We infer, therefore, that the proportion of nitrogen furnished by food of various kinds is not the true measure of their nutritious value, and cannot for practical purposes take the place of that process by which the amount of rough gluten is determined.No better illustration can be given of the uncertainty which attends the inferences drawn from the ultimate composition, than the fact heretofore stated in regard to hay, the nutritive value of which is placed in the tables containing the results of these analyses, at a figure nearly the same as that of ordinary wheat flour.[39] In the paper on the “Composition of Wheat,” by M. Peligot—(” Comptes Rendus,” February 5th, 1849)—to which I have already referred, the author gives the results of the various analyses which he has made, and details the process he adopted.Aware of the complex and difficult nature of the examination as conducted by him, he seems to doubt in regard to some of the results given in his tables In the fourteen samples which he analysed, the proportion of water ranges from 13.2 to 15.2, which is a rather higher average than is yielded by our American samples, especially those which have not been shipped across the Atlantic. Of the nitrogenous matter, soluble and insoluble, the proportions range from 9.90 per cent, to 21.50 per cent.; the former being from a sample of very soft and white French wheat; the latter from a very hard wheat with long grains, from Northern Africa, cultivated at Verrieres. Another sample from Egypt yielded 20.60 per cent, of these nitrogenous matters, both of which are very remarkable proportions.In describing the process for ascertaining the amount of insoluble nitrogenous matters, this author adverts to their estimation either by the quantity of nitrogen gas furnished, or of ammonia formed, the last being preferred for substances, which, like wheat, contain only a few hundredths of nitrogen. The results which he obtained by this method were

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compared with those yielded by the direct extraction of the gluten by softening the farina under a small stream of water. “These results,” says he, “differ but little from each other when we operate upon wheat in good condition, although the gluten which we thus obtain holds some starch and fatty matter, while the starch which is carried away by the water contains also some gluten.” The loss and gain, as I have already explained, and as has been proved by these and other comparisons, are nearly balanced, and the amount of rough gluten will therefore afford a fair exhibit of that of the insoluble nitrogenous matters in this grain.

> The salts in the samples of wheat analysed by M. Peligot, were either wanting or were in small proportion; while the amount of fatty matter ranged from 1.00 to 1.80 and 1.90 per cent.

These results agree very well with those which I have obtained. But it is probable that the proportion is liable to great variation, inasmuch as it is inferred that the fatty matter originates from starch through its exposure to the general deoxidising influence which prevails in plants.[40] There are also many difficulties attending the accurate determination of this matter, and which are probably the cause of the higher proportion often given. It is properly remarked by M. Peligot that the ether employed in this process should be free from water, and that the flour ought also to be very dry. By neglecting these precautions, we separate not only the fatty matter, but also a certain amount of matters soluble in the water, which is furnished as well by the wheat as by the ether.It would not, I think, be difficult to point out some incorrect views entertained by this chemist, and more especially those which relate to the fatty matter. Some of his processes for the separation of various substances, if not faulty, require so many conditions for success as to render the results, at least in other hands, exceedingly uncertain.But the capital error which he has committed is that concerning the bran, already adverted to, which he considers injurious to the flour, chiefly in consequence of the large proportion of fatty matter which it contains.In regard to the soluble nitrogenous matter usually called albumen, from its resemblance to the animal substance of the same name, I have to remark that in my trials the proportion has been found to be considerably less than that often given in tables of the composition of wheat. In one sample it was found to be as low as 0.15 per cant., in another it did not rise above 0.20 per cent. The amount was usually so inconsiderable, that I did not think it worth while to retard the progress of the work by following out processes which could add little to the utility of these investigations.Although much time and labor have been expended upon the analyses of the ash of plants,

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I have but slight confidence in the results heretofore given. The difficulties which attend the obtaining the ash in a proper condition, and the fact that the products of all the organs and parts of the plants have been analysed together, must necessarily impair the accuracy of the experiments, and render the inferences drawn from them of uncertain value. Much, indeed I may say almost everything, still remains to be done in this department of agricultural chemistry.

> *Weight of wheat as an index to its value*.—Much has been said in regard to the relative weights of the bushel of wheat of different varieties or under different modes of culture.

As ordinarily determined, this weight ranges from fifty-six to sixty-five or sixty-six pounds, being in a few cases set down somewhat higher. It is said also that the bushel of wheat weighs less in some years than it does in others, and that the difference often amounts to two, or three, or even four pounds. Though this may seem of comparatively little consequence for a few bushels, yet, for the aggegate of the wheat crop of the United States, or for a State, or even a county, it makes a great difference. Thus, were we to estimate the product of one year in the United States at one hundred and ten million bushels, weighing fifty-six pounds to the bushel, and another year at one hundred and eight million bushels, weighing sixty-two pounds, the difference in favor of the latter, though the least in quantity, would amount to five hundred and thirty-six million pounds in weight, or more than one million and a quarter of barrels of flour.—-(Report of the American Commissioner of Patents for 1847, p. 117.)It may be remarked, however, that it is not after all so easy to determine with accuracy the weight of a bushel of wheat, nor to decide upon the circumstances which have an influence in increasing the density of a grain of wheat. If the microscopical representations of wheat are to be relied on, it is probable that the increase in the density of wheat depends upon the increase in the proportion of gluten. I have found in several cases that, the proportion of water being the same, those samples of wheat which contain the largest proportion of gluten exhibit the highest specific gravity, or, in other words, will yield the greatest number of pounds to the bushel. But the weight of wheat will be influenced by the proportion of water which it contains; the drier the grain, the greater is its density; a fact which may account for the difference which has been observed in the weight of wheat in different seasons. If this is the cause, the calculation above given in reference to the United States is fallacious—but if the amount of gluten is *actually*, instead of *relatively*, increased by peculiarities in seasons, it is no doubt correct.

> I have devised a series of experiments to test the accuracy of the statements made upon this point, but have not yet had leisure to complete them.

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General conditions from the analyses of wheat flour.—The large number of analyses which I have made, and the uniformity of the processes pursued, enable me to draw some general conclusions which it may be useful to present in a connected form.1. In the samples from the more northern wheat-growing States, there seems to be little difference in the proportion of nutritive matter that can be set down to the influence of climate. Thus, the yield of the wheat from Michigan, Wisconsin and Iowa, is scarcely inferior to that from New York, Indiana, and Illinois, although the two latter are somewhat farther south. Local causes, and more especially the peculiarities of culture and manufacture, have more influence, within these parallels of latitude, than the difference of mean temperature.2. The samples from New Jersey, Lower Pennsylvania, the southern part of Ohio, Maryland (probably Delaware), Virginia, the Carolinas, and Georgia,[41] contain less water and more nutritive matter than those from the States previously enumerated. That the samples from Missouri, which is included within nearly the same parallels of latitude as Virginia, do not exhibit so high an average of nutritive matter as those from the latter State, must be ascribed principally to a want of care in the management of the crop, and perhaps also in the manufacture of the flour. Virginia flour, for obvious reasons, maintains a high reputation for shipment.3. The difference in the nutritive value of the various samples of wheat depends greatly upon the variety, and mode of culture, independently of climate. The correctness of the former statement is shown by the much larger proportions of gluten yielded by many of the samples of *hard* wheat from abroad, the Oregon wheat in Virginia, and a variety of Illinois wheat, &c. And in regard to the effect of particular modes of culture, the various analyses of Boussingault may be referred to, and that in my table of a sample from Ulster county, New York.4. The deterioration of many of the samples of wheat and wheat flour arises in most cases from the presence of a too large per centage of water. This is often the result of a want of proper care in the transport, and is the principal cause of the losses which are sustained by those who are engaged in this branch of business.5. There seems to be little doubt that a considerable portion of the wheat and wheat flour, as well as of other breadstuffs, shipped from this country to England, is more or less injured before it reaches that market. It is also shown that this is mostly to be ascribed to the want of care above noticed, and to the fraudulent mixture of good and bad kinds. The remedy in the former case is the drying of the grain or flour before shipment, by some of the modes proposed, and the protection of it afterwards as completely as possible

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from the effect of moisture. The frauds which are occasionally practised should be promptly exposed, and those who are engaged in them held up to merited reproach.6. It has been fully shown, by the results of many trials, that the flour obtained by the second grinding of wheat, or the whole meal, contains more gluten than the fine flour. Hence the general use of the latter, and the entire rejection of the bran, is wasteful, and ought in every way to be discouraged.7. It cannot but be gratifying to us that the average nutritive value of the wheat and wheat flour of the United States is shown by these analyses to be fully equal to, if not greater than, that afforded by the samples produced in any other part of the world. And it will, in my opinion, be chiefly owing to a want of proper care and of commercial honesty, if the great advantages which should accrue to this country from the export of these articles are either endangered or entirely lost.

TABLE EXHIBITING THE PER CENTAGE COMPOSITION OF VARIOUS SAMPLES OF
AMERICAN AND FOREIGN WHEAT FLOUR, BY LEWIS C. BECK, M.D. (1849).

Kind of Wheat Flour, and from whence obtained	Water	Gluten and albumen	Starch	Glucos dextrine, &c.	Bran
Country Mills, New Jersey	12.75	11.55	65.95	8.10	.65
West Jersey Wheat	12.80	12.32	69.48	5.90	.50
White Wheat, New Jersey	11.55	12.60	66.85	8.50	.50
Pennsylvania Wheat	11.90	13.16	66.20	7.25	.75
ditto ditto	13.35	12.73	66.90	6.50	.52
ditto ditto (2nd grinding)	13.35	14.72	71.28		.65
Pelham Wheat, Ulster Co., N.Y.	10.79	13.17	67.74	7.60	.70
“Pure Genesee” Wheat	13.20	11.05	75.20		.55
Ohio Wheat, “fine”	12.85	12.25	73.90		1.00
Ohio Wheat, “superfine”	13.00	9.10	77.80		.10
Winter Wheat, Ohio	13.10	11.56	66.84	7.90	.60
ditto ditto (2nd grinding)	13.05	12.69	73.61		.65
Michigan Wheat, “superfine”	13.25	11.10	74.80		.85
Michigan Wheat	12.25	10.00	67.70	8.75	.75
ditto ditto (2nd grinding)	12.75	11.20	66.00	8.50	1.05
Illinois Wheat	12.73	14.61	65.20	6.45	.80
Magnolia Mill, St. Louis, Mo.	13.13	10.27	69.75	6.15	.35
Mound Mill, St. Louis	13.48	10.53	67.35	8.15	.20
Walsh’s Mill, St. Louis	12.70	10.63	69.40	6.65	.40

Washington Mill, St. Louis |12.88| 11.00 | 68.65| 7.27 | .20
Missouri Mill, St. Louis |13.00| 10.46

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| 67.79| 8.35 | .40
O’Fallan’s Mill, St. Louis |12.85| 11.25 | 68.24| 7.00 | .66
Phoenix Mill, St. Louis |13.22| 10.10 | 68.70| 7.30 | .15
Nonantum Mill, St. Louis |12.10| 11.02 | 68.60| 7.93 | .35
Franklin Mill, St. Louis |12.25| 10.29 | 69.85| 7.26 | .35
Eagle Mill, St. Louis |11.00| 10.15 | 69.50| 8.65 | .20
Winter Wheat, Missouri |14.00| 9.30 | 70.05| 6.30 | .35
Wisconsin Wheat |12.80| 13.20 | 68.90| 6.50 | .70
ditto ditto (2nd grinding) |12.80| 13.46 | 72.54 |1.20
Maryland Wheat |13.00| 12.30 | 66.65| 7.10 | .65
Richmond City Mill |11.70| 13.00 | 67.50| 6.90 | .50
Haxall and Co., Richmond, Va. |11.40| 12.80 | 68.50| 6.60 | .35
Virginia Wheat, “superfine” |12.05| 12.95 | 74.50 | .50
Haxall and Co., “best brand, ’49” |11.40| 13.25 | 68.20| 6.25 | .60
Haxall and Co., “2nd brand, ’49” |11.00| 13.20 | 75.60 | .20
Richmond City Mill, ’49 |11.90| 10.50 | 70.00| 7.10 | .50
Oregon White Wheat, Va. |12.80| 14.80 | 71.30 |1.10
ditto ditto (2nd grinding) |13.85| 14.50 | 65.15| 5.90 | .60
Gallego Mill, Richmond, Va. |11.50| 13.50 | 68.35| 6.00 | .65
Ship Brandywine, Liverpool |13.38| 10.62 | 67.60| 7.75 | .65
Ship Fanchon, Liverpool |13.83| 11.38 | 67.45| 6.34 |1.00
Ship New World, Liverpool |13.65| 11.60 | 65.80| 7.70 | .65
Ship Juniata, Liverpool |12.50| 14.14 | 64.20| 8.36 | .80
Ship Stephen Lurman, Liverpool |11.65| 13.18 | 64.50| 9.55 | .68
Ship Leila, Liverpool |13.22| 13.18 | 64.65| 8.00 | .95
Ship Oxenbridge, Liverpool |13.90| 10.13 | 68.42| 7.30 | .25
| |& bran | | |
Ship Italy, Liverpool |12.94| 10.60 | 68.56| 7.90 |
Ship West Point, Liverpool |14.30| 12.30 | 63.00| 9.45 | .95
Ship W.H. Harbeck, Liverpool |13.53| 10.18 | 66.95| 8.80 | .30
Ship Princeton, Liverpool |13.40| 11.52 | 65.60| 7.90 | .85
Ship Columbus, Liverpool |13.50| 10.45 | 66.45| 8.50 |1.03
Ship Russell Glover, Liverpool |13.45| 10.47 | 66.20| 8.83 |1.05
Ship South Carolina, Liverpool |13.80| 9.00 | 70.80| 5.95 | .38
ditto ditto (2nd grinding) |13.30| 9.45 | 76.90 | .35
Ship Cambridge, Liverpool |14.50| 8.52 | 70.60| 5.40 | .40
ditto ditto (2nd grinding) |14.10| 9.10 | 70.55| 5.45 | .20
Ship Columbus, Liverpool |14.85| 8.47 | 76.48 | .20
ditto ditto (2nd grinding) |14.15| 9.00 | 76.60 | .25
Ship Ashburton, Liverpool |13.55| 11.68 | 69.22| 5.30 | .25
Wheat grown in Canada West |12.80| 7.23 | 74.12| 5.10 | .75
ditto ditto (2nd grinding) |12.60| 8.45

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| 78.55 | .40
Chilian Wheat |12.44| 9.45 | 67.80| 8.37 |1.30
Chilian Wheat |12.85| 8.65 | 71.60| 6.10 | .60
| |& bran | | |
Valparaiso Wheat |12.50| 14.55 | | |
French Wheat |13.20| 9.85 | 69.00| 7.65 | .30
Spanish Wheat |13.50| 10.30 | 68.90| 7.00 | .30
Canivano Wheat |11.33| 16.35 | 63.10| 6.50 |2.30
Canivano Wheat |11.15| 15.40 | 67.25| 5.70 | .60
ditto ditto (2nd grinding) |12.60| 18.70 | 67.00 |1.70
Hard wheat, grown near Malaga |10.87| 12.15 | 64.38| 12.60 |
| | | |& lactic acid
ditto ditto (2nd grinding) |10.00| 14.50 | 60.20| 15.30 |
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There is no crop, the skilful and successful cultivation of which on the same soil, from generation to generation, requires more art than is demanded to produce good wheat. To grow this grain on fresh land, adapted to the peculiar habits and wants of the plant is an easy task. But such fields, except in rare instances, fail sooner or later to produce sound and healthy plants, which are little liable to attacks from the malady called “rust,” or which give lengthened ears or “heads,” well filled with plump seeds.Having long resided in the best wheat-growing district in the Union, the writer has devoted years of study and observation to all the influences of soil, climate, and constitutional peculiarities, which affect this bread-bearing plant. It is far more liable to smut, rust, and shrink in some soils than in others. This is true in western New York, and every other section where wheat has long been cultivated. As the alkalies and other fertilizing elements become exhausted in the virgin soils of America, its crops of wheat not only become smaller on an average, but the plants fail in constitutional vigor, and are more liable to diseases and attacks from parasites and destructive insects. Defects in soil and improper nutrition lead to these disastrous results. Soils are defective in the following particulars: 1. They lack soluble silica, or flint in an available form, with which to produce a hard glassy stem that will be little subject to “rust.” Soluble flint is never very abundant in cultivated soils; and after they have been tilled some years, the supply is deficient in quantity. It is not very difficult to learn with considerable accuracy the amount of silica which rain-water as it falls on the earth will dissolve out of 1,000 grains of soil in the course of eight or ten days. Hot water will dissolve more than cold; and water charged with carbonic acid more than pure water which has been boiled. The experiments of Prof. Rogers of the University of Virginia, as published in Silliman’s

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Journal, have a direct bearing on this subject. The researches of Prof. Emmons of Albany, in his elaborate and valuable work on “Agriculture,” as a part of the Natural History of New York, show that 10,000 parts of soil yield only from one to three parts of soluble silica. The analyses of Dr Jackson, as published in his Geological Survey of New Hampshire, give similar results. Earth taken from an old and badly exhausted field in Georgia, gave the writer only one part of soluble flint in 100,000.What elements of crops rain water, at summer heat, will dissolve out of ten or twenty pounds of soil, in the course of three months, is a point in agricultural science which should be made the subject of numerous and rigid experiments. In this way, the capabilities of different soils and their adaptation to different crops may be tested, in connection with practical experiments in field culture, on the same kind of earth.Few wheat-growers are aware how much dissolved flint an acre of good wheat demands to prevent its having coarse, soft, and spongy stems, which are anything but a healthy organization of the plant. In the Journal of the Royal Agricultural Society of England, vol. 7, there is an extended “Report on the Analysis of the Ashes of Plants, by Thomas Way, Professor of Chemistry at the Royal Agricultural College, Cirencester,” which gives the result of sixty-two analyses of the ash of wheat, from as many samples of that grain, mostly grown on different soils and under different circumstances.In this report are given the quantity of wheat per acre, the weight of straw cut close to the ground to the acre, and also that of the chaff. These researches show, that from ninety-three to one hundred and fifty pounds of soluble flint are required to form an acre of wheat; and I will add from my own investigations, that three-fourths of this silica is demanded by nature during the last sixty days preceding the maturing of the crop. This is the period in which the stem acquires its solidity and strength, and most of its incombustible earthy matter. The quantity of this varies from three to fifteen per cent. of the weight of the straw. Prof. Johnston and Sir Humphry Davy give instances in which more than fifteen per cent. of ash was found; and Prof. Way gives cases where less than three per cent. were obtained. The mean of forty samples was four and a half per cent. Dr. Sprengel gives three and a half as the mean of his analyses. M. Boussingault found an average of seven per cent. As flint is truly the *bone* of all the grass family, imparting to them strength, as in cane, timothy, corn, oats, rye, rice, millet, and the proportion of this mineral varies as much in wheat-straw, as bone does in very lean and very fat hogs or cattle.A young growing animal, whether a child or a colt, that is kept on food which lacks *bone-earth*, (phosphate of lime,) will have soft cartilaginous

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bones. Nature cannot substitute *iron* or any other mineral in the animal system, out of which to form hard strong bones; nor can any other mineral in the soil perform the peculiar function assigned to silica in the vital economy of cereal plants. To protect the living germs in the seeds of wheat, corn, oats, rye, barley, &c, the cuticle or bran of these seeds contains considerable flint. The same is true of chaff.The question naturally arises,—How is the farmer to increase the quantity of soluble silica or flint in his soil? This is a question of the highest practical importance. There are three principal ways in which the object named may be attained. First, by keeping fewer acres under the plough. Land in pasture, if well managed, will gain its fertility, and in the process accumulate soluble silica in the surface soil. In this way more wheat and surer crops may be made by cultivating a field in wheat two years than four or six. If the field in the mean time be devoted to wool-growing, butter or cheese-making, or to stock-raising, particular care must be taken to make great crops of grass or clover to grow on the land, and have all the manure, both solid and liquid, applied to its surface.There are many counties in England that yield an average of thirty-two bushels of wheat per acre for ten crops in succession. There are but few of the old counties in the United States which average the half of that quantity: and yet America has greater agricultural capabilities than that of Great Britain.Another way to increase soluble silica in the soil, is to grow such crops, in rotation with wheat culture, as will best prevent the loss of dissolved flint, at any time by leaching and washing, through the agency of rain water. This remark is intended to apply more particularly to those large districts devoted to cotton and tobacco culture, plants that take up no considerable amount of silica, and which by the constant stirring of the earth, and the clean tillage which they demand, favor the leaching of the soil. To keep too much of a plantation of these crops, is to lessen its capabilities for producing good crops of corn, wheat, and barley, at a small expense. Corn plants, well managed, will extract more pounds of silica in three or six months from the soil, than any other. As not an ounce of this mineral is needed in the animal economy of man or beast, it can all be composted in cornstalks, blades, and cobs, or in the dung and urine derived from corn, and be finally reorganized in the stems of wheat plants. Corn culture and wheat culture, if skilfully and scientifically conducted, go admirably together. Of the two, more bread, more meat, and more *money* can be made from the corn than from the wheat plant in this country. But so soon as what is called “high farming” in England, shall be popular in the United States, the crops both of wheat and corn grown here will demonstrate

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how little we appreciate the vast superiority of our climate for the economical feeding and clothing of the human family, over that of our “mother country.” In several counties in England, it takes from twelve to fourteen months to make a crop of wheat, after the seed is put into the ground. At or near the first of December, 1847, Mr. M.B. Moore, of Augusta, Ga., sowed a bushel of seed wheat on an acre and a half of ground, which gave him over thirty bushels by the middle of May following. This ground was then ploughed, and a fine crop of hay made and cut in July. After this, a good crop of peas was raised, and harvested in October, before it was time to seed with wheat again, as was done. While the mean temperature of England is so low, that corn plants will not ripen, in Georgia one can grow a crop of wheat in the winter, and nearly two crops of corn in succession in the summer and autumn, before it is time to sow wheat again. No writer, to my knowledge, has done full justice to the vast agricultural resources of the southern portion of the American confederacy. But there is much of its soil which is not rich in the elements of bread. Nothing but the careful study of these elements, and of the natural laws by which they are governed, can remedy defects in wheat culture anywhere, but especially on very poor land.All alkaline minerals, such as potash, soda, lime, ammonia, and magnesia, hasten the solution of the several insoluble compounds of silica in the soil. This fact should be remembered by every farmer. To undertake an explanation of the various ways in which alkalies, oxides, and acids act and re-act upon each other in the surface of the earth, when subject to tillage, would be out of place in this outline view of wheat-growing in the United States. I may state the fact, however, as ascertained by many analyses, that a cubic foot of good wheat soil in the valley of the Genesee, contains twenty times more lime than do the poorest soils in South Carolina and Georgia. The quantity of gypsum, bone-earth, and magnesia, available as food for plants, varies in an equal degree. Not only lime, but phosphoric acid, potash, and magnesia are lacking in most soils, if one desires to raise a large crop of wheat, and have the seeds of the grain weigh as much as the straw. In a number of the specimens of wheat analyzed by Prof. Way, when cut close to the roots, the dry wheat outweighed the dry straw.Having secured the growth of a bright, hard, glassy stem, the next thing is to develop a long, well-filled ear. To this end, available ammonia or nitrogen, phosphorus, potash, and magnesia are indispensable. Ammonia (spirits of hartshorn) is necessary to aid in forming the combustible part of the seed. The other ingredients named are required to assist in making the incombustible part of the grain. In 100 parts of the ash of wheat, there are the following substances, *viz*.:—

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Silica	2.28
Phosphoric acid	45.73
Sulphuric acid	0.32
Lime	2.06
Magnesia	10.94
Peroxide of iron	2.04
Potash	32.24
Soda	4.06
Chloride of sodium	0.27

Total	99.94

The quantity of ash in wheat varies from 11/4 to 21/2 per cent.; the average is about 1.69. The amount of phosphoric acid in any given quantity of the ash of wheat varies from forty to fifty per cent. of the same.Seeds that have a thick cuticle or bran, and little gluten, contain a smaller per centage of phosphoric acid, and more silica. About one-third of the ash is potash; in nearly all cases magnesia varies from nine to fourteen per cent.; lime from one and a half to six per cent. Peroxide of iron is seldom as abundant as in the ash above given, and the same is true of soda. Chloride of sodium is common salt, and exists in a small quantity. Salt is beginning to be much used as a fertilizer on wheat lands in western New York. It operates indirectly to increase the crop.The following may be taken as about the average composition of the ash of wheat-straw. It is "Specimen No. 40," in the tables of Prof. Way, and I copy verbatim all that is said upon the subject: [Soil, sandy; subsoil, stone and clay; geological formation, silurian; drained; eight years in tillage; crop, after carrots, twenty tons per acre; tilled December, 1845; heavy crop; mown, August 12th; carried, August 20th; estimated yield, forty-two bushels per acre; straw long, grain good, weight sixty-two pounds to the bushel.] Length of straw, forty-two inches.

Relation of Grain, Straw and Chaff.

	Actual quantities.	Per centage.
Grain	1633 lbs.	45.15
Straw	1732	47.89
Chaff	250	6.96
	——	
Total	3615 lbs.	

Specific gravity of grain	1.396
Weight of grain per acre	2604 lbs.
" " straw " "	2,775 3/10ths.
" " chaff " "	401 1/6th.

Mineral Matter in an Acre.
Wheat 44 1/2 lbs.
Straw 113
Chaff 47 1/6th.

Total 204 7/10ths.

Analysis of the Ash of the Grain.

	Per centage.	Removed from an acre.	
		lbs.	ozs.
Silica	5.63	2	8
Phosphoric acid	43.98	19	8
Sulphuric acid	.21	0	1 1/6th.
Lime	1.80	0	12 8/10ths.
Magnesia	11.69	5	3 2/10ths.

Peroxide of iron	.29	0	2
Potash	34.51	15	5 6/10ths.
Soda	1.87	0	13 3/10ths.
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Total	99.98	44	6 l/10ths.

Analysis of Straw with its proportion of Chaff.

	Per centage.	Removed per acre.	
		lbs.	ozs.
Silica	69.36	111	1 7/10ths.
Phosphoric acid	5.24	8	6 7/10ths.
Sulphuric acid	4.45	7	2 2/10ths.
Lime	6.96	11	2 2/20ths.
Magnesia	1.45	2	5
Peroxide of iron	.29	1	2
Potash	11.79	18	14
Soda	none	none.	
Chloride of sodium	"	"	
-----	---	-----------	
Total	99.54	160	1 l/10ths.

If we subtract the 111 pounds of silica from 160 pounds of minerals in the straw and chaff, the difference between what are left and those in wheat, is not great. As the stems and leaves of wheat plants grow before their seeds, if all the phosphoric acid, potash, and lime available in the soil is consumed before the organization of the seeds begin, from what source is nature to draw her supply of these ingredients to form a good crop of wheat? If the farmer could reverse the order of nature, and grow a good supply of seeds first, and make straw afterwards, then many a one would harvest more wheat and less straw. But the cultivator must grow the stems, roots, and leaves of wheat, corn, and cotton, before nature will begin to form the seeds of these several plants: and every one should know that the atoms in the soil, which are consumed in organizing the bodies of cultivated plants, are, in the main, identical in kind with those required to make their seeds. The proportions, however, differ very considerably. Thus, while 100 parts of the ash of wheat contain an average of 45 parts of phosphoric acid, 100 of the ash of the wheat straw contain an average of only 5 parts. The difference is as 9 to 1. In magnesia the disparity is only a little less striking.In what are called the organic elements of wheat (the combustible part) there are seven times more nitrogen in 100 pounds than in a like weight of straw. Hence, if the farmer converts straw into manure or compost, with the view ultimately of transforming it into wheat, it will take 7 pounds of straw to yield nitrogen enough to form one pound of wheat. Few are aware how much labor and money is annually lost by the feeding of plants on food not strictly adapted to the peculiar wants of nature in organizing the same. It is true, that most farmers depend on the natural fertility of the soil to nourish their crops, with perhaps the aid of a little stable and barn-yard manure, given to a part of them. As the natural resources

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of the land begin to fail, the supply must be drawn from other quarters than an exhausted field, or its cultivator will receive a poor return for the labor bestowed.In Great Britain, where the necessity for liberal harvests and artificial fertilizing is far greater than in this country, the yield of wheat is said to be governed in a good degree by the amount of ammonia available as food for growing plants. This opinion is founded not at all on theory, but altogether on the teachings of experience. But in England, limeing and manuring are so much matters of constant practice, that few soils are so improverished as many are in the United States, With land as naked and sterile as is much that can be found in the whole thirteen colonies between Maine and Alabama, English farmers could hardly pay their tithes and poor rates, to say nothing of other taxes, rent, and the coat of producing their annual crops.

> The first step towards making farming permanently profitable in all the older States, is to accumulate in a cheap and skilful manner the raw material for good harvests in the soil.

Over a territory so extensive as the United States, it is extremely difficult to lay down any rule that will be applicable even to a moiety of the republic. There are, however, many beds of marl, greensand, gypsum, limestone, saline and vegetable deposits available for the improvement of farming lands, in the Union. In addition to these, there are extraneous resources, the ocean with its fish, its shells, its sea-weeds, and its fertilizing salts, which will yield an incalculable amount of bread and meat. In the subsoil and the atmosphere, every agriculturist has resources which are not duly appreciated by one in a thousand.As a general rule, the soil must be *deepened* before it can be permanently improved. One acre of soil 12 inches deep is worth more to make money from, by cultivating it, than four acres 6 inches in depth. Thus, admit that a soil 6 inches deep will produce 14 bushels of wheat, and that 12 bushels will pay all expenses and give 2 for profit. Four acres of this land will yield a net income of only 8 bushels. Now double the depth of the soil and the crop: making the latter 28 bushels, instead of 14 per acre, and the former 12 inches deep, in the place of 6. Fifteen bushels instead of twelve, will now pay all annual expenses, and leave a net profit not of *two* but of *thirteen* bushels per acre. If small crops will pay expenses, large ones will make a fortune; provided the farmer knows how to enrich his land in the most economical way. It is quite as easy to pay too dear for improving lands, as to lose money at any other business whatever.The first thing for the operator to do is to acquire all the knowledge within his reach, from the experience of others who have done for their soils what he proposes to accomplish for

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his. Twenty or fifty dollars, invested in the best agricultural works in the English language, may save him thousands in the end, and double his profits in two years. The Agricultural Journals of the United States abound in information most useful to the practical farmer: and the back volumes, if collected and bound, will form a library of great value.*Rotation of Crops in connexion with Wheat Culture*.—A system of tillage and rotation which will pay best in one locality, or on one quality of soil, and in a particular climate, will be found not at all adapted to other localities, different soils and latitudes. Hence, no rule can be laid down that will meet the peculiar exigencies of a farming country so extensive as the thirty States east of the Rocky Mountains. There are soils in Western New York, known to the writer, which have borne good crops of wheat every other year for more than twenty years, and produce better now than at the beginning of their cultivation. The resources of the earth in supplying the elements of wheat and corn are extremely variable. There are friable shaley rocks in Livingstone county, N.Y., which crumble and slake when exposed to the air, that abound in all the earthy minerals necessary to form good wheat. These rocks are hundreds of feet in thickness, and have furnished much of the soil in the valley of the Genesee. The Onondaga Salt Group, and other contiguous strata, which extend into Canada West, form soils of extraordinary capacity for growing wheat. Indeed, the rocks and “drift” of a district give character to its arable surface.Nothing is more needed at this time than a good geological map of the United States, accompanied by an accurate and popularly arranged work on agricultural geology. The writer had hoped to give such a map in this report; but it is thought best to devote another year to the collection of geological surveys and facts, and to the making of more critical and extended researches before publishing.In the matter of rotation of crops in connection with wheat culture, clover and corn are generally preferred in all the Northern, and most of the Middle States. In New York, Ohio, Pennsylvania, Michigan, Wisconsin, Northern Indiana, and Illinois, so far as the writer is acquainted, a crop of wheat is made in rotation, either every third, fourth, or fifth year. Wherever wool growing is united with wheat culture, clover and wheat are the staple crops of the farm. Wool and superfine flour are exported; farmers taking nearly all the bran and shorts of the millers who purchase their wheat.The offal of wheat makes not a little feed with chaff and cut straw. Many agriculturists grow peas, beans, turnips, beets, and carrots in large quantities, as well as clover, corn, oats, and barley. Peas and beans, both stems and pulse, when well cured, are excellent feed for sheep; and on good land they are easily grown. They prepare the

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soil well for wheat.All the manure derived from sheep is husbanded with extreme care by the farmers who are gradually enriching their lands. On a deep, rich, arable soil, quite a number of sheep may be kept per acre, if highly cultivated; and their manure prepares the land for producing generous crops of wheat at a small expense. Of all business men, farmers should be the closest calculators of *profit* and *loss*.Great care should be taken to sow good and clean seed on clean land. Previous to putting the seed in the ground (drilling is preferable to sowing broadcast), wheat should be soaked five or six hours—not longer—in strong brine. After this, add a peck or more of recently slaked lime to each bushel, and shovel it over well, that the lime may cover each seed. It is now ready to commit to the earth. Most good farmers roll the earth after seeding: some before.In the Southern States, planters are in the habit of permitting their wheat to remain too long in the field after it is cradled, and in small shocks. Good barns are too scarce in all the planting States, and in some others.*Summer fallowing* is generally abandoned, except in cases where old pastures and meadows, new prairie, or bushy bad fields are to be subdued. As a general rule, friable soils need not be ploughed long before the intended crop is expected to begin to grow. Among fertilizers, wood ashes, salt, bones, lime, guano, and poudrette have been used in wheat culture with decided advantage. In Great Britain, manure derived from the consumption of turnips and other root crops by sheep and neat cattle, is much used in preparing land for wheat. Sheep, clover and peas, corn and hogs, rotate well to insure the economical production of this staple. Manure is usually applied to the crop preceding wheat.

It may be interesting to some readers to see in this place the mean
result of several organic analyses of wheat made by M. Boussingault.
Wheat, dried at 230 deg. *in vacuo*, was found to contain:

Carbon 46.1
Oxygen 43.4
Hydrogen 5.8
Nitrogen 2.3
Ash 2.4

Total 100.0

Charcoal may be regarded as a fair representative of carbon, and water as the representative of both oxygen and hydrogen. It will be seen by the above figures, that over 95 per cent. of wheat is made up of elements which greatly abound in nature in an available condition; and the same is true of all other plants. It is doubtless owing to this circumstance, that a comparatively small quantity of guano and other highly concentrated fertilizers are able to produce crops five, ten, and fifty times greater than their own weight. Azote, or nitrogen, in the form of ammonia, or nitric acid, (aqua fortis), and the incombustible part of plants are the elements which least abound in soils, and should be husbanded with the greatest care.

The Hon. C.P. Holcomb, of Delaware, furnishes some interesting remarks on the wheat crop of the United States:—

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A short wheat crop in England, Mr. Webster says, affects the exchanges of the civilized world. In the vast increase of population in the absence of long wars and famines, the importance of this staple is constantly increasing. Its cultivation is the most attractive and pleasant of all descriptions of husbandry; and its rewards are generally remunerating, when the soil and climate are favorable, and the markets are not too distant.It is important to know what our relation is to this staple of the world, and what is, and what is likely to be, our contribution to the great aggregate of production. Beyond feeding our own great and rapidly increasing population, it probably will not soon, if ever, be very great. It is a mistake, I apprehend, to suppose our country is naturally a great wheat-producing country. The wheat district at present, in comparison to the whole extent of our territory, is limited. It is confined, so far as any appreciable amount is grown, to about ten degrees of latitude and twenty degrees of longitude, and embracing about one half the number of the States. The crop of 1848 is estimated by the Commissioner of Patents at one hundred and twenty-six millions, and our population at twenty-two millions. This gives a less number of bushels, per head, to our population than the consumption of Great Britain, which is generally set down at one hundred and sixty millions, or six bushels to each inhabitant. But with us Indian corn is a great substitute; so are potatoes and oats in Ireland and Scotland. Still our consumption of wheat, including the black population, is undoubtedly less, per head, than theirs. But in the absence of any certain data, to ascertain either the actual production, or our consumption, our only safe course is to take the actual excess, or the amount exported, after supplying our own wants. This, for the fiscal year 1848, being the crop of 1847, amounted, in flour and wheat, to twelve millions two hundred and ninety-four thousand one hundred and seventy-five bushels, although Mr. Burke’s figures would show a surplus of some forty millions! That there was not, and never has been any such surplus in the country is very evident, for the foreign demand was all the time good, and drew away all we had to part with.The crop of 1848 was, undoubtedly, one of the best and largest we have ever grown; yet I have ascertained, by application at the registrar’s office, that the exports for the fiscal year 1842, amounted in wheat to but 1,527,534 bushels, and in flour to 2,108,013 barrels, or less by 226,676 bushels than the exports of 1848. Twelve millions is comparatively a small surplus in a favorable season, for a country with a population of twenty-two millions of inhabitants. The loss of a small per cent. in an unfavorable season would at once sink this excess.

Let us now notice more in detail the different sections of our country as adapted to the growth of wheat.

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The New England States, some of them aided in their recent enterprises by bounties offered by the state governments, have failed to insure such success as is likely to encourage them to continue the culture of wheat; or, at all events, to induce them to aim at increasing their product to any considerable extent, since, as one of their own farmers candidly states, “the attempt to grow a crop of wheat is an experiment.”The States south of North Carolina, and inclusive of a part of Delaware, have never heretofore succeeded in growing wheat to any considerable extent, though there were periods in their history—before the general introduction of the culture of cotton—when, if it had been practicable to make the cereal one of their staples, they would certainly have done so. Besides the common dangers from rust and blight, the fly, and sometimes the frost—as the past season—they have a most formidable enemy in the weevil. In Upper Georgia, in the Cherokee country in particular, wheat will probably be cultivated to some extent, and a limited cultivation of it by the planters for their own use will probably continue in several of the southern states. But the cotton, rice, and sugar states, like the manufacturing states of New England, will not soon, if ever, add much to the supply of wheat; the rich staples of the former, and the varied husbandry and grazing of the latter, suited to supply the immediate wants of a manufacturing population, will be likely to receive their attention in preference.Kentucky and Tennessee, though their agricultural history dates back beyond the settlement of the north-western states, have already been out-stripped by at least two of them. In neither of these states has the culture of wheat ever been put forward, and regarded as one of their best staples, or as very favorably adapted to their soil and climate. Still, notwithstanding the formidable danger from rust, the production of Tennessee is estimated to be equal to nine bushels to each person, and Kentucky about seven and a half bushels. Missouri may be classed with Kentucky and Tennessee, which she much resembles in soil, climate, and productions, except that she raises much less wheat than either, her crop being placed by the Commissioner of Patents at only two millions, or less than four bushels to each resident of the state. But, besides that the experience of the past discourages the idea that these fine states are likely to become great wheat-producing states, the fact that the staple of cotton may be cultivated over a considerable portion of one of them, and that hemp and tobacco are among the valuable products of the other two; that Tennessee is the very largest corn-producing state in the Union, showing her soil and climate are particularly adapted to this description of grain, and that Kentucky and Missouri are unsurpassed as grazing countries, and there is little ground to suppose that any change in their husbandry will very greatly

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or suddenly augment the production of wheat. Let us come now to the States of Indiana, Illinois, Wisconsin, and Iowa, and that *fabulous* wheat district or territory to the west of these again, from which, according to the vaticinations of some, may be drawn supplies of wheat to feed the population of both Europe and America, or fill warehouses that would sustain our people through a longer famine than that which afflicted the people of Egypt! I cannot help thinking that, to some extent, this generally fertile district of country has, so far as the production of wheat is concerned, been “shouted forth in acclamations hyperbolical.” My own impression in regard to it is, including the states last named, derived in part from observation, from intercourse and correspondence with intelligent agriculturists of these states, and from a careful examination of a geological survey of two of them, that the soil and climate of this whole district of country are *not* particularly favorable to the production of wheat. The popular idea I know to be otherwise. I am not going to dwell upon it, or to examine the subject at any length. There is a single remark that may help to explain the reputation that has gone abroad in reference to the wheat-producing qualities of these lands. The prairie sod, when first broken up, generally produces wheat well, often most abundantly, provided it escapes the rust, insect, &c. But, when this ground has been much furrowed, becomes completely pulverized by exposure to the atmosphere, the light and friable mould, of which most of it is composed, drenched, as a good deal of it is, at times, with surface water, fails to hold or sustain the roots of the plant, it is thrown out, or winter-killed; and “winter-killed,” “winter-killed,” “winter-killed,” we all know, is among the catalogue of disasters that almost annually reach us. Sometimes, when escaping the winter, the high winds of spring blow this light soil from the roots, exposing them to such an extent, that, in a dry time in particular, the wheat often perishes. When breaking up fresh prairies, there was much encouragement and promise of hope, but which, I believe, has not been, nor is likely to be, realized by their husbandmen, in the degree that early experiments induced them to look for.As appears by the last report of the Commissioner of Patents, the crop of Illinois, in reference to population and production, is below that of Kentucky, and both Indiana and Illinois are below that of Tennessee. The crop of Indiana is set down at 8,300,000, her population at 1,000,000, or equal to 81/2 bushels a-head. The production of Illinois is stated at 5,400,000, her population at 800,000, or less than seven bushels to each inhabitant—and both these “fair and fertile plains” are still farther behind the old “battered moors” of Maryland and Virginia.Much of their wheat, too, is spring wheat, sown often on land where the fall crop

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had winter-killed, increasing the number of bushels much more than the value of the crop. I have heard it estimated that full one-third of all the wheat shipped from Chicago was of this description. Chicago is their great wheat depot. Several millions of bushels are shipped from this point, *the contributions from parts of three States*, Wisconsin, Indiana, and Illinois; and which concentration of their joint product at this new western city, or something else, seems to have imparted to each and all these states the reputation of great wheat-growing states, though they are, in fact, with the advantage of a virgin soil, behind several of the western states, and two at least of the eastern or Atlantic States. The geological explorations of the Hon. Robert Dale Owen, undertaken under the authority of Congress, throws much light on the character of the soil of Wisconsin and Iowa, and the description given undoubtedly characterizes much of that region of country. The specific gravity of the soil, Mr. Owen states to be remarkably *light*; but what he represents to be a “striking feature in the character of the Iowa and Wisconsin soils, is the *entire absence, in the most of the specimens of clay, and in a large proportion of silex*.” Again, he speaks of their being particularly adapted to the growth of the sugar-beet, which he truly says, “flourishes best in a *loose fertile mould*.” Again, he detected no phosphates; but they might be there, as the *virgin* soil produced good wheat. So does the virgin soil of most of the prairie land.—“The soil was rich in geine,” &c. But I submit that this does not describe a wheat soil, hardly in any one particular. Liebig tells us, that “however great the proportion of *humus* in a soil, it does not necessarily follow it will produce wheat”—and cites the country of Brazil.Again, he adds, “how does it happen that wheat does not flourish on a sandy soil (which much of the soil of these states is described to be), and that a calcareous soil is also unsuitable to its growth, unless it be mixed with a considerable quantity of clay?”The late Mr. Colman, in his *European Agriculture*, states, that “the soil preferred for wheat (in England) is a strong soil with a large proportion of clay. But the question after all is, not whether these States cannot grow wheat, and in comparatively large quantities, for we know that while their lands are fresh, they can and do—but whether, considering the hazard of the crop from winter-killing, the rust, the fly—the risk from the two former being equal to a large per cent. premium of insurance, they are not likely to find their interest in grazing, in raising and feeding stock, instead of attempting to extend their wheat husbandry. Lord Brougham has said, that grazing countries are always the most prosperous, and their population the most contented and happy. The meat markets of Great Britain are likely to prove better and more

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stable for us, than their grain markets.The Hon. Henry L. Ellsworth, a distinguished citizen, and large farmer of Indiana—distinguished throughout the Union for his zeal in the cause of agriculture—thus expresses himself on this subject: “After a full consideration of the subject, I am satisfied that stock-raising at the West is much more profitable than raising grain. Indeed, an examination of the north-western States shows a vast difference in the wealth of the grazier over those who crop with grain. The profits of wheat appear well in expectation on paper, but the prospect is blasted by a severe winter, appearance of insects, bad weather in harvesting, in threshing, for there are but few barns at the West, or transporting to market, or last, a fluctuation in the market itself.”Such is the opinion of Mr. Ellsworth, the result of observation and experience, himself largely interested in ascertaining the safest and surest course to be pursued. The destiny he has indicated for this beautiful fertile region of country, will undoubtedly be fulfilled; it will become a great pastoral, stock-raising, and stock-feeding country.Ohio stands now, as she did at the census of 1840, at the head of all the wheat States, in the aggregate of production; her crop of 1848 being estimated at 20,000,000, which is about equal to 101/2 bushels per head of her population. The geological survey of this State, and the character of the soil, as described in the Reports of the Board of Agriculture, in a large range of her counties, as a “clayey soil,” “clayey loam,” “clay subsoil,” &c., shows Ohio to possess a fine natural wheat soil, if indeed, alter thirty years of a generally successful wheat husbandry, such additional testimony or confirmation was necessary.Michigan has also been successful in the cultivation of wheat. Her burr-oak openings are unsurpassed in producing wheat. They are intervening ridges between low grounds, or marshes and bodies of water, and their location not generally considered very healthy. A doubt has also been suggested as to whether this soil, being a clayey loam, resting on a sandy and gravelly subsoil, is likely to wear as well as some other portions of the fertile soil of the State. The Commissioner of Patents puts her crop for 1848 at 10,000,000 of bushels, which is equal to 231/2 bushels to each inhabitant! By the census of 1840, the population of Michigan was 212,267; number of bushels of wheat, 2,157,108. Her population in 1848 is estimated at 412,000. While she has barely doubled her population, she has, according to the above estimate, more than *quadrupled* her production of wheat—increased it at the rate of about one million bushels a year for eight consecutive years, making the quantity she grows to each head of her population *more than double* that of any State in the Union.We can at least say, and appeal to the

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past history of the country to show it, that for a period of more than one hundred years, the supply of the Atlantic wheat States has generally been constant, and for the most part abundant. They have furnished the “staff of life” to several generations of men, and cotemporary with it, an annual amount for export, that materially assisted in regulating the exchanges of the country.

England requires for her own consumption, upon the average of years, somewhere about 32,000,000 bushels of wheat more than she produces. The average annual entries of foreign wheat for consumption in the United Kingdom, for the sixteen years ending with 1845, were about nine and a half million bushels. Inasmuch as the average number of acres in wheat crop were in 1846 about 4,600,000, the average produce 142,200,000 bushels, or over 30 bushels to the acre—an improvement in the harvest to the extent of two bushels per acre, will destroy the demand, and a deficiency to that extent will double it. Now as there is an available surplus at the neighbouring ports in Europe, in the Baltic and the Black Sea, of about 18,000,000 of bushels only, whenever there is a demand for home consumption, for, say 20,000,000 bushels, as was the case in each of the five years from 1838 to 1843, larger shipments from America will take place; but whenever there are good harvests, as in the six years from 1831 to 1837, in which the deficiency only ranged from 230,000 to 1,000,000 bushels, the trade is not worth notice. It must be remarked, however, that in a country like Britain, where capital is abundant, consumption great, speculation rife, the harvest so uncertain, and the stake so great that a cloudy day transfers thousands from one broker to another, the importation cannot be closely assimilated to the actual wants of the country. The ordinary yield of grain in the United Kingdom after deductions for seed, is about 400,000,000 bushels, and as nearly 100,000,000 bushels of grain and meal were imported in 1847, there must have been a general deficiency of nearly twenty-five per cent.

In the “Statistics of the British Empire,” the average extent of land under grain culture, &c., in 1840, was estimated as follows:—

ENGLAND AND WALES.

		Produce per Acre.	Total Produce.
Wheat	3,800,000	31/4 quarters.	12,350,000
Barley and rye.	900,000	4 "	3,600,000
Oats and beans.	3,000,000	41/2 "	13,500,000

SCOTLAND.

Wheat	220,000	3	660,000
Barley	280,000	31/2	980,000
Oats	1,275,000	41/2	5,737,500

In Scotland, ten years ago, 150,000 acres were reckoned to be under cultivation with wheat, 300,000 with barley, and 1,300,000 with oats, which is the great crop and chief food of the people.

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Mr. Braithwaite Poole, in his “Statistics of British Commerce,” 1852, states—“The annual average production of all sorts of corn in the United Kingdom has been estimated by competent parties at rather more than 60,000,000 quarters, and L80,000,000 in value; but in the absence of general official returns, we cannot vouch for its accuracy, although, from various comparisons, there are reasonable grounds for assuming this calculation to be as nearly correct as possible. Some persons in the corn trade imagine the aggregate production to approach almost 80,000,000 quarters; but I cannot find any data extant to warrant such an extended assumption.”

The estimated produce of wheat, in quarters, and acreage, he states as follows:—

	Quarters.	Acreage.
England	15,200,000	3,800,000
Ireland	1,800,000	600,000
Scotland	1,225,000	350,000
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Total	15,225,000	4,750,000

The average price of wheat per quarter in the last thirteen years, in England and Wales, has been as follows:—

	s.	d.
1840	66	4
1841	64	4
1842	57	3
1843	50	1
1844	51	3
1845	50	10
1846	54	8
1847	69	9
1848	50	6
1849	44	3
1850	40	4
1851	38	7
1852	41	0

The best wheat, as well as the greatest quantity, is raised in the midland counties. From two and a half to three Winchester bushels per acre are required for seed, and the average produce varies from twenty-two to thirty-two bushels per acre.

THE CONTINENT.

The quantity of wheat raised in France in 1835 was 71,697,484 hectolitres, of which eleven millions was required for seed. The average produce per hectare was stated at thirteen and a half hectolitres.

The total grain and pulse raised in that year was set down at 204,165,194 hectolitres.

	Hectolitres.
Maslin	12,281,020
Barley	18,184,316
Rye	32,999,950
Buckwheat	5,175,933
Maize and Millet	6,951,179
Oats	49,460,057
Peas and Beans	3,318,691

Oats, next to wheat is the largest crop grown in France, for the support of two million horses and three and a half million mules and asses.

According to the “Annuaire de l’Economie Politique de la Statistique,” there were 13,900,000 hectares (each about 21/2 acres) under cultivation with the cereals in France.

The primary article of consumption is wheat. At the rate of three hectolitres (1 qr. 1/4 bush.) to each individual, every family would require thirteen to fourteen hectolitres, costing 210 to 280 francs (L8 15s. to L11 10s.) according as the price varies, between its present value fifteen francs, and its occasional cost twenty francs. In the reign of Louis XVI, Arthur Young referred with horror to the

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black bread eaten by the French. Since that time half a century has passed, and whilst the agricultural produce in France has tripled in value, the labourers who produce it continue, from custom and necessity, to eat a detestable bread made from rye, barley, or peas and potatoes; and, to make the matter still worse, it is badly baked, without yeast, and being sometimes kept for weeks, it becomes covered with mould, and altogether presents an appearance enough to turn the stomach of a savage.

According to Mr. McGregor's estimate some ten or twelve years ago, the land under wheat culture was 13,808,171 acres, producing 191,000,000 bushels; and 11,715 acres with spelt, or red wheat, the yield of which was 374,000 bushels.

The other crops were—

	Acres	Crops, bushels
Maslin	2,251,438	32,000,000
Rye	6,369,879	76,000,000
Barley	2,936,453	45,000,000
Oats	7,416,297	134,000,000
Maize	1,561,372	20,000,000

Wheat and oats are grown all over Russia, which is the greatest corn land in the world.

In Austrian Italy the yield of grain has been reckoned at three million quarters, but this seems rather low. About one-half of this is maize and rye, and a quarter wheat.

It is reckoned that eight million quarters of grain are raised yearly in Denmark, but this seems doubtful. In 1839, a million quarters of grain, however, were shipped from that kingdom.

BRITISH AMERICAN PROVINCES.

According to the census return of 1852, the number of acres under grain crops, and the produce in Canada, were as follows:—

Lower Canada—Produce. Upper Canada—Produce.

	Acres.	Bushels.	Acres.	Bushels.
	Lower Canada—Produce		Upper Canada—Produce	
	Acres	Bushels	Acres	Bushels
Wheat	427,111	3,075,868	782,115	12,692,852

Barley	42,927	668,626	29,916	625,875
Rye	46,007	341,443	38,968	479,651
Oats	540,422	8,967,594	421,684	11,193,844
Buckwheat	51,781	530,417	44,265	639,381
Maize	22,669	400,287	70,571	1,666,513

Flour may be valued at 21s. the barrel.

The grain crops in Lower Canada are taken in the minot, and not in the bushel, except in the townships. In like manner, the acres are taken in arpents. An arpent is about one-seventh less than an acre; and a minot about one-eighth (some say one-twelfth) more than a bushel.

During the years 1850-1, Western Canada exported upwards of two million barrels of flour, and three million bushels of wheat, being equivalent to 13,600,000 bushels of wheat. The value of the wheat and flour exported in 1851 was L404,033. Canadian flour, like that of Genessee, is of very superior quality.

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WHEAT.—UPPER CANADA.

	Bushels.		To each inhabitant.
Wheat crop of 1841 was	3,221,991	or	6.60
Do. 1847	7,558,773	"	10.45
Do. 1849	9,706,082	"	12.08
Do. 1851	12,692,852	"	13.33

The quantity of land under wheat in “Upper Canada was 782,115 acres, showing a yield of about sixteen and three quarter bushels to the acre. The wheat produced in 1852 was valued at nearly two million pounds sterling.

LOWER CANADA.

	Minots.		
Wheat crop in 1843 was	942,835	or	1.36
Do. 1851	3,075,868	"	3.46

UNITED STATES.

	Bushels.		
Wheat crop in 1839 was	84,832,272	or	4.96
Estimated by patent office 1847	114,245,500	"	5.50
Crop of wheat 1849	100,684,627	"	4.33

In order, however, to institute a fairer comparison, I will divide the States into three classes, *viz*.:—1st. States growing over six million bushels.

	Bushels.	Population.	Bush, per head.
Pennsylvania	15,367,691	2,311,736	6.65
Ohio	14,487,351	1,980,408	7.32
New York	13,131,498	4,148,182	3.16
Virginia	11,232,616	1,421,661	7.90
Illinois	9,414,575	851,471	11.06
Indiana	6,214,458	988,416	6.28
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Total	69,847,189	11,701,924	5.97

2nd. States growing over one million and less than six million bushels.

	Bushels.	Population.	Bush, per head.
Michigan	4,925,889	397,654	12.39
Wisconsin	4,286,131	305,191	14.04
Maryland	4,494,681	583,031	7.71
Missouri	2,981,652	682,043	4.38
Kentucky	2,140,822	982,405	2.15
North Carolina	2,130,102	868,903	2.45
Tennessee	1,619,381	1,002,525	1.61
New Jersey	1,601,190	481,555	3.27
Iowa	1,530,581	192,214	7.96
Georgia	1,088,534	905,999	1.21
South Carolina	1,066,277	668,507	1.60
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Total	27,865,240	7,078,131	3.93

3rd. The remaining States and territories.

2,791,470 4,466,246 0.63

Total wheat crop in the United States, 100,503,899 bushels. Population, 23,246,301. Bushels per head, 4.33.

Increase:—U. States, 1839 84,823,272 bushels
" 1849 100,503,896 "

15,680,627

Or 18.49 per cent. in ten years.

Upper Canada, 1841 3,221,991 "
" 1851 12,692,825 "

9,470,861

Or nearly quadrupling itself in ten years.

		Bushels.	Population.	Bush. per head.
Pr. Ed. Island	1847	219,787	62,678	3.50
Newfoundland	1850	297,157	276,117	1.08
New Brunswick	1850	206,635	193,800	1.06

The Eastern States in 1849 raised 1,090,896 bushels. Population 2,668,106, or 0.41 each.

The population of Upper Canada is 952,904, and allowing five bushels for each, 4,760,020 bushels; and for seed at one and a half bushels per acre 1,173,173 bushels = 5,933,193; leaves for export 6,761,668 bushels. More than sufficient to supply the consumption of the whole of the Eastern States.

“Were the population of Lower Canada to consume flour at the given rate, it would require—

	Bushels.
890,261 at five bushels each	4,451,305
Seed	640,000

	5,091,305
Grown	3,075,868

	2,015,437

Leaving a surplus of wheat in Canada 4,746,231 bushels, or at four and a half bushels for each, equal to 1,054,718 barrels of flour.

Professor Johnston in his report on New Brunswick, furnishes some valuable information as to the produce there.

The following table of average weights indicates a capacity in the soil and climate to produce grain of a very superior quality:—

COUNTIES	Wheat	Barley	Oats	Rye	Buck-Wheat	Maize
Saint John	61	—	41	—	50	—

Westmoreland	60	48	351/2	—	48	59
Albert	58	50	343/4	50	45	—
Charlotte	59	45	39	—	57	59
King’s	591/2	48	37	—	48	60
Queen’s	581/2	50	361/2	53	43	61
Sunbury	57	55	38	53	47	57
York	63	50	38	—	51	60
Carleton	64	—	38	—	52	65
Kent	63	—	37	—	50	—
Northumberland	62	53	37	—	45	57
Gloucester	63	51	39	—	—	—
Restigouche	63	48	42	—	—	—

The general average weights for the whole Province are, for

Wheat	60 11-13	lbs.
Barley	50	"
Oats	38	"
Rye	521/2	"
Buckwheat	48 8-11	"
Indian Corn	591/2	"
Potatoes	63	"
Turnips	66	"
Carrots	63	"

The annexed statement shows not only the average yield per acre of each description of crop, but affords an opportunity of contrasting it with the like products in the State of New York:—

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AVERAGE PRODUCE PER IMPERIAL ACRE.

	New Brunswick	State of New York
	Bushels	Bushels
Wheat	20	14
Barley	29	16
Oats	34	26
Rye	201/2	91/2
Buckwheat	333/4	14
Indian Corn	413/4	25
Potatoes	226	90
Turnips	460	88
Hay	13/4	—

A possibility of error in striking the averages is suggested in the report; and to guard against it the following statement of the averages derived from the minimum returns is given, *viz*.:—Wheat 173/4 bushels; Barley, 27; Oats, 33; Buckwheat, 28; Rye, 18; Indian Corn, 361/2; Potatoes, 204; Turnips, 389. The diminished averages scarcely affect the question of productiveness, as in every particular they exceed the averages for the favored Genesee Valley and the southern shores of Lake Ontario.

While the productiveness of the soil is thus proven by the statements of most experienced farmers, the average prices appear to be equally favorable to the Provincial growers. The following tables of averages set this in a clear point of view:—

AVERAGE PRICES OF GRAIN PER BUSHEL AND PER QUARTER.

	Per Bushel	Per Quarter
Wheat	7s. 6d.	60s. 0d.
Barley	4 21/2	33 8
Oats	2 0	16 0
Rye	4 10	38 8
Buckwheat	3 9	30 0
Indian Corn	4 8	37 4

ROOT CROPS AND HAY.

Potatoes	1s. 11d. per bushel.
Turnips	1 2 "

Eng. Hay	49	0	per ton.
Carrots	2	5	per bushel.
Man. Wurtzel	2	1	"
Marsh Hay	20	0	per ton.

AVERAGE MONEY VALUE OF AN ACRE OF EACH CROP.

	New Brunswick	Canada West	State of Ohio
Wheat	L 6 13 0	L2 4 7	L2 19 0
Barley	5 13 71/2	1 19 41/2	2 4 0
Oats	6 3 6	1 11 0	1 13 9
Rye	4 7 0	1 5 101/2	1 12 4
Buckwheat	5 5 0	3 5 0	1 16 3
Indian Corn	8 10 4	2 14 41/2	2 15 0
Potatoes	19 11 0	6 6 0	6 9 41/2

On a review of the foregoing and other tables, Professor Johnston has drawn the following conclusions:—

"That grain and roots generally can be raised more cheaply in the Province of New Brunswick than in New York, Ohio, or Upper Canada; and that the Province ought to be able to compete with those countries and drive them from its home markets."

Such are the deductions of a skilful and scientific, practical and theoretical agriculturist, from the statements furnished by the most enterprising and successful of our colonists. Nevertheless, I cannot conceal a doubt whether all the elements of comparison have been duly weighed. The result, especially as regards wheat, is so contrary to pre-conceived opinions, that further investigations should be made. Is it not possible that, while an equality of expense in preparing the land for a wheat crop appears to have been assumed, the great care and expense necessary in New Brunswick to prepare the land, and an occasional succession of minimum returns would, to a very considerable extent, account for the supposed discrepancy?

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Wheat has, from time immemorial, been a staple crop in the plains of Northern India, and especially in the Punjaub. The climate and soil are well fitted for this cereal, but owing to defects and carelessness in the agriculture and harvesting, the crops, though excellent, fall short of what most corn-growing countries produce. Further—owing to foul boats and granaries, and to the moist heat of the months immediately succeeding harvest, the wheat reaches England in a state too dirty and weevelled for market. The hard wheat is preferred by the natives in India to the soft, probably for no better cause than that the hardness of the grain more closely resembles their favorite food, rice.

BARLEY.

Oats, rye and barley, are the staple crops of northern and mountainous Europe and Asia. In England barley is grown principally in the eastern and some of the midland counties, and chiefly for malting. It is most extensively cultivated in the Himalaya and Thibet, replacing in many districts the wheat, and producing an admirable flour.

Since the establishment of the studs at Buxar, Ghazepore, &c., oats have been extensively cultivated. It is a winter crop.

Although believed to have been indigenous to the countries bordering on the torrid zone, this grain possesses the remarkable flexibility of maturing in favorable seasons and situations on the eastern continent as far north as 70 deg., and flourishes well in lat. 42 deg. south. Along the Atlantic side of the continent of America, its growth is restricted to the tract lying between the 30th and 50th parallels of north latitude, and between 30 and 40 deg. south. Near the westerly coast, its range lies principally between latitude 20 and 62 deg. north. The barley chiefly cultivated in the United States is the two-rowed variety which is generally preferred from the fulness of its grain and its freedom from smut. Barley has never been much imported from that country, as the Americans have been rather consumers than producers. The consumption of barley there in 1850 in the manufacture of malt and spirituous liquors amounted to 3,780,000 bushels, and according to the census returns, the quantity of barley raised was 4,161,504 bushels in 1840, and 5,167,213 bushels in 1850. In this country barley is extensively used for malting, distilling, and making beer; large quantities are consumed in Scotland, or carried into England.

In Prussia, about ten and a half million hectolitres of barley are annually raised. In the Canary Isles, about 354,000 bushels are annually exported. In Van Diemen's Land in 1844, 174,405 bushels of barley were grown on 12,466 acres.

The quantity of barley made into malt in the United Kingdom in the year ending 10th October, 1850, was 5,183,617 quarters, of which about four million quarters were used by 8,500 maltsters. The quantity of malt charged with duty in the year ending 5th January, 1851, was 636,641 tons; the average price per quarter, 26s. 2d.

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Barley is at present extensively cultivated in the temperate districts and islands of Europe, Asia, Africa and Australia. In Spain, Sicily, the Canaries, Azores and Madeira, two crops are produced in a year. In North America its growth is principally confined to Mexico, the middle, western, and northern States of the Union, and to the British North American provinces. The introduction of barley into the American colonies may be traced back to the period of their settlement. By the year 1648 it was raised in abundance in Virginia, but soon after its culture was suffered to decline, in consequence of the more profitable and increased production of tobacco. It has also been sparingly cultivated in the regions of the middle and northern States for malting and distillation, and has been employed, after being malted, as a substitute for rice.

Barley, like wheat, has been cultivated in Syria and Egypt for more than 3,000 years, and it was not until after the Romans adopted the use of wheaten bread, that they fed their stock with this grain. It is evidently a native of a warm climate, as it is known to be the most productive in a mild season, and will grow within the tropics at an elevation of 3,000 to 4,000 feet above the level of the sea. It is one of the staple crops of northern and mountainous Europe and Asia. It is the corn that, next to rice, gives the greatest weight of flour per acre, and it may be eaten with no other preparation than that of boiling. It requires little or no dressing when it is sent to the mill, having no husk, and consequently produces no bran. In this country barley is chiefly used for malting and distilling purposes. In the year 1850, 40,745,050 bushels of malt paid duty, the number of maltsters in the United Kingdom being from 8,000 to 9,000. About one and a half million quarters of barley were imported in 1849, and a little over a million quarters in 1850, principally from Denmark and Prussia. The counties in England where this grain is chiefly cultivated are Norfolk, Suffolk, Cambridge, Bedford, Herts, Leicester, and Nottingham. The produce of barley on land well prepared, is from thirty to fifty bushels or more per statute acre, weighing from 45 to 55 lbs. per bushel, according to quality. It is said to contain 65 per cent. of nutritive matter, while wheat contains 78 per cent.

The estimated average produce of barley in this country may be stated as follows:—

	Acres.	Crop.
England	1,500,000	6,375,000
Ireland	320,000	1,120,000
Scotland	450,000	1,800,000
	--------	-----------
	2,270,000	9,295,000

The average produce per acre, in the United Kingdom, is 41/4 quarters in England, 31/2 in Ireland, and 4 in Scotland. The prices of barley per quarter have ranged, in England, from 36s. 5d. in 1840, to 27s. 6d. in 1842. In 1847 barley reached 44s. 2d., and gradually declined to 23s. 5d, in 1850.

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OATS.

Oats are principally in demand for horses, and the extraordinary increase of the latter has occasioned a proportional increase in the culture of oats. They are grown more especially in the north and north-eastern counties; in the midland counties their culture is less extensive, but it is prevalent throughout most parts of Wales.

Nearly twice as much oats as wheat is raised in the United Kingdom, but the proportion grown in Scotland is not so large as is supposed. The following is a fair estimate of the comparative production:—

Acres.	Produce.	
England	2,500,000	12,500,000
Ireland	2,300,000	11,600,000
Scotland	1,300,000	6,500,000
---------	---------	
Total	6,100,000	30,500,000

We import annually about l1/4 million quarters from foreign countries and nearly three-fourths of a million quarters from Ireland. The average produce per acre throughout the kingdom is five quarters. The price within the last 10 years has ranged from 28s. 7d. per quarter (the famine year) to 17s. 6d.

The oat, when considered in connection with the artificial grasses, and the nourishment and improvement it affords to live stock, may be regarded as one of the most important crops produced. Its history is highly interesting, from the circumstance that in many portions of Europe it is formed into meal, and forms an important aliment for man; one sort, at least, has been cultivated from the days of Pliny, on account of its fitness as an article of diet for the sick. The country of its origin is somewhat uncertain, though the most common variety is said to be indigenous to the Island of Juan Fernandez. Another oat, resembling the cultivated variety, is also found growing wild in California.

This plant was introduced into the North American Colonies soon after their settlement by the English. It was sown by Gosnold on the Elizabeth Islands in 1602; cultivated in Newfoundland in 1622, and in Virginia, by Berkley, prior to 1648.

The oat is a hardy grain, and is suited to climates too hot and too cold either for wheat or rye. Indeed, its flexibility is so great, that it is cultivated with success in Bengal as low as latitude twenty-five degrees North, but refuses to yield profitable crops as we approach the equator. It flourishes remarkably well, when due regard is paid to the selection of varieties, throughout the inhabited parts of Europe, the northern and central portions of Asia, Australia, Southern and Northern Africa, the cultivated regions of nearly all North America, and a large portion of South America.

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In the United States the growth of the oat is confined principally to the Middle, Western and Northern States. The varieties cultivated are the common white, the black, the grey, the imperial, the Hopetown, the Polish, the Egyptian, and the potato oat. The yield of the common varieties varies from forty to ninety bushels and upwards per acre, and weighing from twenty-five to fifty pounds to the bushel. The Egyptian oat is cultivated south of Tennessee, which after being sown in autumn, and fed off by stock in winter and spring, yields from ten to twenty bushels per acre. In the manufacture of malt and spirituous liquors oats enter but lightly, and their consumption for this purpose does not exceed 60,000 bushels annually in the United States.

In 1840, Ireland exported 2,037,835 quarters of oats and oatmeal, but in 1846, on account of the dearth, the grain exports fell off completely. Most of the grain grown in Ireland requires to be kiln-dried, and is, therefore, of lower value.

The oat, like rye, never has entered much into our foreign commerce, as the domestic consumption has always been nearly equal to the quantity produced. The annual average exports from the United States for several years preceding 1817, were 70,000 bushels.

By the census returns of 1840, the total produce of the United States was 123,071,341 bushels; of 1850, 146,678,879 bushels.

In Prussia 43 million hectolitres of oats are annually raised.

The quantity of oats imported into the United Kingdom, has been declining within the last few years. In 1849, we imported 1,267,106 quarters; in 1850, 1,154,473; in 1851, 1,209,844; in 1852, 995,479. In 1844, 221,105 bushels of oats were raised in Van Diemen’s Land on 13,864 acres.

RYE.

Rye (*Secale cereale*) is scarcely at all raised in this country for bread, except in Durham and Northumberland, where, however, it is usually mixed with wheat, and forms what is called “maslin,”—a bread corn in considerable use in the north of Europe.

Geographically rye and barley associate with one another, and grow upon soils the most analogous, and in situations alike exposed. It is cultivated for bread in Northern Asia, and all over the Continent of Europe, particularly in Russia, Norway, Denmark, Sweden, Germany and Holland; in the latter of which it is much employed in the manufacture of gin. It is also grown to some extent in England, Scotland and Wales. With us it is little used as an article of food compared with wheat and oats, though in the north of Europe and in Flanders it forms the principal article of human subsistence, but generally mixed with wheat, and sometimes, also with barley; 100 parts of the grain consist of 65.6 of meal, 24.2 of husk, and 10.2 of water. The quantity of rye we import seldom reaches 100,000 quarters per annum.

The straw is solid, and the internal part, being, filled with pith, is highly esteemed for Dunstable work, for thatching and litter, and it is also used to stuff horse collars.

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In Ireland there are 21,000 acres under culture with rye, producing 105,000 quarters.

In North America rye is principally restricted to the Middle and Eastern States, but its culture is giving place to more profitable crops.

In Bohemia, as in most parts of Germany, rye forms the principal crop, the product being about 3,250,000 quarters annually.

The three leading varieties cultivated in the United States are the spring, winter, and southern; the latter differing from the others only from dissimilarity of climate. The yield varies from 10 to 30 or more bushels per acre, weighing from 48 to 56 pounds to the bushel. The production of rye has decreased 4,457,000 bushels in the aggregate, but in New York it is greater by the last decennial census than in 1840, by about 40 per cent. Pennsylvania, which is the largest producer, has fallen off from 6,613,373 to 4,805,160 bushels. Perhaps the general diminution in the quantity of this grain now produced may be accounted for, by supposing a corresponding decline in the demand for distilling purposes, to which a larger part of the crop is applied in New York. This grain has never entered largely into its foreign commerce, as the home consumption for a long period nearly kept pace with the supply. The amount exported from the United States in 1801, was 392,276 bushels; in 1812, 82,705 bushels; in 1813, 140,136 bushels. In 1820-1 there were exported 23,523 barrels of rye flour; in 1830-1, 19,100 barrels; in 1840-1 44,031; in 1845-6, 38,530 barrels; in 1846-7, 48,892 barrels; in 1850-1, 44,152 barrels. During the year ending June 1, 1850, there were consumed of rye about 2,144,000 bushels in the manufacture of malt and spirituous liquors.

According to the American census returns of 1840, the product of the country was 18,645,567 bushels; in 1850, 14,188,637 bushels. We imported 246,843 quarters of rye and rye meal, in 1849, equivalent to 49,368 tons; but in 1850 the imports were only 94,078 quarters and in 1851 they were but 26,323 quarters. About 20,000 acres are under cultivation with rye in Ireland, the produce of which is 100,000 quarters.

BUCKWHEAT.

Buckwheat belongs to the temperate and arctic climates, and is cultivated in Northern Europe, Asia, and America for the farinaceous albumen of its seeds, which, when properly cooked, affords a delicious article of food to a large portion of the human race. It also serves as excellent fodder to milch cows, and the straw, when cut green and converted into hay, and the ripened seeds, are food for cattle, poultry, and swine.

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It is raised most abundantly in Central Asia and the Himalaya. In the latter country the different varieties are grown at various elevations, between 4,000 and 12,000 feet. The finest samples exhibited in 1851 were from Canada, but some of excellent quality was also shown by the United States, Russia, and Belgium. The common variety grown in Europe is the *Polygonum fagopyrum*, and *P. emarginatum* is grown in China and the East. In this country the produce varies from 2 to 4 quarters per acre. The quantity of seed sown is 5 to 8 pecks the acre. Vauquelin found 100 parts of its straw to contain 29.5 of carbonate of potash, 3.8 of sulphate of potash, 17.5 of carbonate of lime, 13.5 of carbonate of magnesia, 16.2 of silica, 10.5 of alum, and 9 of water.

It is believed to be a native of Central Asia, as it is supposed to have been first brought to Europe in the early part of the twelfth century, at the time of the crusades for the recovery of Syria from the dominion of the Saracens; while others contend that it was introduced into Spain by the Moors, four hundred years before.

The cultivation of buckwheat, in one or other of its species, is principally confined to Great Britain, France, Switzerland, Italy, Netherlands, Germany, Sweden, Russia, China, Tartary, Japan, Algeria, Canada, and the middle and northern portions of the United States.

In America from 30 to 45 bushels per acre may be considered as an average yield in favorable seasons and situations, but 60 or more bushels are not unfrequently produced.

According to the census returns of 1840, the annual quantity raised in the United States was 7,291,743 bushels; of 1850, 8,950,916 bushels.

The average annual imports of buckwheat into this country have not exceeded 1,000 quarters, until last year (1852), when they reached 8,085 quarters. A small quantity of the meal is also annually imported.

MAIZE.

Maize (*Zea Mays*), is the common well-known Indian corn forming one of the most important of the grain crops, and has a greater range of temperature than the other cereal grasses. It was found cultivated for food by the Indians of both North and South America, on the first discovery of that continent, and thence derived its popular name. Maize succeeds best in the hottest and dampest parts of tropical climates. It may be reared as far as 40 degrees north and south latitude on the American continent; while in Europe it can grow even to 50 degrees or 52 degrees of latitude, some of the numerous varieties being hardy enough to ripen in the open air, in England and Ireland. It is now cultivated in all regions in the tropical and temperate zones, which are colonized by Europeans. It is most largely grown, however, about the Republics bordering on the northern shores of South America, California, the United States and Canada, the West India islands and Guiana, on the coasts of the Mediterranean, and partially in India, Africa, and Australia. We see the singular fact in Mexico of land which, after perhaps thousands of years' culture, is so little exhausted, that with a very little labor bestowed on it, a bad maize harvest will yield two hundredfold profit, while a good crop returns 600 fold.

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This grain adopts itself to almost every variety of climate, and is found growing luxuriantly in the low countries of tropical Mexico, and nearly equally well on the most elevated and coldest regions of the table-land; in the rich valleys of the Cordilleras or the Andes, and on the sandy heights of those mountains wherever a rill of water can be brought to nourish its roots. In short, it ripens under the sun of America, in every part of both continents.

Though wheat is characterised as the most nutritious food for man in all quarters of the world, yet the Indian corn crop of the United States is not second in value to any product of the earth; cultivated in the middle and Eastern States, nay, even in the rich cotton-growing districts, Indian corn is fast rising in importance, and will soon equal in value that important commercial staple. This indigenous grain yields to the nation an annual average of five hundred millions of bushels, and has, within the last five years, attracted much attention as a life-sustaining food, more particularly at the period of Ireland's severe suffering, in 1847, and the following years. Nations, as well as statesmen and farmers, have found it an object worthy of their consideration and esteem.

When due regard is paid to the selection of varieties, and cultivated in a proper soil, maize may be accounted a sure crop in almost every portion of the habitable globe, between the 44th degree of north latitude and a corresponding parallel south. Among the objects of culture in the United States, it takes precedence in the scale of cereal crops, as it is best adapted to the soil and climate, and furnishes the largest amount of nutritive food. Besides its production in the North American Republic, its extensive culture is limited to Mexico, the West Indies, most of the States of South America, France, Spain, Portugal, Lombardy, and Southern and Central Europe generally. It is, however, also cultivated with success in Northern, Southern, and Western Africa, India, China, Japan, Australia, and the Sandwich Islands, the groups of the Azores, Madeira, the Canaries, and numerous other oceanic isles.

Maize is not a favorite grain as bread-corn with the European nations, for although it abounds in mucilage, it is asserted to contain less gluten, and is not likely to be much used by those who can procure wheaten flour, or even rye bread.

The large importations which were made by our Government during the prevalence of the potato disease, brought it into more general use among some classes, and the imports for home consumption are still extensive, having been as follows in the last few years:—

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	1848.	1849.
Indian corn, quarters	1,582,755	2,249,571
" meal, cwts.	233,880	102,181

	1850.	1851.
Indian corn, quarters	1,286,264	1,810,425
" meal, cwts.	11,401	

The trade in maize, or Indian corn, is totally new since 1846. The famine in Ireland in that year, and the potato rot in almost every successive year since, have now fully established it. Like the gold discoveries, the potato rot may be regarded as a providential means of effecting a great change in the condition of society. Those discoveries are not without their influence in the East, and, combined with the potato rot, they have rapidly increased the commerce between the East and West of Europe, while they are spreading broad paths between all Europe and the lands in the Southern Ocean. The imports of maize from all parts, in 1852, amounted to 1,550,000 quarters, of which about 1,100,000 quarters arrived in vessels from the Mediterranean, &c., calling at Queenstown or Falmouth for orders. The balance consisted of imports from America, France, Portugal, &c., and also of cargoes addressed direct to a port of discharge, without first calling off the coast for orders. The quantities received in 1851 and 1852 from the Mediterranean were as follows:—

	1852.	1851.
Received from	qrs.	qrs.
Galatz	223,000	286,067
Ibraila	362,600	211,779
Salonica	35,640	95,377
Odessa	219,170	74,065
Egypt	50,960	86,260
Italy	8,250	162,544
Constantinople, Malta, Trieste, and other ports in the Mediterranean	190,720	286,358
	---------	---------
	1,090,340	1,202,450

The various quarters from whence we derive supplies of this grain, are shown in the following table of the imports for the last three years, which I have compiled from the most recent Parliamentary returns.

INDIAN CORN AND MEAL IMPORTED INTO THE UNITED KINGDOM.

PLACES.	1849. Corn. qrs.	1849. Meal. cwts.	1850. Corn. qrs.	1850. Meal. cwts.	1851. Corn. qrs.	1851. Meal. cwts.
Russian Ports in Black Sea	25,519		19,721		98,176	
Denmark	1,300		250		5	

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Hanover	1,344					
Belgium	67					
France	135,115	510	102,978	26	164,128	29
Portugal Proper	61,446		67,518	53	21,922	
Azores and Madeira	17,214	7	7,794	6	4,356	1
Spain and Bahama Islands	26,856	48	19,982	48	34,771	
Sardinian Territories	13,357		25	2	1,302	1
Tuscany	11,481	95	15,612	94	34,760	
Papal Territories	8,927		1,876		75,588	
Naples and Sicily	18		10,066		101,489	
Austrian Territories	90,540		45,748		73,966	
Malta and Gozo	18,198		4,969		11,002	
Ionian Islands	5,390		7,324		5,967	
Greece	57,520		8,712		3,252	
Egypt	12,767		71,808		127,692	
Turkish dominions, including Wallachia, Moldavia and Syria	563,799		348,456		748,180	
Morocco	760					
West Coast of Africa	889		2,322			
B.N.A. Colonies	1,645	164	1,530		4,377	7
U.S. of America	1,170,154	100,859	538,155	11,253	295,978	9,522
Brazil	1,253		468		725	
Other places			1,756			
						1
	2,225,459	101,683	1,277,070	11,482	1,807,636	9,561

(Parliamentary Paper, No. 14, Sess. 1852.)

The many excellent properties of Indian corn, as a wholesome nutritious food, and the rich fodder obtained from the stalk and leaf for the nourishment of cattle, invite more earnest attention from the farmer and planter in the Colonies to its better and extended cultivation.

Though the average quantity of grain from each acre in the United States is not more than thirty or forty bushels, yet it is known that with due care and labor 100 to 130 bushels may be obtained.

In feeding cattle little difference is discoverable between the effects of Indian corn meal and oil-cake meal; the preference rather preponderates in favor of the latter.

Corn cobs, ground with the grain, have advocates, but this food is not relished, and swine decline it.

Indian corn contains about the same proportion of starch as oats (sixty per cent.), but is more fattening, as it contains about nine or ten per cent. of oily or fatty ingredients.

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The following analysis of maize is given by Dr. Samuel David, of Massachusetts:—

FLESH FORMING PRINCIPLES.

Gluten, albumen, and casein 12.60

FAT FORMING PRINCIPLES.

Gum, sugar, starch, woody fibre, oil, &c. 77.09
Water 9.00
Salts 1.31

100.

Prof. Gorham, in “Thomson’s Organic Chem.,” published in London in 1838, gives another analysis:—

	Fresh grain.	Dried grain.
Water	9.00	
Starch	77.00	84.60
Gluten	3.00	3.30
Albumen	2.50	2.74
Gum	1.75	1.92
Sugar	1.45	1.60
Loss	5.30	5.84
	------	------
	100.	100.

Professor Johnston supplies a table, which, he says, exhibits the best approximate view we are yet able to give of the average proportion of starch and gluten contained in 100 lbs. of our common grain crops as they are met with in the market.

From this table I extract the following:—

	Starch, gum, &c.	Gluten, albumen, &c.
Wheat flour.	55 lbs.	10 to 15 lbs.
Oats	65 "	18 lbs.
Indian corn	70 "	12 "
Beans	40 "	28 "
Peas	50 "	24 "

Potatoes	12 "	2-1/3 "

The Professor remarks that the proportion of oil is, in 100 lbs. of

Wheat flour	2	to	4
Oats	5	"	8
Indian corn	5	"	9
Beans and peas	21/2	"	3
Potatoes	01/4	"	

Maize is one of those plants in which potash preponderates, for analysis of its ashes gives the following proportions:—

Salts of potash and soda 71.00
—— lime and magnesia 6.50
Silica 18.00
Loss 4.50

100.

Dr. Salisbury has also furnished the proximate analysis of five varieties of ripe maize or Indian corn:—

Proportions.
One hundred grains of each. Water. Dry.

Golden Sioux corn, a bright, yellow, twelve-rowed}
variety, frequently having fourteen rows } 15.02 84.98
Large eight-rowed yellow corn 14.00 86.00
Small eight-rowed ditto 14.03 85.97
White flint corn 14.00 86.00
Ohio Dent corn, one of the largest varieties of }
maize } 14.50 85.50

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COMPARATIVE ORGANIC ANALYSIS.

	Golden Sioux.	Ohio Dent Corn.	Small 8-rowed Corn.	Large 8-rowed Corn.	White Flint Corn.
Starch	36.06	41.85	30.29	49.22	40.34
Gluten	5.00	4.62	5.60	5.40	7.69
Oil	3.44	3.88	3.90	3.71	4.68
Albumen	4.42	2.64	6.00	3.32	3.40
Casein	1.92	1.32	2.20	0.75	0.50
Dextrine	1.30	5.40	4.61	1.90	3.00
Fibre	18.50	21.36	26.80	11.96	18.01
Sugar and extract	7.25	10.00	5.20	9.55	8.30
Water	15.02	10.00	13.40	14.00	14.00

Large quantities of starch are now made from this grain in Ohio; an establishment near Columbus consume 20,000 bushels of corn annually for this purpose. The offal of the grain is given to hogs, 500 to 600 head being annually fattened therewith. The quality of the starch is said to be superior to that of wheat, and commands a higher price in New York.

A corn plant, fifteen days after the seed was planted, cut on the 3rd June close to the ground, gave of—

Water	86.626
Dry matter	10.374
Ash	1.354
Ash calculated dry	13.053

By the above figures it will be seen that nearly 90 per cent, of the young plant is water; and that in proportion to the dry matter, the amount of earthy minerals which remain, as ash, when the plant is burnt, is large. This excess of water continues for many weeks. Thus, on the 5th July, thirty-three days from planting, the relations stood thus:—

Water 90.518
Dry matter 9.482
Ash 1.333
Ash calculated dry 14.101
(Ash very saline.)

Before green succulent food of this character is fit to give to cows, oxen, mules, or horses, it should be partly dried. Plants that contain from 70 to 75 per cent. of water need no curing before eaten. The young stalk cut July 12, gave over 94 per cent. of water. Such food used for soiling without drying would be likely to scour an animal, and give it the cholic.

The root at this time (July 12) gave of—

Water 81.026
Dry matter 18.974
Ash 2.222
Ash calculated dry 11.711
(Ash tastes of caustic potash.)

Ash of the whole plant above ground, 6.77 grains. Amount of ash in all below ground, 3.93 grains.

So late as July 26, the proportion of water in the stalk was 94 per cent.; and the ash calculated dry 17.66 per cent. The plant gained 21.36.98 grains in weight in a week preceding the 6th September. This was equal to a gain of 12.72 grains per hour.

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The rapid growth of corn plants, when the heat, light, and moisture, as well as the soil are favorable, is truly wonderful. A deep, rich, mellow soil, in which the roots can freely extend to a great distance in depth and laterally, is what the corn-grower should provide for his crop. The perviousness of river bottoms contributes largely to their productiveness of this cereal. A compact clay, which excludes alike air, water, and roots, forbidding all chemical changes, is not the soil for Indian corn.

When farmers sell corn soon after it is ripe, there is considerable gain in not keeping it long to dry and shrink in weight. Corn grown by Mr. Salisbury, which was ripe by the 18th October, then contained 37 per cent. of water, which is 25 per cent. more than old corn from the crib will yield. The mean of man experiments tried by the writer has been a loss of 20 per cent. in moisture between new and old corn. The butts of cornstalks contain the most water, and husks or shucks the least, when fully matured and not dried. The latter have about 30 per cent, of dry matter when chemically desiccated.

COMPOSITION OF THE ASH OF THE LEAVES AT DIFFERENT STAGES.

	July 19.	Aug. 2.	Aug. 23.	Aug. 30.	Oct. 18.
Carbonic acid	5.40	2.850	0.65	3.50	4.050
Silicia	13.50	19.850	34.90	36.27	58.650
Sulphuric acid	2.16	1.995	4.92	5.84	4.881
Phosphates	21.60	16.250	17.00	13.50	5.850
Lime	.69	4.035	2.00	3.88	4.510
Magnesia	.37	2.980	1.59	2.30	0.865
Potash	9.98	11.675	10.85	9.15	7.333
Soda	34.39	29.580	21.23	22.13	8.520
Chlorine	4.55	6.020	3.06	1.63	2.664
Organic acids	5.50	2.400	3.38	2.05	2.200
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	98.14	97.750	98.187	99.83	99.334

The above figures disclose several interesting facts. It will be seen that the increase of silica or flint in the leaf is steadily progressive from 131/2 per cent. at July 19, to 58.65 at October 18.

Flint is substantially the *bone earth* of all grasses. If one were to analyse the bones of a calf when a day old, again when thirty days of age, and when a year old, the increase of phosphate of lime in its skeleton would be similar to that witnessed in the leaves and stems of maize. In the early stages of the growth of corn, its leaves abound in phosphates; but after the seeds begin to form, the phosphates leave the tissues of the plant in other parts, and concentrate in and around the germs in the seeds. On the 23rd of August, the ash of the whole stalk contained 191/2 per cent. of phosphates; and on the 18th of October, only 15.15 per cent. In forming the cobs of this plant, considerable potash is drawn from the stalk, as it decreases from 35.54

per cent. August 16, to 24.69 October 18. When the plant is growing fastest, its roots yield an ash which contains less than one per cent. of lime; but after this development is nearly completed, the roots retain, or perhaps regain from the plant above, over 41/2 per cent. of this mineral. Soda figures as high as from 20 to 31 per cent. in the ash obtained from corn roots. Ripe seeds gave the following results on the analysis of their ash:—

Silica 0.850
Phosphoric acid 49.210
Lime 0.075
Magnesia 17.600
Potash 23.175
Soda 3.605
Sodium 0.160
Chlorine 0.295
Sulphuric acid 0.515
Organic acids 5.700

99.175

The above table shows a smaller quantity of lime than is usually found in the ash of this grain. It is, however, never so abundant as magnesia; and Professor Emmons has shown that the best corn lands in the State of New York contain a considerable quantity of magnesia. All experience, as well as all chemical researches, go to prove that *potash* and phosphoric acid are important elements in the organisation of maize. Corn yields more pounds of straw and grain on poor land than either wheat, rye, barley, or oats; and it does infinitely better on rich than on sterile soils. To make the earth fertile, it is better economy to plant thick than to have the rows five feet apart each way, as is customary in some of the Southern States, and only one stalk in a hill. This gives but one plant to twenty-five square feet of ground. Instead of this, three square feet are sufficient for a single plant; and from that up to six, for the largest varieties of this crop.

Mr. Humboldt states the production of maize in the Antilles as 300 for one; and Mr. H. Colman has seen in several cases in the New England States of America, a return of 400 for one; that is to say, the hills being three feet apart each way, a peck of Indian corn would be sufficient seed for an acre. If 100 bushels of grain is in such case produced by an acre—and this sometimes happens—this is clearly a return of 400 for one.

Of the whole family of cereals, *Zea Mays* is unquestionably the most valuable for cultivation in the United States. When the time shall come that population presses closely on the highest capabilities of American soil, this plant, which is a native of the

New World, will be found greatly to excel all others in the quantity of bread, meat, milk, and butter which it will yield from an acre of land. With proper culture, it has no equal for the production of hay, in all cases where it is desirable to grow a large crop on a small surface.

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Although there has been much written on the Eastern origin of this grain, it did not grow in that part of Asia watered by the Indus, at the time of Alexander the Great's expedition, as it is not among the productions of the country mentioned by Nearchus, the commander of the fleet; neither is it noticed by Arian, Diodorus, Columella, nor any other ancient author; and even as late as 1491, the year before Columbus discovered America, Joan di Cuba, in his "Ortus Sanitatis," makes no mention of it. It has never been found in any ancient tumulus, sarcophagus, or pyramid; nor has it ever been represented in any ancient painting, sculpture, or work of art, except in America. But in that country, according to Garcilaso de la Vega, one of the ancient Peruvian historians, the palace gardens of the Incas, in Peru, were ornamented with maize, in gold and silver, with all the grains, spikes, stalks, and leaves; and in one instance, in the "garden of gold and silver," there was an entire cornfield, of considerable size, representing the maize in its exact and natural shape; a proof no less of the wealth of the Incas, than their veneration for this important grain.

In further proof of the American origin, it may be stated that this plant is still found growing, in a wild state, from the Rocky mountains in North America, to the humid forests of Paraguay, where, instead of having each grain naked, as is always the case after long cultivation, it is completely covered with glumes or husks. It is, furthermore, a well authenticated fact, that maize was found in a state of cultivation by the aborigines, in the island of Cuba, on its discovery by Columbus, as well as in most other places in America, first explored by Americans.

The first successful attempt to cultivate this grain in North America, by the English, occurred on James' river, in Virginia, in 1608. It was undertaken by the colonists sent over by the Indian company, who adopted the mode then practised by the natives, which, with some modifications, has been pursued throughout this country ever since. The yield, at this time, is represented to have been from two hundred to more than one thousand fold. The same increase was noted by the early settlers in Illinois. The present yield, east of the Rocky Mountains, when judiciously cultivated, varies from 20 to 135 bushels to an acre.

The varieties of Indian corn are very numerous, exhibiting every grade of size, color, and conformation, between the "chubby reed" that grows on the shores of Lake superior—the gigantic stalks of the Ohio valley—the tiny ears, with flat, close, clinging grains, of Canada—the brilliant, rounded little pearl—the bright red grains and white cob of the eight-rowed haematite—the swelling ears of the big white and the yellow gourd seed of the South. From the flexibility of this plant, it may be acclimatised, by gradual cultivation, from Texas to Maine, or from Canada to Brazil; but its character, in either case, is somewhat changed, and often new varieties are the result. The blades of the plant are of great value as food for stock, and is an article but rarely estimated sufficiently, when considering of the agricultural products of the Southern and Southwestern States especially.

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To supply slaves on plantations with bread, including old and young, requires from twelve to thirteen bushels of corn each a year. Taking thirteen bushels as the average consumption of breadstuffs by the 22,000,000 of people in the United States, the aggregate is 286,000,000 bushels per annum.

The increase of production, from 1840 to 1850, was 214,000,000 bushels, equal to 56 per cent.

The production of New England advanced from 6,993,000 to 10,377,000 bushels, showing an increase of 3,384,000 bushels, nearly fifty per cent. New York, New Jersey, Pennsylvania, Delaware and Maryland, increased 20,812,000 bushels, more than fifty per cent. In the production of this crop no State has retrograded. Ohio, which in 1840 occupied the fourth place as a corn-producing State, now ranks as the first. Kentucky is second, Illinois third, Tennessee fourth. The crop of Illinois has increased from 2,000,000 to 5,500,000 bushels, or at the rate of 160 per cent. in ten years.

Of the numerous varieties some are best adapted to the Southern States, while others are better suited for the Northern and Eastern. Those generally cultivated in the former are the Southern big and small yellow, the Southern big and small white flint, the yellow Peruvian, and the Virginian white gourd seed. In the more Northerly and Easterly States they cultivate the golden sioux, or Northern yellow flint, the King Philip, or eight-rowed yellow, the Canadian early white, the Tuscarora, the white flour, and the Rhode Island white flint.

The extended cultivation of this grain is chiefly confined to the Eastern, Middle, and Western States, though much more successfully grown in the latter. The amount exported from South Carolina, in 1748, was 39,308 bushels; from North Carolina, in 1753, 61,580 bushels; from Georgia, in 1755, 600 bushels; from Virginia, for several years preceding the revolution, annually 600,000 bushels; from Philadelphia, in 1765-66, 54,205 bushels; in 1771, 259,441 bushels.

The total amount exported from America in 1770, was 573,349 bushels; in 1791, 2,064,936 bushels, 351,695 of which were Indian meal; in 1800, 2,032,435 bushels, 338,108 of which were in meal; in 1810, 1,140,960 bushels, 86,744 of which were meal. In 1820-21, there were exported 607,277 bushels of corn, and 131,669 barrels of Indian meal; in 1830-31, 571,312 bushels of corn, and 207,604 barrels of meal; in 1840-41,535,727 bushels of corn, and 232,284 barrels of meal; in 1845-46, 1,286,068 bushels of corn, and 298,790 barrels of meal; in 1846-47 16,326,050 bushels of corn, and 948,060 barrels of meal; in 1850-51, 3,426,811 bushels of corn, and 203,622 barrels of meal. More than eleven millions of bushels of Indian corn were consumed in 1850, in the manufacture of spirituous liquors.

According to the census of 1840, the corn crop of the United States was 377,531,875 bushels; in 1850, 592,326,612 bushels.

The increase in the production of corn in Ohio has been (in ten years) 66 per cent. I have also before me the auditor's returns for the crop of 1850, as taken by assessors, and the number of acres planted. The auditor's returns are:—

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Seventy-three counties 55,079,374
Darke county 524,484
Twelve counties, average 8,400,000

Total 64,003,858

This is an advance of 15 per cent. on the crop of 1840, and it is known that the crop of 1850 was better than that of 1849. The number of acres planted, and the average production was:—

Acres planted 1,810,947
Bushels produced 64,003,858
Average per acre 35-3/8 bush.

Considering how large a portion of hill land is planted, and how many fields are ill cultivated, the average is high. Many persons have believed that taking all years and all lands into view, the average of corn lands was not more than thirty bushels. But the immense fertility of *bottom* lands on the rivers and creeks of Ohio make up for bad cultivation and inferior soil. We may see something of the differences in the production of corn, by taking the averages of different counties, thus:—

	Acres.	Crop.	Average.
Butler	62,031	2,646,353	421/2
Warren	42,322	1,757,409	42
Pickaway	65,860	2,627,727	40
Ross	69,520	2,918,958	42

Compare the average of these counties, which embrace some of the best lands in the State, with the following:—

	Acres.	Crop.	Average.
Carroll	10,107	316,999	32
Jackson	15,680	439,850	30
Monroe	23,375	728,242	31
Portage	10,426	329,529	32
Vinton	11,413	345,470	30

The last counties contain but little bottom land, and hence the average of corn is reduced one-fourth in amount. Of these counties, two are full of coal and iron. The resources of the last are more slow to develop, but in the end will be equally valuable.

But a small quantity of the corn of Ohio is exported *as grain*. It is first manufactured into other articles, and then exported in another form. The principal part of these are hogs, cattle, and whiskey. It is difficult to say exactly how much corn is *in this way exported*, but the following is an approximation—

	Bushels.
In Fat Cattle	4,000,000
In Fat Hogs	10,000,000
In Whiskey	2,500,000

Total	16,500,000

Taking into view the export of corn meal—about twenty millions of bushels—the residue goes to the support of the stock animals on hand, of which there are near three millions, exclusive of those fatted for market.

The exported corn in the shape of cattle, hogs, and whiskey, is worth about thirty cents cash, while on the farm it is not worth twenty—thus proving that it is more profitable to consume corn on the farm, than to export it in bulk. This fact is well known to good farmers, who seldom attempt to sell corn as a merchantable article.

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No mining in the world has ever been equal to mining in a fertile soil, and no treasury is so reliable as a granary of surplus products.

Indian corn and meal generally find a market in the West Indies, Newfoundland, Spain, and Portugal. It commands a good price, and finds a ready sale in the ports which are open to its reception.

Deducting one-sixteenth for the amount exported, and one-tenth for seed, the quantity of maize annually consumed for food in the United States by a family of five persons is 85 bushels.

Maize may be considered as the great staple of the agricultural products of the States. It is exported in large quantities, in a raw state, or when manufactured into meal. Before it is manufactured into meal it is dried by a fire, in a kiln prepared for that purpose. By this process the meal is much less liable to become sour on the voyage, and can be preserved much longer in a warm climate. No inconsiderable quantities have likewise been consumed in distillation; and the article of kiln-dried meal for exportation is destined to be of no small account to the corn-growing sections of that country.

The improvement continually making in the quality of the seed augurs well for the productiveness of this indigenous crop, as it has been found that new varieties are susceptible of being used to great advantage.

The following was the produce of the different States in the years named, as given in the Official Census Returns:—

	1840 Bushels.	1841 Bushels.	1843 Bushels.	1850 Bushels.
Maine	950,528	988,549	1,390,799	
New Hampshire	1,162,572	191,275	330,925	
Massachusetts	1,809,192	1,905,273	2,347,451	
Rhode Island	450,498	471,022	578,720	
Connecticut	1,500,441	1,521,191	1,926,458	
Vermont	1,119,678	1,167,219	1,252,853	
New York	10,972,286	11,441,256	15,574,590	
New Jersey	4,361,975	5,134,366	5,805,121	
Pennsylvania	14,240,022	14,969,472	15,857,431	
Delaware	2,099,359	2,164,507	2,739,982	
Maryland	8,233,086	6,998,124	6,205,282	

Virginia	34,577,591	33,987,255	45,836,788	
N. Carolina	23,893,763	24,116,253	27,916,077	
S. Carolina	14,722,805	14,987,474	18,190,913	
Georgia	20,905,122	21,749,227	26,960,687	
Alabama	20,947,004	21,594,354	24,817,089	
Mississippi	13,161,237	5,985,724	9,386,399	
Louisiana	5,952,912	6,224,147	8,957,392	
Tennessee	44,986,188	46,285,359	67,838,477	52,000,000
Kentucky	39,847,120	40,787,120	59,355,156	58,000,000

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Ohio	33,668,144	35,552,161	38,651,128	59,788,750
Indiana	28,155,887	33,195,108	36,677,171	53,000,004
Illinois	22,634,211	23,424,474	32,760,434	57,000,000
Missouri	17,332,524	19,725,146	27,148,608	
Arkansas	4,846,632	6,039,450	8,754,204	
Michigan	2,277,039	3,058,090	3,592,482	
Florida Territory	898,074	694,205	838,667	
Wisconsin	379,359	521,244	750,775	
Iowa T.	1,406,241	1,547,215	2,128,416	
D. of Columbia	39,485	43,725	47,837	
Total	377,531,875	387,380,185	494,618,306	500,000,000

The Indian corn crop of 1850, for the whole of the United States, is returned as over 500 million bushels, a gain of about 40 millions on that of 1840.

I give below the quantities of Indian corn and meal which were exported from the United States in the following years:—

	Corn, Bushels.	Meal, Bushels.	Value. Dolls.
1790	1,713,241		
1794	1,505,977	241,570	
1798	1,218,231	211,694	
1802	1,633,283	566,816	
1806	1,064,263	108,342	1,286,000
1810	1,054,252	86,744	1,138,000
1814	61,284	26,438	170,000
1818	1,075,190	120,029	2,335,405
1822	509,098	148,288	900,656
1826	505,381	158,652	1,007,321
1829	897,656	173,775	974,535
1833	437,174	146,678	871,814

—(*Pitkin's Statistics of the United Stales, and Seybert's Statistical Annals*.)

System of culture pursued in the United States.—Maize, the *corn, par excellence*, of America, is grown in every State in the Union.

Tennessee, Kentucky, Ohio, Virginia, and Indiana, are in their order the greatest producers of this grain. In Illinois, North Carolina, Georgia, Alabama, Missouri, Pennsylvania, South Carolina, New York, Maryland, Arkansas, and the New England States, it appears to be a very favorite crop. In Massachusetts, the most Northern and least favorable State on that account, being cold, a fair proportion is grown, the aggregate produce being greater there than in any of the grains, except oats; more, indeed, than might be expected, were not labor somewhat cheaper than in more Southern States, where the climate is more congenial. The ordinary produce is twenty-five bushels per acre; forty bushels is often raised, and in prize crops the weight has come up to 100 bushels per acre. In Ohio the average is fifty-five bushels to the acre. The eight and twelve-rowed varieties of Indian corn are those most usually grown in New

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York, and the average produce of a good field in that State is from forty to sixty bushels; on ordinary ground twenty-five to thirty is a fair crop. The same returns appeared to be derived from ground in New Jersey. Mr. Doubleday, of Binghampton, New York, estimates the produce of that neighbourhood at forty bushels, and the expense of raising the crop as follows, estimating the worth of the land at twenty-five dollars (say L5) per acre:—

Dollars. Cents.
The interest of which is 1 16
One ploughing with double team, and harrowing 3 50
Seed and planting 1 00
Plaster or gypsum, and putting on the hill 0 37
Ploughing and hoeing twice, cutting
or stalking the corn 2 75
Husking or thrashing 2 50
----
11 62

Average yield, forty bushels; cost of produce, twenty-nine cents. (1s. 41/2d.) per bushel.

Nothing is here put down for manure or cartage, because the fodder, cut up and saved, as usually adopted, is equal to the manure required. It is looked upon that the preparation of ground for corn costs less than wheat; the approved plan is to plant on sward ground, ploughing at once, and turning the ground completely over, then harrowing longitudinally until, a good tilth is obtained. Should the soil not be rich enough, stable manure is first spread on the land.

Now suppose the corn to sell at seventy-five cents the bushel, the account would stand thus:—

Dollars. Cents.
Forty bushels, at seventy-five cents. 30 00
Cost 11 62

Gain per acre 18 38

or L3 13s. 6d. British money profit per acre.

In Lichfield, Connecticut, the cost of produce has been, for the items as stated above, eighteen dollars twenty-five cents, or the cost of each bushel thirty-six and one-half cents. The acre produce was fifty bushels, so that it stood thus:—

	Dollars.	Cents.
Fifty bushels, at seventy-five cents	37	50
Cost	18	25
Gain	19	5

or L3 12s. per acre.

The cost of producing maize varies somewhat in the other States, thus:—

	Per bushel. Cents.
New Hampshire (Unity) the cost was	50
Fayette county, Pennsylvania	16 1/4
Donesville, Michigan, only	17 1/2
Plymouth, Massachusetts	17 7/10

The cost on producing this crop was small, but it appears to have been a small crop, and did not bring more than thirty cents per bushel.

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In Monroe county, the richest land in the State of New York, estimating the land at fifteen dollars per acre, the producing cost stood at:—

Dollars. Cents.
Interest at six per cent. 0 45
One ploughing sward, cover or stubble 1 00
Harrowing, furrowing, seed, and planting 0 871/2
Cultivating three times and hoeing 1 00
Husking the hill 1 00
Shelling and cleaning 1 00
----
5 821/2

This yielded fifty bushels, the cost of producing the bushel was eleven and three-fifths cents. This low cost was owing to the fact of no manure being used; and while it speaks volumes as to the natural fertility of American soils, yet it reflects very disgracefully upon the careless system adopted there, as under such treatment no land could continue, after some years, to produce a crop which could come into competition with those from newer and less exhausted lands; but if under a good system of tillage the ground was yearly renewed with manure, and those amendments which every soil requires, after a crop has been raised from it, added to the soil in top-dressing and in ploughing-in, we should never hear of the exhausted state of New England land, or see the sons of the soil moving west and cultivating newer soils, thus removing much of the capital and intelligence of a country away from it.

Supposing the corn of Monroe county sold at seventy cents per bushel, the balance would appear thus:—

Dollars. Cents.
Fifty bushels, at seventy cents 35 00
Cost of production 5 821/2

Gain 29 181/2

L6 1s. per acre profit.

In Northern Ohio and in Illinois the cost of production averages twenty cents per bushel.

The mode of cultivation in Connecticut and the New England States has been thus described to me by Mr. L. Durand, an experienced agriculturist:—If the soil selected is light and mellow, it should be ploughed and subsoiled in the spring, first spreading on the coarse unfermented manure which is to be ploughed in. For marking the rows for planting, a “corn marker” may be used to advantage. It is made by taking a piece of scantling, three inches square and ten to twelve feet long, with teeth of hickory or white oak inserted at distances of two to four feet, according to the width designed for the rows. Then an old pair of waggon-thills and a pair of old plough-handles are put to it, and your marker is done. With a good horse to draw this implement, the ground may be made ready for planting very rapidly. It is better to leave the ground flat than to ridge it, for the latter mode has no advantage, except when the ground is wet. The difference in the two modes is chiefly this:—When the ground is ridged, the corn being planted between the edges of the furrows, it comes immediately in contact with the manure, springs up and grows rapidly the fore part of the season. When the ground is left flat, and the manure turned under the furrows, the corn will often look feeble at first, and in growth will frequently be much behind that on the ridges; and the inference early in the season is, that the ridged ground will give the best crop, but as soon as the roots of the corn on the flat ground get hold of the manure (say about the 20th of July), the corn will shoot rapidly ahead, and the full force of the manure will be given to the stalk just at the time of forming the grain. Corn cultivated in this way, if the soil is deeply tilled, will often keep green, while that on ridges is dried up.

Many farmers, at planting, shell the corn off the cob, and plant it dry. Others soak it a few days in warm water. But when the seed is only treated in this way, it is very likely to be pulled up by birds and injured by worms. The best way to prevent this is to first soak the corn in a strong solution of saltpetre; then take a quantity of tar, and having warmed it over a fire, pour it on the corn, and stir with a stick or paddle till the grain is all smeared with the tar; then add gypsum or plaster till the corn will separate freely, and no birds will touch the grain.

The time of planting, in the United States, varies with the season and the section of the country. In New England it may generally be planted from the 15th to the 25th May. Where the ground is flat, a light harrow or a cultivator is much better to go between the rows than the plough. Formerly a great deal of useless labor was spent in hilling up corn; in dry seasons this was worse than useless. The earth hauled round the stalk does not assist its growth, nor aid in holding it up; the brace roots, which come out as the stalk increases in height, support it; and it has been observed, that in a heavy storm and thunder gust, corn that is hilled will be broken down more than that which is not hilled. The ground which is kept level has also the advantage of more readily absorbing rain, rendering the crop less liable to suffer from drought. The field should have two or three regular hoeings, and the weeds be carefully kept under.

In harvesting the following will be found a good plan:—Let two hands take five rows, cutting the corn close to the ground. A hill should be left standing to form the centre of the shock, placing the stalks round it, so that they may not lie on the ground. After the shock is made of sufficient size, take a band of straw, and having turned down the tops of the stalks, bind them firmly, and the work is done.

Maize may be cut as soon as the centre of the grain is glazed, even if the stalks are green. There will be sufficient nutriment in the stalk to perfect the ear, and the fodder is much better than when it gets dry before it is cut. If the shocks are well put up, they may stand four or five weeks. The corn may then be knocked out, and the fodder secured for winter use.

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The report of the Ohio Board of Agriculture for 1849, contains many interesting statements in reference to maize culture, made by the officers of numerous county agricultural societies. In Miami county, 2,030,670 bushels were grown, at an average yield of fifty-five bushels per acre. Three varieties are cultivated: the common gourd seed, for cattle; the yellow Kentucky, for hogs and distilling; and the white, for grinding and exportation. According to the returns from Green county, which produced 1,250,000 bushels of corn in 1849, “a regular rotation of clover, corn, wheat, and clover again, is best for corn; and no crop pays better for extra culture.” The Harrison county Agricultural Society reports the pork crop at 4,800,000 pounds; and it gave its first premium for corn to Mr. S.B. Lukens, whose statement is as follows:—

“The ground had been in meadow ten years, was ploughed six inches deep about the middle of April, was harrowed twice over on the 9th May, and planted on the 11th four feet by two feet. It came up well, was cultivated and thinned when ten inches high; three stalks were left in a hill. About two weeks afterward it was again cultivated, and the suckers pulled off. About the last of June it was again cultivated, making three times the same way, as it was laid off but one way.

&nb
sp; d. c.
Expense of culture, gathering, and cribbing, was 17 10
Produce of 374-3/8 bushels, at 311/4 cents 117 10

Profit on three acres 100 00

The evidence on which a premium was awarded was such as should satisfy any one that 374 bushels were grown on three acres of land, and at a cost not exceeding 17 dollars 10 cents, delivered in the crib. This is producing corn at less than 5 cents a bushel.

Whether the statement be true to the letter or not, it shows conclusively the great value of a *rich soil* for making cheap corn. The Board of Agriculture estimates the crop of Ohio last year at 70,000,000 of bushels. Taking the United States as a whole, probably the crop of corn was never better than in the year 1849. One that has rich land needs only to plough it deep and well, plant in season, and cultivate the earth properly with a plough or cultivator, to secure the growth of a generous crop. On poor soils the case is very different.

To raise a good crop of corn on poor land, and at the least possible expense, requires some science and much skill in the art of tillage. Take the same field to operate in, and one farmer will grow 100 bushels of corn at half the cost per bushel that another will expend in labor, which is money. It unfortunately happens that very skilful farmers are few in number, in comparison with those who have failed to study and practice all attainable improvements.

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To produce cheap corn on poor land, one needs a clear understanding of what elements of the crop air and water will furnish, and what they cannot supply. It should be remembered that the atmosphere is precisely the same over ground which yields 100 bushels of corn per acre, that it is over that which produces only five bushels per acre. Now, the whole matter which forms the stems, leaves, roots, cobs, and seeds of corn, where the crop is 100 bushels per acre, is not part and parcel of the soil. A harvest equal to fifty bushels per acre can be obtained without consuming over ten per cent, of earth, as compared with the weight of the crop. No plant can imbibe more of the substance of the soil in which it grows, than is dissolved in water, or rendered gaseous by the decomposition of mould.

The quantity of matter dissolved, whether organic or inorganic, during the few weeks in which corn plants organise the bulk of their solids, is small. From 93 to 97 parts in 100 of the dry matter, in a mature, perfect plant, including its seeds, cob, stems, leaves, and roots, are carbon (charcoal) and the elements of water. It is not only an important, but an exceedingly instructive fact, that the most effective fertilisers known in agriculture are those that least abound in the elements of water and carbon. The unleached dry excrements of dunghill fowls and pigeons, have five times the fertilising power on all cereal plants that the dry dung of a grass-fed cow has, although the latter has five times more carbon, oxygen, and hydrogen, per 100 pounds, than the former. Although it is desirable to apply to the soil in which corn is to grow as much of organised carbon and water as one conveniently can, yet, where fertilisers have to be transported many miles; it is important to know that such of the measure as would form *coal*, if carefully burnt, can best be spared. The same is true of those elements in manure which form vapor or water, when the fertiliser decomposes in the ground.

Carbonic acid and nascent hydrogen evolved in rotting stable manure are truly valuable food for plants, and perform important chemical offices in the soil; but they are, nevertheless, not so indispensable to the economical production of crops, as available nitrogen, potash, silica, magnesia, sulphur, and phosphorus. These elements of plants being less abundant in nature, and quite indispensable in forming corn, cotton, and every other product of the soil, their artificial supply in guano, night soil, and other highly concentrated fertilisers, adds immensely to the harvest, through the aid of a small weight of matter. In all sections where corn is worth 30 cents and over a bushel, great benefits may be realised by the skilful manufacture and use of poudrette. This article is an inodorous compound of the most valuable constituents of human food and clothing. It is the raw material of crops.

It is not necessary to restore to a cornfield all the matter removed in the crop to maintain its fertility. A part of each seed, however, ought to be carried back and replaced in the soil, to make good its loss by the harvest.

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In every barrel of meal or flour sent to market (196 pounds), there are not far from 186 pounds of carbon (coal), and the elements of water. When a bird eats wheat or corn, I have reason to believe, from several experiments, that over 80 per cent, of the food escapes into the air through its capacious lungs in the process of respiration; and yet the 20 per cent, of guano left will re-produce as much wheat or corn as was consumed. Imported guano, which has been exposed to the weather for ages, often gives an increase in the crop of wheat equal to three pounds of seed to one of fertiliser; while it has given a gain of seven to one of corn, and fifty to one of green turnips.

Like other grains that have been long cultivated, Indian corn abounds in varieties. In Spain they count no less than 130, and in the United States the number is upwards of forty. The difference consists in size, color, period of maturation, and hardness and weight of grain. Of size there exists a considerable variety, from Zea Curagua of Chili, and the Egyptian or chicken corn, both extremely diminutive, to the large white flint, and ground seed corn of the United States. The differences in color are the red, yellow, and white. The period of maturation varies, apparently, very considerably; but it is questionable whether this variation is real, and independent of climate. In the Northern States of America, Indian corn ripens in a shorter period of time than it does in the South, owing, possibly, to the greater length of the summer day in those latitudes.

In selecting varieties, some experienced and judicious farmers prefer that which yields the greater number of ears, without regard to their size, or number of rows. Others prefer that which furnishes one or two larger ears, having from twelve to twenty-four rows. In the Northern States of America the yellow corn bears the highest price in the market, and is considered the most prolific and best suited to feed cattle and hogs. For bread, the white Button is preferred at the North, and the white ground seed is used for that purpose in other quarters. Preference, however, is most frequently given to white flint corn, which is unquestionably the heaviest, and contains the greatest proportion of farina.

In Mississippi many varieties are grown, principally those known as flint and bastard flint. The gourd-seed varieties are very objectionable in that climate, principally on account of their softness rendering them unfit for bread, and open to the attacks of insects in the field and the crib. They require a grain, *white*, *hard*, and rather flinty—-*white* because of its great consumption in bread and hommony, in the preparation of both of which their cooks greatly excel. When meal is ground for bread, the mill is set rather wide, that the flinty part of the grain may not be cut up too fine, this being sifted out for “small hommony;” the farinaceous part of the grain is left for bread. This hommony

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is a beautiful and delicious dish. On most plantations the negroes have it for supper, with molasses or buttermilk. A *hard flinty* grain is necessary to head the weevil, with which not only the cribs but the heads of corn in the field are infested. These are the *Calandra oryzae*, the true rice weevil, distinguished from his European cousin by the two reddish spots on each *elytra* or wing-cover, and known in America as the “black weevil;” also a little brown insect, not a true weevil, but a *Sylvanus*. This sylvanus, and another of the same genus, most probably the *S. surinamensis*, attack the corn in the field before it becomes hard, causing serious damage—but nothing to equal that occasioned by the black weevil.

I know of no generally successful method of staying or even checking the injury caused by the insects, though much might be written in the way of suggestion.

In Michigan, the *dent* variety in dry seasons produces the best crops on sandy loam, as its roots run deeper than the common *eight-rowed* yellow or white. In moist seasons the latter varieties usually do well. They are grown most generally in the Northern part of the State, while in the Southern section the Ohio dent is principally raised. The shuck and blade are much used as fodder for cattle, in the early part of winter.

Indian corn is very liable to change of character from soil and climate, growing smaller the farther North it is raised. The mixing of the eight-rowed yellow with the Ohio dent has, so far as my experience goes, been beneficial in increasing the yield. Sandy loam, or clay, is considered the soil best adapted to corn. It is usually planted in May, and harvested in September. The blade is not taken off there as at the South; some farmers cut up their corn when ripe, put it into shocks, and husk it late in the fall; others cut the stalks, bind them in sheaves, and stack them for winter in the fields, or put them away in barns or sheds; while others husk the corn on the hill without cutting the stalks, and late in the fall turn their cattle into the field to eat the fodder. Of these different modes the preference is usually given to cutting the stalks and putting them under cover after being well cured, and busting the corn on the hill. The corn is thought to ripen better in this way, and to keep better in the cribs. The Ohio dent, having a smaller ear containing less moisture than other varieties, ripens quicker and keeps better. This crop ranges from 25 to 65 bushels per acre, and the difference in the yield is to be attributed to the manner of cultivation. My experience shows that a crop of 45 bushels per acre costs 13 cents a bushel, including interest on land. Corn is principally raised in Michigan for home consumption, and the stalks and shucks, if well cured, are worths dollars per acre, compared with hay at 5 dollars per ton.

As much as 134 bushels per acre have been obtained, in some instances, in Massachusetts; till the last 20 years 35 bushels was considered an average crop, but by a due rotation of crops, and ploughing in long manure, at least 75 bushels to the acre are now raised. The kinds preferred there, are an eight-rowed variety, procured originally from Canada; the Cass corn, another eight-rowed variety, and the Dutton corn, each of which averages about 60 lbs. to the bushel.

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Maize is a principal crop in the Connecticut River Valley, Western Vermont, and along the Lake shore; but in the high dividing ridge, and in the Northern counties bordering on Canada, the climate is too severe for its profitable cultivation.

“The kind mostly grown (observes Mr. Colburn, of Vermont) is the yellow eight-rowed, though some prefer the twelve and sixteen-rowed, known here by the name of the Button corn; but my experience in cultivating the different kinds for the last twenty-four years, has forced me to the conclusion that the common eight-rowed, mixed with a kind called the Brown corn, does the best; the kernel of the-latter bearing upon a chocolate hue, and the mixture of these two kinds of seed imparting a deep rich color to the whole, when they become blended, and enhancing the yield whenever the soil is in high tilth. Of this kind, the writer has raised, the past season, upon eleven acres on the Connecticut River alluvium, over eight hundred bushels shelled corn, four acres of which, with extra preparation, produced four hundred and sixteen bushels.It will never do to carry seed corn from South to North, as it will not mature in a higher or colder climate than that from which it has been taken. Even half a degree of latitude sensibly affects the maturing of the blade, and renders it an uncertain crop in our high northern latitudes. To insure an extra yield of this valuable grain, the soil must be highly manured, deeply ploughed, thorough cultivated and hoed, and top-dressed with lime, house ashes, and plaster. This done, it is the most remunerative and profitable of all grain crops.”

In Delaware there are many varieties, and everybody esteems his own kind the best. The grain varies from pure “flint” to pure “gourd seed”—of course the mixtures which are between these two varieties are most common—it inclines more to gourd seed than to flint. Mint weighs full standard fifty-six, the gourd seed from forty-nine to fifty-two pounds, and the mixtures range between. Flint ripens from ten days to two weeks earlier. It will not produce as many pounds per acre as the lighter gourd seed. Soil exerts its influence over the character of corn, a heavy soil tending to produce flint—-light soil, gourd seed.

The corn is “cut up” in the fall, and after curing in the shuck, is husked; the shuck remaining on the stalk with the blades.

The average yield, on improved land, is fifty bushels; though crops of one hundred and twelve, and one hundred and sixty bushels per acre are reported to have been raised in the county, in 1849. The yield increases from year to year. A general and rapid improvement of the State is in progress, and in nothing is this seen more clearly than in the corn crop. Mossy “old sedge” fields, which have been laid out for years, are broken up, and will yield, if it be a good season, from five to ten bushels per acre; fence them, lime them with twenty to thirty bushels, and seed the oat crop with clover, and in two years the clover sod will return eighteen to twenty bushels of corn. Another dressing of lime, or its equivalent in marl, of which there is an abundance in the lower half of

Newcastle County, will show thirty bushels of corn; and of wheat, if the farm manure be used on it, nine to twelve bushels will not be too much to expect.

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In Arkansas, Indian corn is regarded as the “king of grains.” It constitutes the chief food of every animal, from man down to the marauding rat, while its dried blade furnishes seven-tenths of the long food for working animals. The *large white* is the variety most esteemed, and most generally cultivated, for the reasons that it yields more grain and fodder, makes, when ground into meal, whiter and sweeter bread, and is less liable to injury from the weevils. The blade is usually esteemed the best long food for horses, exceeding in price the best Northern hay; the average price may be stated at about seventy cents per cwt. The shuck is fed to cows and young mules, they eat it, but with less relish than they do the blades, which are sweeter and more nutritious. The former are much used for mattresses, being preferred to moss, as they are cleaner, and easier manufactured. When mixed with coarse cotton, and properly prepared, they will make a mattress but little inferior to curled hair: price about fifty cents per cwt. The average price of this grain may be set down at forty cents per bushel; and the yield on upland in some parts of the State may be stated at thirty bushels per acre.

Five varieties of maize are grown in Peru. One is known by the name of *chancayano*, which has a large semi-transparent yellow grain; another is called *morocho*, and has small yellow grain of a horny appearance; *amarello*, or the yellow, has a large yellow opaque grain, and is more farinaceous than the two former varieties; *blanco*, white—this variety is large, and contains more farina than the former; and *cancha*, or sweet maize. The last is only cultivated in the colder climates of the mountains; it grows about two feet high, the cob is short, and the grains large and white; when green, it is very bitter, but when ripe and roasted, it is particularly sweet, and so tender that it may be reduced to flour between the fingers. In this roasted state it constitutes the principal food of the mountaineers of several provinces.

The natives remove the husk from the maize by putting it into water with a quantity of wood ashes, exposing it to a boiling heat, and washing the grain in running water, when the husk immediately separates from the grain.

In Jamaica I found maize to produce two crops in the year, and often three. It is usually grown there on the banks or ridges of the cane fields. It may be planted at any time when there is rain, and it yields from fifteen to forty bushels per acre, according to the richness of the soil, and the more or less close manner in which it is planted.

In the colony of New South Wales, including the district of Port Phillip, there were 20,798 acres under cultivation with maize in 1844, the produce from which was returned at 575,857 bushels; 27,058 bushels of maize were exported from Sydney in 1848.

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Culture in the East Indies.—The growers on the hills of Nepaul reckon three kinds of maize: a white grained species, which is generally grown on the hill sides; a yellow grained one, grown in the low and hot valleys; and a smaller one, called “Bhoteah,” or “Murilli Makii,” which is considered the sweetest of the three, but from being less productive is not generally grown on good lands. Maize thrives best on a siliceous, well-drained, rich soil. A correspondent in my “Colonial Magazine,” vol. ii. p. 309, says the finest Indian corn he ever saw was in the Himalayas of the Sikim-range, where the soil consists of a substratum of decomposed *mica* from the under or rocky stratum, with a superstratum of from three to six inches of decayed vegetable matter, from leaves, &c., of the ancient forests.

Throughout Hindostan, June is the usual time for sowing. In Behar, about two seers are usually sown upon a beggah; in Nepaul, twenty-four seers upon an English acre; in the vicinity of Poonah, one and a-half seer per beggah. Before the seed is sown the land is usually ploughed two or three times, and no further attention given to the crop than two hoeings. In Nepaul, where it is the principal crop cultivated, the seed is sown, after one delving and pulverisation of the soil, in the latter end of May and early part of June, in drills, the seeds being laid at intervals of seven or eight inches in the drills, and the drills an equal space apart. The drills are not raised as for turnip sowing, but consist merely of rows of the plant on a level surface. The seed is distributed in this manner with the view of facilitating the weeding of the crop, not for the purpose of earthing up the roots, which seems unnecessary. The Indian corn sowing resembles that of the *gohya* (or upland) rice, in the careful manner in which it is performed; the sower depositing each grain in its place, having first dibbled a hole for it five or six inches deep, with a small hand hoe, with which he also covers up the grain.

The after-culture of this crop is performed with great care in the valleys, but much neglected in the hills, especially on new and strong lands. In the former it undergoes repeated weeding during the first month of its growth, the earth being loosened round the roots, at each weeding, with the hand hoe. After the first loosening of the soil, which is performed as soon as the plants are fairly above ground, a top dressing of ashes or other manure is given. By this mode the crop gets the immediate benefit of the manure, which otherwise, from the extraordinary rapidity of its growth, could not be obtained by it. In three months from the time of sowing, the seed is ripe. The crop is harvested by cutting off the heads. In Nepaul these are either heaped on a rude scaffolding, near the cultivator’s house, or, more commonly, they are suspended from the branches of the trees close by, where, exposed to wind and weather, the hard and tough sheath of the seed cones preserves the grain for many months uninjured.

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Cattle are voraciously fond of the leaves and stems, which are very sweet, and even the dry straw, which Dr. Buchanan surmises may be the reason why it is not more generally cultivated by the natives, as the difficulty would be great to preserve the crop. So slow is the progress of changes in the regions of India, that near Kaliyachak, though the people give all other straw to their cattle, yet they burn that of maize as unfit for fodder. In Nepaul the stalks, with the leaves attached, often twelve feet long, cut by the sickle, are used as fodder for elephants, bedding for cattle, and as fuel. The maize crop within the hills of Nepaul suffers much from the inroads of bears, which are very numerous in these regions, and extremely partial to this grain. The average return from this crop is seldom below fifty seers, ranging frequently far above it.[42] Maize is increasing in cultivation in Java, and some of the Eastern islands. It is found to have the advantage there over mountain rice, of being more fruitful and hardy, and does not suffer from cold until the mean temperature falls to 45 deg. of Fahrenheit, and no heat is injurious to it. Several varieties of it are known, but for all practical purposes these resolve themselves into two kinds: one, a small grain, requiring five months to ripen, and a larger one, which takes seven to mature. In some provinces of Java it yields a return of 400 or 500 fold. Mr. Crawfurd found, from repeated trials, that in the soil of Mataram, in Java, an acre of land, which afforded a double crop, produced of the smaller grain 8481/2 lbs. annually.

RICE.

This is one of the most extensively diffused and useful of grain crops, and supports the greatest number of the human race. The cultivation prevails in Eastern and Southern Asia, and it is also a common article of subsistence in various countries bordering on the Mediterranean. It is grown in the Japan Islands, on all the sea coasts of China, the Philippine and other large Islands of the Indian Archipelago, partially in Ceylon, Siam, India, both shores of the Red Sea, Egypt, the shores of the Mozambique Channel, Madagascar, some parts of Western Africa, South Carolina, and Central America. Three species only are enumerated by Lindley:—*Oryza sativa*, the common rice, a native of the East; *O. latifolia*, a species having its habitat in South America; and *O. Nepalensis*, common in Nepaul. But there are a host of varieties known in the East; these, however, may for all practical purposes, be resolved into two kinds—the upland or mountain rice (*O. Nepalensis*, the *O. mutica*, of Roxburgh), and the lowland or aquatic species (*O. sativa*).

Zizania aquatica is exceedingly prolific of bland, farinaceous seeds, which afford a kind of rice in Canada and North-West America, where it abounds wild in all the shallow streams. The seeds contribute essentially to the support of the wandering tribes of Indians, and feed immense flocks of wild swans, geese, and other water fowl. Pinkerton says, this plant seems intended to become the bread-corn of the North. Two other species of Zizania are common in the United States of America.

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Rice, the chief food, perhaps, of one-third of the human race, possesses the advantage attending wheat, maize, and other grains, of preserving plenty during the fluctuations of trade, and is also susceptible of cultivation on land too low and moist for the production of most other useful plants. Although cultivated principally within the tropics, it flourishes well beyond, producing even heavier and better filled grain. Like many other plants in common use, it is now found wild [it is to be understood that the wild rice, or water oat (*Zizania aquatica*), already referred to, which grows along the muddy shores of tide waters, is a distinct plant from the common rice, and should not be confounded with it], nor is its native country known. Linnaeus considers it a native of Ethiopia, while others regard it of Asiatic origin.

The chief variety of this cereal is cultivated throughout the torrid zone, wherever there is a plentiful supply of water, and it will mature, under favorable circumstances, in the Eastern continent, as high as the 45th parallel of north latitude, and as far south as the 38th. On the Atlantic side of the Western continent, it will flourish as far north as latitude 38 degrees, and to a corresponding parallel south. On the Western coast of America, it will grow so far north as 40 or more degrees. Its general culture is principally confined to India, China, Japan, Ceylon, Madagascar, Eastern Africa, the South of Europe, the Southern portions of the United States, the Spanish Main, Brazil, and the Valley of Parana and Uruguay.

In 1834, 29,583 bags of rice were shipped from Maranham, but I am not aware what have been the exports since.

At the Industrial Exhibition in London, in 1851, there were displayed many curious specimens and varieties of rice, grown without irrigation, at elevations of three thousand to six thousand feet on the Himalaya, where the dampness of the summer months compensates for the want of artificial moisture. Among these American rice received not only honorable mention for its very superior quality, but the Carolina rice, exhibited by E.I. Heriot, was pronounced by the jury “magnificent in size, color, and clearness,” and it was awarded a prize medal. The jury also admitted that the American rice, though originally imported from the Old World, is now much the finest in quality.

This grain was first introduced into Virginia by Sir William Berkeley, in 1647, who received half a bushel of seed, from which he raised sixteen bushels of excellent rice, most or all of which was sown the following year. It is also stated that a Dutch brig, from Madagascar, came to Charleston in 1694, and left about a peck of paddy (rice in the husk), with Governor Thomas Smith, who distributed it among his friends for cultivation. Another account of its introduction into Carolina is, that Ashley was encouraged to send a bag of seed rice to that province, from the crops of which sixty tons were shipped to England in 1698. It soon after became the chief staple of the colony. Its culture was introduced into Louisiana in 1718, by the “Company of the West.”

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The present culture of rice in the United States is chiefly confined to South Carolina, Georgia, Florida, Alabama, Mississippi, and Texas. The yield per acre varies from twenty to sixty bushels, weighing from forty-five to forty-eight pounds when cleaned. Under favorable circumstances as many as ninety bushels to an acre have been raised.

Judge Dougherty, who resides near the borders of Henderson county, Texas, has raised a crop of several hundred bushels of upland rice. The crop averages thirty bushels to the acre. He thinks rice can be raised there as easily as Indian corn, and will be far more profitable.

Another variety is cultivated in America to a limited extent, called Cochin-China, dry, or mountain rice, from its adaptation to a dry soil, without irrigation. It will grow several degrees further north or south than the Carolina rice, and has been cultivated with success in the Northern provinces of Hungary, China, Westphalia, Virginia and Maryland; but the yield is much less than that already stated, being only fifteen to twenty bushels to an acre. It was first introduced into Charleston, from Canton, by John Brodly Blake, in 1772.

The American crop of rice in 1848, reached 162,058 tierces in market, and of these 160,330 tierces were exported from South Carolina. The largest rice crop grown in South Carolina for the past thirty years, was in 1847, when 192,462 tierces were raised; 140,000 to 150,000 is about the average, and it has only exceeded 170,000 on four occasions.

The amount of rice exported from South Carolina in 1724, was 18,000 barrels; in 1731, 41,957 barrels; in 1740, 90,110 barrels; in 1747-48, 55,000 barrels; in 1754, 104,682 barrels; in 1760-61, 100,000 barrels; from Savannah, in 1755, 2,299 barrels, besides 237 bushels of paddy or rough rice; in 1760, 3,283 barrels, besides 208 bushels of paddy; in 1770, 22,120 barrels, besides 7,064 bushels of paddy; from Philadelphia, in 1771, 258,375 pounds. The amount exported from the United States, in 1770, was 150,529 barrels; in 1791, 96,980 tierces; in 1800, 112,056 tierces; in 1810, 131,341 tierces; in 1820-21, 88,221 tierces; in 1830-31, 116,517 tierces; in 1840-41, 101,617 tierces; in 1845-46, 124,007 tierces; in 1846-47, 144,427 tierces; in 1850-51, 105,590 tierces.

According to the census of 1840, the rice crop of the United States amounted to 80,841,422 lbs.; in 1850, 215,312,710 lbs.

Rice being an aquatic plant, is best grown in low moist lands, that are easily inundated.

The ground is ploughed superficially, and divided into squares of from twenty to thirty yards in the sides, separated from each other by dykes of earth about two feet in height, and sufficiently broad for a man to walk upon. These dykes are for retaining the water when it is required, and to permit of its being drawn off when the inundation is no longer necessary. The ground prepared, the water is let on, and kept

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at a certain height in the several compartments of the rice field, and the seedsman goes to work. The rice that is to be used as seed must have been kept in the husk; it is put into a sack, which is immersed in the water until the grain swells and shows signs of germination; the seedsman, walking through the inundated field, scatters the seed with his hand, as usual; the rice immediately sinks to the bottom, and many even penetrate to a certain depth in the mud. In Piedmont, where the sowing takes place at the beginning of April, they generally use about fifty-five pounds of seed per acre. The rice begins to show itself above the surface of the water at the end of a fortnight; as the plant grows, the depth of the water is increased, so that the stalks may not bend with their own weight. About the middle of June this disposition is no longer to be apprehended; the rice is not so flexible as it was, so that the water can be drawn off for a few days to permit hoeing; after which the water is again let on, and maintained to the height of the plant. In July it is usual to top the stalks, an operation which renders the flowering almost simultaneous.

Rice generally flowers in the beginning of the month of August, and a fortnight later the grain begins to form. It is at this period especially that the stalks require to be supported, and this is effectually done by keeping the water at about half their height. The rice field is emptied when the straw turns yellow. The harvest generally takes place at the end of September. In the Isle of France rice is cultivated in very damp soils, upon which a great deal of rain falls, but which are not flooded, as in other tropical countries: but the process is not so certain nor the crop so great, as when inundation is employed. In Piedmont the usual return of a rice field is reckoned at about fifty for one. At Munzo, in New Granada, the paddy fields which are not inundated, under the influence of a mean temperature of 26 deg. centrigrade (79.0 deg. Fahrenheit), yield 100 for 1.—-(Simmonds’s “Colonial Magazine,” vol. xi., p. 92.)

The rice now grown about New Orleans is as sweet, if not sweeter, than that imported from South Carolina, but it is deficient in hardness and brightness when ready for market, a defect owing entirely to two causes, neither of which is beyond the control of the planter. The one cause is the mode of culture, it being generally grown without due attention to the seed—seeded at too late a period of the season, and allowed to become *rare-ripe* upon the stalk. The other cause is the very imperfect mode of its preparation for market; this being invariably accomplished by the primitive pestle and mortar, or the old-fashioned “pecker mill.” The same seed is planted in the same soil from year to year, a system which, it is generally conceded, will deteriorate the quality and production of any grain crop. A very large proportion of the rice grown in Carolina is prepared

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for market at the steam toll-mills, in the vicinity of Charleston; and a mill of this description near New Orleans, would remedy the greatest defect in the rice of the country, greatly increase the demand for the article, and undoubtedly yield a large return for the investment. The toll mills at and around Charleston are, and always have been, prosperous. The mills of Mr. Lucas, in England, erected to clean "paddy," *i.e.* "rough rice," sent there in bulk from Carolina, have succeeded also, and have increased the consumption of the article in that country. The "rough rice," "paddy," or grain, as it comes from the ear, is composed, first, of a rough, silicious outer covering, impervious to water, which is very useful in the neighbourhood of cities, for filling up low lots or pools, for horse beds, and for packing crockery and *ice*, being far better for the latter purpose than the sawdust used; second, a brown flour or bran, lying directly under the outer covering; and third, of the clean or white rice. There is no question that, as a common diet, it is better adapted to the climate of Louisiana than Indian corn; and it can be grown on the hitherto *waste lands of the sugar plantations*; it is always substituted by the physician, when practicable, as the food best adapted to the laborer, in seasons of diarrhoea and other similar diseases, is *preferred* before any other grain by the negro; and if the clean rice be ground and bolted, a meal is produced which can be made up into various forms of cake and other bread, of unrivalled sweetness and delicacy. The outer flour, or brown bran, which is separated from the chaff at the toll mill, is known as "rice flour," and corresponds to the "bran" of wheat, it is a most excellent food for horses, poultry, pigs and *milch cows*, and would always command a ready sale in New Orleans. It is used extensively for these purposes at and around Charleston, and is shipped thence, by the cargo, to Boston and other Northern ports.

No portion of the globe is better adapted to the growth of this grain than the delta of the Mississippi. The river is *always* "up and ready" to do the all-important duty of irrigation in March, April, May, and June, in which period of the year the crop ought to be made; and I am informed, and doubt not, that *two* cuttings can be obtained from the same plants, between March and the killing frosts of the succeeding November.

An interesting report by Dr. E. Elliot, on the Cultivation of Rice, was read before the Pendleton Farmer's Society, South Carolina, at a recent annual meeting, from which I shall make an extract.

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In “Ramsay’s History of South Carolina” it is stated:—“Landgrave Thomas Smith, who was Governor of the Province in 1693, had been at Madagascar before he settled in Carolina. There he observed that rice was planted and grew in low moist ground. Having such ground in his garden, attached to his dwelling in East Bay, Charleston, he was persuaded that rice would grow therein, if seed could be procured. About this time a vessel from Madagascar, being in distress, came to anchor near Sullivan’s Island. The master inquired for Mr. Smith, as an old acquaintance. An interview took place. In the course of conversation Mr. Smith expressed a wish to obtain some seed rice to plant in his garden. The cook being called, said that he had a small bag of rice suitable for the purpose. This was presented to Mr. Smith, who sowed it in a low spot in Longitude Lane. From this small beginning did one of the great staple commodities of South Carolina takes its rise, which soon became the chief support of the colony, and its great source of opulence.”“Such is the historical account of the introduction of rice into South Carolina; and from that day to this, it has constituted one of her staple articles of production. Although the climate and soil were found admirably suited to the plant, the planters encountered incredible difficulty in preparing or dressing the rice for market. From the day of its introduction, to the close of the Revolution, the grain was milled, or dressed, partly by hand and partly by animal power. But the processes were imperfect, very tedious, very destructive to the laborer, and very exhausting to the animal power. The planter regarded a good crop as an equivocal blessing, for as the product was great so in proportion was the labor of preparing it for market. While matters stood thus, the planters were released from their painful condition by a circumstance so curious that it deserves a place in the history of human inventions. A planter from the Santee, whilst walking in King-street, Charleston, noticed a small windmill perched on the gable end of a wooden store. His attention was arrested by the beauty of its performance. He entered the store and asked who the maker was. He was told that he was a Northumbrian, then resident in the house—a man in necessitous circumstances, and wanting employment. A conference was held; the planter carried the machine to the Santee, pointed out the difficulties under which the planters labored, and the result was the rice pounding-mill. This man was the first Mr. Lucas, and to his genius South Carolina owes a large debt of gratitude. For what the cotton planter owes to Eli Whitney, the rice planter owes to Mr. Lucas. His mills were first impelled by water, but more recently by steam, and though much mechanical ingenuity and much capital have been expended in improving them, the rice pounding-mill of this day, in all essential particulars, does not differ materially from the mill

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as it came from the hands of Mr. Lucas.This great impediment being removed, one formidable difficulty still remained in the way of the rice planters, and that was the threshing of the crop by flail. The labor requisite to accomplish this was so great, that we once heard a distinguished planter say, while having one large crop threshed out by flail, that he would regard another large crop as a calamity. Previous to 1830 threshing mills had been tried by various individuals, but with no apparent success. In that year the attempt was renewed, and we were present and witnessed the first trial of a thresher, constructed in New York, and which was tested on Savannah river, under the auspices of General Hamilton. The machinery was driven by apparatus similar to that employed for driving the cotton gin. The result was not very satisfactory, but there was ground for hope, and after an outlay of very large sums, and after many disappointments, the happy expedient was thought of, of testing the mill with steam instead of animal power. The experiment was completely successful, and it was manifest at once that the difficulties had not been in the imperfect construction, of the thresher, but in the insufficiency of the moving power.It is now twenty years since we witnessed the working of the small mill alluded to, and the rice threshing-mill, with steam-engine attached, is now a splendid piece of operative machinery. The rice in sheaf is taken up to the thresher by a conveyor, it is threshed, the straw taken off, then thrice winnowed and twice screened, and the result in some cases exceeds a thousand bushels of clean rough rice, the work of a short winter day.Humanity rejoices at these inventions—at this transfer to water and steam, of processes so slow and so exhausting to the human as well as to the animal frame—and in this feeling we are confident every planter deeply sympathises. Moreover, the relief they have afforded in other respects has been perfectly indescribable. Previous to these improvements all the finer portions of the winter were appropriated exclusively to the milling and the threshing of the crop with the flail, yet it is manifest they added not one particle to the value of the property; indeed, while going on, all other work, and all preparation for another crop had to be suspended, so that the condition of the plantation was not progressive, but retrograde.A short recapitulation will show what has been accomplished by the enterprise of our planters in the last seventy years. At the close of the Revolution it is believed the rice fields were poorly drained, and when broken up were chiefly turned with the hoe, then trenched with the hoe; then came three or four hoeings and as many pickings. The rice was then cut with the sickle and carried in on the head, then threshed with the flail, then milled and dressed, in some cases wholly by human

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labor, and in others by a rude machine, called a pecker mill. Now, in 1852, the hoeing, the pickings, and the cutting with the sickle remain unchanged; but the lands are better drained, and in the turning the plough has superseded the hoe; the trenching, when, necessary, is done by animal power; the rice, when cut, is carried in on a flat and wagon, then threshed and milled by machinery, so perfect that it is difficult to imagine how it can be surpassed.It is one hundred and fifty-nine years since the introduction of rice into Carolina, and there are grounds for supposing that our people have accomplished more during that period, in the cultivation and preparation of this grain, than has been done by any of the Asiatic nations who have been conversant with its growth for many centuries. We had the rare opportunity, a few years since, of seeing a Chinese book on rice planting, which contained many engravings. The language we could not read, but we comprehended a sufficient number of the engravings to institute a comparison between their system and our own, and the result was, in our method of irrigation we were their equals, while in economy of cultivation, and in the preparation of the grain for market and for use, we are greatly their superiors. Again, some six or seven years since the East India Company, of London, sent an agent to this country to procure American cotton seed, gins, and overseers, for the purpose of testing the practicability of raising cotton by our method in India. This agent, Captain Bayles, when in Savannah, was heard to say that he had especial directions from the Company to inform himself minutely of our system of rice culture. Here, then, was an embassage from the banks of the Ganges, a spot where rice has been cultivated probably for twenty centuries, to inquire into the method of cultivation and preparation, of a people amongst whom the grain had no existence one hundred and sixty years ago.”

The following is the mode of culture for rice in Carolina:—It is sowed as soon as it conveniently can be after the vernal equinox, from which period until the middle, and even the last of May, is the usual time of putting it in the ground. It grows best in low marshy land, and should be sowed in furrows twelve inches asunder; it requires to be flooded, and thrives best if six inches under water; the water is occasionally drained off, and turned on again to overflow it, for three or four times.

When ripe the straw becomes yellow, and it is either reaped with a sickle, or cut down with a scythe and cradle, some time in the month of September; after which it is raked and bound, or got up loose, and threshed or trodden out, and winnowed in the same manner as wheat or barley.

Husking it requires a different and particular operation, in a mill made for that purpose. This mill is constructed of two large flat wooden cylinders, formed like mill-stones, with channels or furrows cut therein, diverging in an oblique direction from the centre to the circumference, made of a heavy and exceedingly hard timber, called lightwood, which is the knots of the pitch pine. This is turned with the hand, like the common hand-mills. After the rice is thus cleared of the husks, it is again winnowed, when it is fit for exportation.

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A bushel of rice will weigh about sixty or sixty-six pounds, and an acre of middling land will produce twenty-five bushels.

Various machines have been contrived for cleaning rice, of which one secured by patent to Mr. M. Wilson, in 1826, and thus described by Dr. Ure, may be regarded as a fair specimen:—It consists of an oblong hollow cylinder, laid in an inclined position, having a great many teeth stuck in its internal surface, and a central shaft, also furnished with teeth. By the rapid revolution of the shaft, its teeth are carried across the intervals of those of the cylinder, with the effect of parting the grains of rice, and detaching whatever husks or impurities may adhere to them. A hopper is set above to receive the rice, and conduct it down into the clean cylinder. About eighty teeth are supposed to be set in the cylinder, projecting so as to reach very nearly the central shaft, in which there is a corresponding number of teeth, that pass freely between the former.

The cylinder may also be placed upright, or horizontal if preferred, and mounted in any convenient framework. The central shaft should be put in rapid rotation, while the cylinder receives a slow motion in the opposite direction. The rice, as cleaned by that action, is discharged at the lower end of the cylinder, where it falls into a shute, and is conducted to the ground. The machine may be driven by hand, or by any other convenient motive power.[43] The growth of rice in North America is almost wholly confined to two States; nine-tenths of the whole product, indeed, being raised in the States of South Carolina and Georgia. A little is grown in North Carolina, Louisiana, and Mississippi.

The aggregate crop, for 1843, amounted to 89,879,185 lbs., while in 1847 it had risen to 103,000,000 lbs.

Besides the rice which is raised in the water, there is also the dry, or mountain rice, which is raised in some parts of Europe on the sides of the hills. It is said to thrive well in Cochin China, in dry light soils, not requiring more moisture than the usual rains or dews supply. By long culture the German rice, raised by the aid of water, is stated to have acquired a remarkable degree of hardness and adaptation to the climate. The upland rice of the United States is thought by some to be only a modified description of the swamp rice. It will grow on high and poor land, and produce more than Indian corn on the same land would do, even fifteen bushels, when the corn is but seven bushels. The swamp rice was originally cultivated on high land, and is not so now, because it is more productive in the swamp, in the proportion, as is said, of twenty to sixty bushels per acre; and the use of water likewise, it is stated, makes it easier of cultivation, by enabling the planter to kill the grasses. It is thought that on rich high land, rice may be made to produce twenty-five or thirty bushels to an acre in a good season. A letter from a gentleman in North Carolina gives the following account of some rice raised there. He says:—

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“I have planted it the two past years with a view to private consumption only; not, however, with the success of my neighbours, who are famous, and have the things under their own management. They make from forty to fifty, and some, sixty bushels to the acre, on fine land that produces ordinarily from ten to fifteen bushels of Indian corn or maize. It is a larger grain than the gold or swamp rice, and very white; hence it is commonly called here the ’white rice.’ It is planted generally about the middle of March, or 1st of April, in small ridges two-and-a-half feet apart, in chops at intervals of about eighteen inches, on the top of the ridge, ten or twelve seeds in each chop. A season that will make Indian corn, will, if long enough, make this rice; but it requires about four or five weeks more than the corn to mature. It ought to be cut before quite ripe, as it threshes off very easily, and is liable to great waste. Instead of the flail, we take the sheaf in the hand, and whip it across a bench in a close room until the rice leaves the straw. It does not stand the pestle as well as the swamp rice, but breaks a good deal in the beating; this, however, I have heard attributed to the dry culture.”

A new variety of rice is mentioned as having been discovered in South Carolina, in 1838, called the big-grained rice. It has been proved to be unusually productive. One gentleman, in 1840, planted not quite half an acre with this seed, which yielded forty-nine and a half bushels of clean winnowed rice. In 1842, he planted 400 acres, and in 1843, he sowed his whole crop with this seed. His first parcel when milled, was eighty barrels, and netted half a dollar per cwt. over the primest rice sold on the same day. Another gentleman also planted two fields in 1839, which yielded seventy-three bushels per acre. The average crop before from the same fields of fifteen and ten acres, had only been thirty-three bushels per acre.

The following were the returns of produce on some of the leading estates of South Carolina, in 1848:—

Plantation	Barrels Shipped		Barrels of 600 lbs.net	Weight	Average Net Produce per barrel.	Net Income Amount Dollars
	Whole	Half				
1. Prospect Hill	1,387	10	1,4951/2	897,166	16 08-100ths	24,001
2. Springfield	737	5	8011/2	480,937	16 60-100ths	13,264
3. Brook Green	1,571	15	1,716	1,026,405	16 53-100ths	28,261
4. Longwood	1,113	4	1,2271/2	736,413	15 53-100ths	19,021
5. Alderly	484	6	533	319,912	16 68-100ths	8,851

Total	5,292	40	5,7731/2	3,460,833		93,398

Nos. 2 and 3 were sown with long grain rice, the others with small grain. These plantations were all on the river Waccamaw. The expenses of a well supplied rice plantation may be stated at 33-1/3 per cent. on the net income.

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A gentleman from the United States, named Colvin, proposes to establish the cultivation of rice in the colony of Demerara. This is no new experiment, rice having been already grown with success in several parts of the colony—for instance, in Leguan, up the Canje Creek, and elsewhere; and some of it is of superior quality, preferable, indeed, to that imported. If Mr. Colvin's object be not merely to demonstrate the practicability of rice being grown in British Guiana, but to promote its cultivation on such a scale as may tend to render it in time one of the staples of the colony, he is deserving of support, and I hope that his efforts will be crowned with complete success.

The editor of the *Gazeta*, a local paper, has been shown some sprigs of rice raised near Matanzas, in Cuba, the smallest of which contains at least three hundred grains, perfectly opened, and of a larger size than is usually produced on the island. He observes that this phenomenon is not limited to a certain number of sprigs, but that the whole crop is similar—that this excess of production is to be attributed to the extraordinary abundance of rain this year. "Here we have a specimen," says the editor, "of the enormous production that could be raised in our fields of this excellent and nutritious grain, if it were cultivated in places contiguous to the rivers, where it could be flowed during drought."

The experiment of cultivating rice in France appears to have succeeded perfectly. A piece of ground of 100 hectares in extent (250 acres) was sown with rice last year in the lands of Arcachon, near Bordeaux, and the crop proved a highly satisfactory one. The seed is sown about the middle of April, and almost immediately appears above ground.

Rice may be kept a very long period in the rough—I believe a lifetime. After being cleaned, if it be prime rice, and well milled, it will keep a long time in this climate; only when about to be used (if old) it requires more careful washing to get rid of the must, which accumulates upon it. Some planters—the writer among the number—prefer for table use rice a year old to the new. The grain is superior to any other provisions in this respect. If a laborer in the gold diggings, or elsewhere, takes with him two days' or a week's provisions, in rice, and his wallet happens to get wet, he has only to open it to the sun and air, and he will find it soon dries, and is not at all injured for his purpose. Rough rice may remain under water twenty-four hours without injury, if dried soon after.

Passing eastward, rice begins to be found cultivated in Egypt, becomes more general in Northern India, and holds undisputed rule in the peninsulas of India, in China, Japan, and the East India islands—shares it in the west coast of Africa with maize, which, on the other hand, is the exclusively cultivated corn plant of the greatest part of tropical America, with only some unimportant exceptions. On the coast of Africa rice ripens in three months; they put it under water when cut, where it keeps sound and good for some time.

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Rice is now the staple commodity of Bourbon, and it produces about 26,000 quintals annually. It forms, together with maize and mandioc, the principal article of food amongst the negroes and colored people.

The Bhull rice lands of Lower Sind.—Like all large rivers which flow through an alluvial soil, for a very lengthened course, the Indus has a tendency to throw up patches of alluvial deposit at its mouth; and these are in Sind called *bhulls*, and are in general very valuable for the cultivation of the red rice of the country. These *bhulls* are large tracts of very muddy swampy land, almost on a level with the sea, and exposed equally to be flooded both by it and the fresh water; indeed on this depends much of the value of the soil, as a *bhull* which is not at certain times well covered with salt water, is unfit for cultivation. They exist on both sides of the principal mouths of the Indus, in the Gorabaree and Shahbunder pergunnas, which part of the province is called by the natives "Kukralla," and was in olden days, before the era of Goolam Shah Kalora, a small state almost independent of the Ameers of Sind. On the left bank of the mouths of the river these *bhulls* are very numerous and form by far the most fertile portion of the surrounding district. They bear a most dreary, desolate, and swampy appearance—are intersected in all directions by streams of salt and brackish water, and are generally surrounded by low dykes or embankments, in order to regulate the influx and reflux of the river and sea. Yet from these dreary swamps a very considerable portion of the rice consumed in Sind is produced; and the Zemindars, who hold them, are esteemed amongst the most respectable and wealthy in Lower Sind.

To visit a *bhull* is no easy matter. Route by land there is none, and the only way is to go by boat, in which it is advisable to take at least one day's provisions and water, as the time occupied in the inspection will be regulated entirely by the state of the tide and weather. Very difficult is it too, to land on any of these places, the mud being generally two or three feet deep, and it is only here and there that a footing can be secured, in the embankment surrounding the field.

Let me now describe the mode of cultivating these anomalous islands, floating as it were in the ocean, and deriving benefit both from it and the mighty river itself, whose offspring they are. Should the river during the high season have thrown up a *bhull*, the Zemindar selecting it for cultivation, first surrounds it with a low bund of mud, which is generally about three feet in height. When the river has receded to its cold weather level, and the *bhull* is free of fresh water (for be it remembered, that these *bhulls* being formed during the inundation, are often considerably removed from the river branches during the low season), he takes advantage of the first high spring tide, opens the bund and allows the whole

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to be covered with the salt water. This is generally done in December. The sea water remains on the land for about nine weeks, or till the middle of February, which is the proper time for sowing the seed. The salt water is now let out, and as the ground cannot, on account of the mud, be ploughed, buffaloes are driven over every part of the field, and a few seeds of the rice thrown into every footmark; the men employed in sowing being obliged to crawl along the surface on their bellies, with the basket of seed on their backs; for were they to assume an upright position, they would inevitably be bogged in the deep swamp. The holes containing the seed are not covered up, but people are placed on the bunds to drive away birds, until the young grain has well sprung up. The land is not manured, the stagnant salt water remaining on it being sufficient to renovate the soil. The rice seed is steeped in water, and then in dung and earth for three or four days, and is not sown until it begins to sprout. The farmer has now safely got over his sowing, and as this rice is not as in other cases transplanted, his next anxiety is to get a supply of fresh water; and for this he watches for the freshes which usually come down the river about the middle and end of February, and if the river then reaches his *bhull*, he opens his bund, and fills the enclosure with the fresh water. The sooner he gets this supply the better, for the young rice will not grow in salt water, and soon withers if left entirely dry.

The welfare of the crop now depends entirely on the supply of fresh water. A very high inundation does not injure the *bhull* cultivation, as here the water has free space to spread about. In fact the more fresh water the better. If, however, the river remains low in June, July, and August, and the south-west monsoon sets in heavily on the coast, the sea is frequently driven over the *bhulls* and destroys the crops. It is in fact a continual struggle between the salt water and the fresh. When the river runs out strong and full, the *bhulls* prosper, and the sea is kept at a distance. On the other hand, the salt water obtains the supremacy when the river is low, and then the farmer suffers. In this manner much *bhull* crop was destroyed in the monsoons of 1851 and 1852, during the heavy gales which prevailed in those seasons. The rice is subject to attacks also of a small black sea crab, called by the natives *Kookaee*, and which, without any apparent cause, cuts down the growing grain in large quantities, and often occasions much loss.

The crop when ripe, which, if all goes well will be about the third week in September, is reaped in the water by men, either in boats, or on large masses of straw rudely shaped like a boat, and which being made very tight and close, will float for a considerable time. The rice is carried ashore to the high land, where it is dried, and put through the usual harvest process of division, &c.: and the *bhull* is then on the fall of the river again ready for its annual pickling.

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The process of preparing the field for rice culture, in the Kandian country, Ceylon, is very simple.

When the paddy is to be cultivated in mud, a piece of ground is enclosed in a series of squares or terraces, by ridges raised with mud and turf; a quantity of water is directed into the field from an adjacent stream or tank, and is allowed to remain on it for fifteen days; at the expiration of this time the field is ploughed with a yoke of buffaloes, which operation is repeated at the end of fifteen days more, when, by the rotting of the weeds and other matter, the field has become manured. After another interval of fifteen days the field is again ploughed and the broken ridges are repaired. Eight days after the field is harrowed, and subsequently rolled or levelled; and when the water has been let out the seed is sown, having in most instances been previously made to germinate, by being spread on platforms and kept wet.

The water is turned in during night, to prevent crabs and insects from destroying the seedlings, and let out during the day; and this they continue to do till the plants attain the height of one foot. Water is only retained in the field until the ears are half ripe, otherwise they would ripen indifferently and be destroyed by vermin. A variety of coast paddy, called “moottoo samboo,” was introduced into the Kandian province in 1832, which was found to produce a more abundant crop, by one third, than the native. It is of six months growth.

In Kashmir rice is the staple of cultivation, and the practice adopted there is thus described by a writer in my “Colonial Magazine,” vol. x. p. 130. It is sown in the beginning of May, and is fit to cut about the end of August. The grain is either sown broadcast in the place where it is intended to stand till it is ripe, or thickly in beds, from which it is transplanted when the blade is about a foot high. As soon as the season will admit after the 21st of March, the land is opened by one or more ploughings, according to its strength, and the clods are broken down by blows with wooden mattocks, managed in general by women, with great regularity and address; after which water is let in upon the soil, which for the most part of a reddish clay, or foxy earth, is converted into a smooth soft mud. The seed grain, put into a sack of woven grass, is submerged in a running stream until it begins to sprout, which happens sooner or later, according to the temperature of the water and of the atmosphere, but ordinarily takes place in three or four days. This precaution is adopted for the purpose of getting the young shoots as quickly as possible out of the way of a small snail, which abounds in some of the watered lands of Kashmir, but sometimes proves insufficient to defend it against the activity of this destructive enemy. When the farmer suspects, by the scanty appearance of the plants above the water in which the grain has been sown, and by the presence of the snail

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drawn up in the mud, that his hopes of a crop are likely to be disappointed, he repeats the sowing, throwing into the water some fresh leaves of the Prangos plant, which either poison the snails or cause them to descend out of the reach of its influence. The seed is for the most part thrown broadcast into about four or five inches of water, which depth is endeavoured to be maintained. Difference of practice exists as to watering, but it seems generally agreed that rice can scarcely have too much water, provided it be not submerged, except for a few days before it ripens, when a dried state is supposed to hasten and to perfect the maturity, whilst it improves the quality of the grain. In general the culture of rice is attended with little expense, although dearer in Kashmir than Hindostan, from its being customary in the former country to manure the rice-lands, which is never done in the latter. This manure, for the most part, consists of rice straw rejected by the cattle, and mixed with cow-dung. It is conveyed from the homestead to the fields by women, in small wicker baskets, and is set on the land with more liberality than might have been expected from the distance it is carried. Many of the ripe lands are situated much higher than might be thought convenient in Hindostan, and are rather pressed into this species of culture than naturally inviting, but still yield good crops, through the facility with which water is brought upon them from the streams which fall down the face of the neighbouring hills. In common seasons the return of grain is from thirty to forty for one, on an average, besides the straw.

The rice of Bengal, by the exercise of some care and skill, has recently been so far improved as nearly to equal that of the Carolinas. Dr. Falconer has introduced into India the numerous and fine varieties of rice cultivated in the Himalayas; of these some of the best sorts were at his suggestion distributed to cultivators along the Doab canal.

A species of hill rice grows on the edge of the Himalaya mountains. The mountain rices of India are grown without irrigation, at elevations of 3,000 to 6,000 feet on the Himalaya, where the dampness of the summer months compensates for the want of artificial moisture. The small reddish Assamese rices, which become gelatinous in boiling, and the large, flat-grained, soft, purple-black Ketana rice, of Java and Malacca, shown at the Great Exhibition, were curious.

The fertility of the province of Arracan is very great, its soil being fit for the culture of nearly all tropical productions; rice, however, is alone cultivated to any great extent; the low alluvial soil which extends over the whole country, from the foot of the mountains to the sea, being admirably suited for its growth. About 115 square miles are under culture with rice. The export trade in rice of the district, is seen by the following statistical return; and it gives employment to from 400 to 700 vessels, aggregating 60,000 to 80,000 tons.

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QUANTITY OF PADDY AND RICE EXPORTED FROM AKYAB, THE PORT OF ARRACAN.

	Maunds of Paddy	Maunds of rice	Total value Rupees	Average price per 100 baskets of 12 seers, in Rupees: Rice	Paddy
1831-32	380,600	28,970	130,591	15.4 to 16.6	8 to 9
1832-33	502,740	175,560	232,915	16 17	7.5 8
1833-34	555,540	418,950	430,830	19 20	9 10
1834-35	127,050	260,650	176,717	18 19	8 9
1835-36	783,870	548,460	354,791	10 11	5 5.8
1836-37	1,737,841	641,010	666,732	10.8 12	5 6
1837-38	1,621,566	248,783	650,385	21 23	9 10.8
1838-39	1,364,100	332,380	821,168	24 25.1	8.8 11.12
1839-40	2,033,698	529,961	1,121,311	21.8 23	9.8 10
1840-41	2,212,068	446,941	1,131,087	20 21.8	10 11
1841-42	1,265,388	270,000	553,014	19 20	8 9
1842-43	1,310,900	393,900	472,889	14 15	7.8 8
1843-44	848,922	707,780	633,710	17 18	7 8

(” Colonial Magazine,” vol. vi., p. 348.)

EXPORT OF RICE FROM MOULMEIN

Baskets	Value	
1840	67,318	38,708
1841	11,175	6,900
1842	64,055	40,034
1843	35,635	35,289
1844	71,822	44,529
1845	149,815	73,034
1846	193,267	101,465

—(Simmonds’s “Colonial Magazine,” vol. xii., p. 462.)

From Tavoy and Mergui rice was also exported, equal in value to 41,000 rupees, in 1846; 100 baskets of 12 seers each, are equal to 30 Bengal maunds. The basket of rice named above, is equal to 551/2 lbs. English.

Paddy means rice in the husk—rice, the grain when unhusked—a distinction to be kept in mind.

The daily average consumption of rice in a family of five, is rated in the Straits' settlements at three and a quarter chupahs.

The Burmese and Siamese are the grossest consumers of rice. A common laboring Malay requires monthly 30 chupahs, or 56 pounds of rice, value 3s. 9d. or 4s. The Burmese and Siamese about 34 chupahs, or 64 pounds. Rice land in Penang yields a return which cannot be averaged higher than seventy-five fold—or nearly thirty guntangs of paddy for each orlong (1-1/3 acres); but it has been considered advisable to rate it here at sixty fold only.

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The rice land of Province Wellesley gives an average return of 1171/2 fold; the maximum degree of productiveness being 600 guntangs of paddy to an orlong of well flooded, alluvial land, or 150 fold, equal to 300 guntangs of clean rice, weighing nearly 4,520 English pounds. The present average produce has been very moderately estimated at 470 guntangs the orlong of paddy. The quantity of seed invariably allotted for an orlong of land is four guntangs. In Siam forty fold is estimated a good average produce. At Tavoy, on the Tenasserim coast, the maximum rate of productiveness of the rice land was, in 1825, and is still believed to be, nearly the same as the average of Siam; while their *average* was only twenty-fold.—(Low, on “Straits Settlements.”)

Rice in Cochin-China is the “staff of life,” and forms the main article of culture. There are six different sorts grown; two on the uplands, used for confectionery, and yielding only one crop annually; the other sorts affording from two to five crops a year; but generally two, one in April and another in October; or three when the inundations have been profuse.

The late Dr. Gutzlaff stated, at a meeting of the Statistical Society of London, that the population of China was about 367,000,000, and the returns of the land subject to tax as used in rice cultivation there, gave nearly half an acre to each living person; and he further stated that in the southern and well watered provinces, it is anything but uncommon to take two crops of rice, one of wheat, and one of pulse, from the same land in a single season. Rice is the only article the Chinese ever offer a bounty for; the price fluctuates according to the seasons, from one and three-quarter dollars to eight dollars per picul. Siam and the Indian Islands, particularly Bali and Lombok, supply the empire occasionally with large quantities.

The price of rice in China varies according to the state of the canals leading to the interior; if they are full of water the prices rise; if on the contrary they are low, prices fall in proportion at the producing districts. The amount of consumption is controlled, in a considerable degree, by the cost of transit; when this is cheap prices rise from the general demand; but when land-carriage to any extent has to be resorted to, they fall; it raises prices so much at any great distance, that rice must be used very sparingly, from its enhanced price. It is obvious that if the waters are sufficiently high to allow a boat to pass fully loaded, she does so at an expense of nearly 50 per cent, less than she would do, if, from want of water, she could only take half the quantity; when transport is cheap every one obtains a full supply; when it is dear the rice districts have more than they can consume.

At home we are so much accustomed to the facilities of transit offered by railroads, canal boats, &c., that we do not readily take into consideration, that in China, except by water, all articles are conveyed from one place to another on men’s shoulders. Taking the population of Canton at the usual estimate of a million, and allowing to each a catty a day, the quantity of rice required for one day’s consumption alone in that city would be 10,000 piculs, of 133 lbs. each = 1,340,000 lbs.

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Java is the granary of plenty for all the Eastern Archipelago; and the Dutch East India Company occupies itself in this culture with solicitude, well persuaded that a scarcity of rice might be fatal to its power. Ordinances to encourage and increase this branch of agriculture, have been promulgated at different times by an authority called to watch over the physical well-being of many millions of inhabitants.

As an evident proof that the culture of rice, of which it would be difficult to fix the quantity produced annually, increases considerably, I may mention that the exportation from Java, in 1840, was 1,488,350 piculs of 125 Dutch lbs.

Rice is cultivated in Java in three systems. The name of *sawah* is given to the rice fields, which can be irrigated artificially; *tepar*, or *tagal*, are elevated but level grounds; and *gagah*, or *ladang*, are cleared forest grounds. The two last only give one crop; a second crop may be obtained from the *sawah*, which then most commonly consists of *katjang*, from which oil is extracted, in *kapus* or fine cotton, and in *ubie*, a kind of potato.

There are, says Mr. Crawfurd, two distinct descriptions of rice cultivated throughout the Indian islands, one which grows without the help of immersion in water, and another for which that immersion is indispensably requisite. In external character there is very little difference between them, and in intrinsic value not much. The marsh rice generally brings a somewhat higher price in the market. The great advantage of this latter consists in its superior fecundity. Two very important varieties of each are well known to the Javanese husbandman, one being a large productive, but delicate grain, which requires about seven months to ripen, and the other a small, hardy, and less fruitful one, which takes little more than five months. The first we constantly find cultivated in rich lands, where one annual crop only is taken; and the last in well watered lands, but of inferior fertility, where two crops may be raised.

Both of these, but particularly the marsh rice, is divided into a great number of sub-varieties, characterised by being awned or otherwise, having a long or round grain, or being in color black, red, or white. The most singular variety is the *O. glutinosa*, of Rumphius. This is never used as bread, but commonly preserved as a sweetmeat. The rudest, and probably the earliest practised mode of cultivating rice, consists in taking from forest lands a fugitive crop, after burning the trees, grass, and underwood. The ground is turned up with the mattock, and the seed planted by dibbling between the stumps of trees. The period of sowing is the commencement of the rains, and of reaping that of the dry season. The rice is of course of that description which does not require immersion.

The second description of tillage consists also in growing mountain or dry land rice. This mode is usually adopted on the common upland arable lands, which cannot conveniently be irrigated. The grain is sown in the middle of the dry season, either broadcast or by dibbling, and reaped in seven or five months, as the grain happens to be the larger or the smaller variety.

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The culture of rice by the aid of the periodical rains forms the third mode. The grain being that kind which requires submersion, the process of sowing and reaping is determined with precision by the seasons. With the first fall of the rains the lands are ploughed and harrowed. The seed is sown in beds, usually by strewing very thickly the corn in the ear. From these beds the plants, when 12 or 14 days old, are removed into the fields and thinly set by the hand. They are then kept constantly immersed in water until within a fortnight of the harvest, when it is drawn off to facilitate the ripening of the grain.

The fourth mode of cultivating rice is by forcing a crop by artificial irrigation, at any time of the year; thus, in one field, in various plots, the operations of sowing, ploughing, transplanting, and reaping may be seen at the same period.

The fertile, populous, and industrious countries of the Eastern Archipelago export rice to their neighbours. The most remarkable of these are Java, Bali, some parts of Celebes, with the most fertile spots of Sumatra, and of the Malay Peninsula. Rice is generally imported to these western countries from those farther east, such as the Spice Islands. Java is the principal place of production for the consumption of the other islands, and the only island of the Archipelago that sends rice *abroad*. The rice of the eastern districts is generally superior to that of the western. The worst rice is that of Indramayu, which is usually discolored. The subdivision of the province of Cheribon, called Gabang, yields rice of fine white grain, equal to that of Carolina. The rice of Gressie preserves best. All Indian rice is classed, in commercial language, into the three descriptions of table rice, white rice, and cargo rice. From the limited demand for the first, it is only to be had in Java, in small quantity. For the same reason the second is not procurable in large quantity, unless bespoken some time before-hand; but the third may be had at the shortest notice in any quantity required. Java rice is inferior in estimation to that of Bengal or Carolina in the markets of Europe.

The following statistics show the extent and progress of the culture in Java:—

	In 1840.	In 1841.
No. of Residencies in which rice is cultivated	18	18
" Regencies	69	68
" Districts	414	414
" Desas or villages	39,931	36,296

Amount of the population who take a part in it,
without distinction of caste 6,704,797 6,857,372

Number of families, &c. 1,466,845 1,475,675

" " families who devote themselves to the cultivation 1,150,406 1,146,083

Number of men bound to obligatory service 1,321,767 1,325,746

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Cleared grounds in *bahus*, of 71 decametres 1,470,047 1,540,054

Upon this extent the population had cultivated for
the government, in *bahus* of 71 decametres 78,182 74,277

Extent of fields which the population had cultivated 1,286,139 1,381,216
on their own account, in *bahus*, &c.

Extent of land in fallow in *bahus*, &c. 105,726 84,561

Produce in piculs of fields cultivated by the
population on its own account 21,273,278 23,810,573

Average produce of a *bahu* 161/2 17

Gross amount of the land tax of 1840 8,502,402 fl 9,030,761 fl.

Extent of rice fields newly cultivated in
bahus 10,328 13,561

This comparative summary shows that the culture of rice increases yearly, and that the average produce of the fields is also continually increasing. These results have been obtained by the attention paid to the proper irrigation of the soil fit for this culture; and to the hydraulic works which the Government executes on its own account in the parts of the island where rice fields can be established, and where they are required to feed a population whose number is still increasing yearly.

I have seen, continues Mr. Crawfurd, lands which have produced, from time beyond the memory of any living person, two yearly crops of rice. When this practice is pursued, it is always the five-months grain which is grown. The rapid growth of this variety, has, indeed, enabled the Javanese husbandman, in a few happy situations, to urge the culture to the amount of six crops in two years and a half. Rice cultivated in a virgin soil, where the wood has been burnt off, will, under favorable circumstances, give a return of twenty-five and thirty fold. Of mountain rice, cultivated in ordinary upland arable lands, fifteen fold may be looked upon as a good return. In fertile soils, when one crop only is taken in the year, marsh rice will yield a return of twenty-five seeds. When a double crop is taken, not more than fifteen or sixteen can be expected. In the fine province of Kadu, an English acre of good land, yielding annually one green crop and a crop of rice, was found to produce of the latter 641 lbs. of clean grain. In the light sandy, but well watered lands of the province of Mataram, where it is the common practice to exact two crops of rice yearly without any fallow, an acre was found to yield no more than 285 lbs. of clean rice, or an annual produce of 570 lbs. —("History of the Indian Archipelago.")

The low estimation of Java rice is not attributable to any real inferiority in the grain, but to the mode of preparing it for the market. In husking it, it is, for the want of proper machinery, much broken, and, from carelessness in drying, subject to decay from the attack of insects and worms. When in the progress of improvement more intelligent methods are pursued in preparing the grain for the market, it will equal the grain of any other country. Machinery must be employed for husking the grain, and some degree of kiln drying will be necessary to ensure its preservation in a long voyage.

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I know nowhere that rice is so cheap as in Java, except in Siam, whence it is exported at one-third less cost. A great deal of rice is exported from Siam to China by the junks, and also occasionally a little from Java.

The quantity exported from Java in 1830 was 13,521 coyans.

" " 1835 " 25,577 "

" " 1839 " 1,103,378 piculs

" " 1841 " 676,213 "

" " 1843 " 1,108,774 "

Rice is grown to some extent in the Dutch portion of Celebes; it yields at a minimum one hundred and fifty fold. The average annual delivery of rice to the Government, from 1838 to 1842, was 3,390,119 lbs. At present the Government pays sixty cents for a measure of forty pounds. That which is sold for the consumption of the inhabitants may be procured at the public warehouse for a guilder the 351/2 lbs.; and that which is sold for export may be had at public auction for 125 florins the coyan of 3,000 lbs.

The following description of some varieties of rice cultivated in the Philippine islands, is given by Mr. Rich, botanist to the United States Exploring Expedition. The varieties are very numerous; the natives distinguish them by the size and shape of their grain:—

> *Binambang*.—Leaves slightly hairy; glumes whitish; grows to the height of about five feet; flowers in December: aquatic.
>
> *Lamuyo* greatly resembles the above; is more extensively cultivated, particularly in Batangas, where it forms the principal article of food of the inhabitants of the coast: aquatic.

Malagcquit.—This variety derives its name from its being very glutinous after bailing; it is much used by the natives in making sweet or fancy dishes; and also used in making a whitewash, mixed with lime, which is remarkable for its brilliancy, and for withstanding rain, &c.: aquatic.

> *Bontot Cabayo*.—Common in Ilocos, where it is cultivated both upland and lowland; it produces a large grain, and is therefore much esteemed, but has rather a rough taste.

Dumali, or early rice.—This rice is raised in the uplands exclusively, and derives its name from ripening its grain three months from planting; the seed is rather broader and shorter than the other varieties; it is not extensively cultivated, as birds and insects are very destructive to it.*Quinanda*, with smooth leaves.—This variety is held in great estimation by the people of Batangas, as they say it swells more in boiling than any other variety; it is sown in May, and gathered in October: upland.*Bolohan*.—This variety has very hairy glumes; it is not held in much esteem by the natives, but it is cultivated on account

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of its not being so liable to the attacks of insects and diseases as most of the other upland varieties.*Malagcquit*.—With smooth leaves, and red glumes (all the preceding are whitish); possesses all the qualities of the aquatic variety of the same name—that of being very glutinous after boiling. This rice is said to be a remedy for worms in horses, soaked in water, with the hulls on; it is given with honey and water.

> *Tangi*.—Leaves slightly hairy, glumes light violet color. This upland variety is held in much esteem for its fine flavor.

435,067 arrobas of rice were exported from Manilla in 1847.

A simple but rude mill is in use in Siam, and many parts of India, for hulling paddy, which is similar to those used 4,000 years ago. It consists of two circular stones, two feet in diameter, resting one on the other; a bamboo basket is wrought around the upper one, so as to form the hopper. A peg is firmly set into the face of the upper stone, half way between its periphery and centre, having tied to it by one end a stick three feet long, extended horizontally, and attached by the other to another stick pending from the roof of the shed under which the mill is placed. This forms a crank, by which the upper stone is made to revolve on the other set firmly on the ground. The motion throws the rice through the centre of the stone, and causes it to escape between the edges of the two.

More starch is contained in this grain than in wheat. Braconnet obtained from Carolina rice 85.07, and from Piedmont rice 83.8 per cent. of starch. Vogel procured from a dried rice no less than 98 per cent. of starch. There are several patent processes in existence for the manufacture of rice-starch, which are accomplished chiefly by digesting rice in solutions, more or less strong, of caustic alkali (soda), by which the gluten is dissolved and removed, leaving an insoluble matter composed of starch, and a white substance technically called fibre. Under Jones's patent, the alkaline solution employed contains 200 grains of real soda in every gallon of liquor, and 150 gallons of this liquor are requisite to convert 100 lbs. of rice into starch. In manufacturing rice-starch on a large scale, Patna rice yields 80 per cent, of marketable starch, and 8.2 per cent. of fibre, the remaining 11.8 per cent. being made up of gluten, gruff, or bran, and a small quantity of light starch carried off in suspension by the solution.

Jones's process may be thus described:—100 lbs. of rice are macerated for 24 hours in 50 gallons of the alkaline solution, and afterwards washed with cold water, drained, and ground. To 100 gallons of the alkaline solution are then to be added 100 lbs. of ground rice, and the mixture stirred repeatedly during 24 hours, and then allowed to stand for about 70 hours to settle or deposit. The alkaline solution is to be drawn off, and to the deposit cold water is

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to be added, for the double purpose of washing out the alkali and for drawing off the starch from the other matters. The mixture is to be well stirred up and then allowed to rest about an hour for the fibre to fall down. The liquor holding the starch in suspension is to be drawn off and allowed to stand for about 70 hours for the starch to deposit. The waste liquor is now to be removed, and the starch stirred up, blued (if thought necessary), drained, dried, and finished in the usual way.[44] Rice is imported into this country in bags of 11/2 cwt., and tierces of 6 cwt., not only for edible purposes, but, when ground into flour, for cotton manufactures, in aiding to form the weaver's dressings for warps. Rice-meal is commonly used for feeding pigs.

Imported.			
British Plantation.	Foreign.	Retained for home consumption of all kinds.	
Bags.	Bags.	Bags.	
1843	136,319	35,125	60,965
1844	127,876	69,112	126,733
1845	173,794	5,713	114,933
Tons.	Tons.	Tons.	
1847	38,736	3,033	28,375
1848	21,226	4,631	15,468
1849	19,397	1,410	14,961

	Total imported.	Re-exported.
1849	976,196 cwts.	290,732 cwts.
" in the husk	31,828 qrs.	
1850	785,451 cwts.	248,136 "
" in the husk	37,150 qrs.	
1851	714,847 cwts.	345,677 "
" in the husk	31,481 qrs.	
1852	989,316 cwts.	414,507 "
" in the husk	23,946 qrs.	

The quantity of rice retained for home consumption, by the corrected returns, in 1850, was 401,018 cwts. and 35,119 quarters; in 1851, 399,170 cwts. and 31,481 quarters; in 1852, 574,809 cwts. and 23,946 quarters. The aggregate imports range from 40,000 to 80,000 tons annually, of which about 500 to 800 tons are in the husk.

Among culmiferous plants and legumes used in the East, are the *Panicum italicum*, *P. miliaceum*, *Eleusine coracana* (the meal of which is baked and eaten in Ceylon under the name of Corakan flour), and *Paspalum* of several varieties. The pigeon pea

(*Cytisus Cajan*), and a very valuable and prolific species of bean, called the Mauritius black bean (*Mucuna utilis*), growing even in the poorest soil, is cultivated in India and Ceylon. *Sorghum vulgare* is the principal grain of Southern Arabia, and the stems are also used extensively for feeding cattle. The plant bears its Indian name of joar, or juri, and is cultivated throughout Western Hindostan. Job's tears (*Croix lachryma*) is another cereal grass, native of the East Indies.

MILLET.

Millet of different kinds is met with in the hottest parts of Africa, in the South of Europe, in Asia Minor, and in the East Indies. It is a small yellowish seed, growing in dense panicles or clusters, the produce of a grassy plant with large and compact seeds, growing to the height, in India, of seven or eight feet.

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The millets, known to Europeans as *petit mais*, are tropical or sub-tropical crops. In India they hold a second rank to rice alone; and in Egypt, perhaps, surpass all other crops in importance. In Western Africa they are the staff of life. The red and white millets shown by Austria, Russia, and the United States, at the Great Exhibition, were beautiful, and Ceylon exhibited fair samples. Turkey abounds in small grains.

Panicum miliaceum and *P. frumentaceum* are the species grown in the East Indies. Loudon says there are three distinct species of millet; the Polish, the common or German, and the Indian. *Setaria Germanica* yields German millet. The plants are readily increased by division of the roots or by seed, and will grow in any common soil. The native West Indian species are *P. fascisculatwm* and *oryzoides*. Millet receives some attention in New South Wales. In 1844 there were 100 acres of land under cultivation with it, and the amount grown in some years in this colony has been about 3,500 bushels.

In the United States millet is chiefly grown for making hay, being found a good substitute for clover and the ordinary grasses. It is a plant which will flourish well on rather thin soils, and it grows so fast that when it is up and well set it is seldom much affected by drought. It is commonly sown there in June, but the time of sowing will vary with the latitude. Half a bushel of seed to the acre is the usual quantity, sown broadcast and harrowed in. For the finest quantity of hay, it is thought advisable to sow an additional quantity of three or four quarts of seed. The ordinary yield of crops may be put at from a ton to a ton and a half of hay to the acre. It should be cut as soon as it is out of blossom; if it stands later, the stems are liable to become too hard to make good hay. The variety known as German millet is that most common in North America. It grows ordinarily to the height of about three feet, with compact heads from six to nine inches in length, bearing yellow seed. There are some sub-varieties of this, as the white and purple-seeded.

The Italian millet, *Setaria italica*, is larger than the preceding, reaching the height of four feet in tolerable soil, and its leaves are correspondingly larger and thicker. The heads are sometimes a foot or more in length, and are less compact than the German, being composed of several spikes slightly branching from the main stem. It is said to derive its specific name from being cultivated in Italy, though its native habitat is India. It is claimed by some that this variety will yield more seed than any other, and the seed is rather larger, but the stalk is coarser, and would probably be less relished by stock.

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If the greatest amount of seed is desired from the crop, it is best to sow it in drills, two to two-and-a-half feet apart, using a seed drill for the purpose. This admits of the use of a small harrow or cultivator between the rows, while the plants are small, which keeps out the weeds. The crop will ripen more uniformly in this way than broadcast, and enables the cultivator to cut it when there will be the least waste. The seed shatters out very easily when it is ripe, and when the crop ripens unequally it cannot be cut without loss, because either a portion of it will be immature, or, if left till it is all ripe, the seed of the earliest falls out. It should be closely watched, and cut in just about the same stage that it is proper to cut wheat, while the grain may be crushed between the fingers. It may be cut with a grain cradle, and, when dry, bound and shocked like grain; but it should be threshed out as soon as practicable, on account of its being usually much attacked by birds, many kinds of which are very fond of the seed. In particular localities they assail the crop in such numbers, from the time it is out of the “milk,” till it is harvested and carried off the field, that it is no object to attempt to ripen it. This crop is sometimes sown in drills, when it is only intended for fodder, being cut and cured in bundles, as the stalks of Indian corn are. It is best to pass it through a cutting machine before feeding it to stock; indeed, all millet hay will be fed with less loss in this way, than if fed to animals without cutting.

The seed is used in various European countries as a substitute for sago, for which it is considered excellent. It is likewise a valuable food for poultry, particularly for young chickens, which from the smallness of the grain can eat it readily, and it appears to be wholesome for them.

In some countries millet seed is ground into flour and converted into bread; but this is brown and heavy. It is, however, useful in other respects, as a substitute for rice. A good vinegar has been made from it by fermentation, and, on distillation, it yields a strong spirit. Millet seed—the produce of *H. saccharatum*—is imported into this country from the East Indies for the purpose chiefly of puddings; by many persons it is preferred to rice. It is cultivated largely in China and Cochin-China. The stalks, if subjected to the same process that is adopted with the sugar-cane, yield a sweet juice, from which an excellent kind of sugar may be made.

Millet will grow best on light, dry soils. The ground being first well prepared, half a bushel of seed to the acre is ploughed in at the commencement of the rains, in India. The crop ripens within three months from the time of sowing. The usual produce is about 16 bushels to the acre. The Canary Islands export annually about 212,400 bushels of millet.

Great Indian Millet, or Guinea Corn.—This is a native of India (the *Sorghum vulgare*, the *Andropogon Sorghum* of Roxburgh), which produces a grain a little larger than mustard or millet seed. It is grown in most tropical countries, and has peculiar local names. In the West Indies, where it is chiefly raised for feeding poultry, it is called Guinea corn. In

Egypt it is known as Dhurra, in Hindostan and Bengal as Joar, and in some districts as Cush.

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In Lower Scinde joar is very extensively cultivated, as well as bajree (*H. spicatus*). It is harvested in December and January; requires a light soil, and is usually grown in the east, after *Cynosurus corocanus*.

Guinea corn is extensively cultivated in some parts of Jamaica. I did not, however, find it thrive on the north side of the island. It is best planted in the West Indies between September and November, and ripens in January. It ratoons or yields a second crop, when cut. The returns are from 30 to 60 bushels an acre, but the crops are uncertain.

Mr. C. Bravo tried Guinea corn at St. Ann's, Jamaica, as a green crop, sown broadcast, for fodder, and it answered admirably, the produce being very considerable. It was weighed, and yielded 14 tons of fodder per acre, and was found very palatable and nutritious for cattle. It was grown on a very poor soil, which had, previously to ploughing, given nothing but marigolds and weeds. The luxuriant growth of the corn completely kept under the weeds. A great number of the stalks were measured, and they averaged 10 feet from the root to the top of the upper leaf. It had been planted 10 weeks, and had, therefore, grown a foot a month. Mr. Bravo is of opinion, that sown broadcast it would answer either as a grain crop, as fodder, or ploughed in to increase the fertility of the soil.

Dr. Phillips, of Barbados, being of opinion that it might be advantageously employed as human food, requested Dr. Shier, the analytical chemist, of Demerara, to determine in his laboratory its richness in protein compounds (the muscle-forming part of vegetable food) in comparison with Indian corn. He, therefore, caused a sample of each to be burned for nitrogen, when the following results were obtained:—

	Indian corn.	Guinea corn.
Water, per cent.	12.81	13.76
In ordinary state—		
Nitrogen, per cent.	1.83	1.18
Protein compounds	11.51	7.42
In dry state—		
Nitrogen, per cent.	2.10	1.36
Protein compounds	13.20	8.60

According to these results, the Guinea corn is less rich in nitrogen or protein compounds than Indian corn, though not much less so than some varieties of English wheat.

Indian corn meal, analysed by Mr. Hereford, from two localities, gave in the ordinary state of dryness 11.53 and 12.48 per cent. of protein compounds—results which come very near to that obtained by Dr. Shier.

Sorghum avenaceum, or *Holcus avenaceus*, is a native of the Cape.

Several species and varieties of sorghum have been introduced, and more or less cultivated in the United States. It is often popularly termed Egyptian corn. It is closely allied to broom corn (*S. saccharatum*), the head being similar in structure, and the seed similar, except that in most varieties of sorghum, the outer covering does not adhere as in broom corn. The plant bears a strong resemblance, while growing, to maize or Indian corn. There is also some similarity in the grain, and it is extensively used as food by many oriental nations.

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A variety, under the name of African purple millet, was some years since introduced into North America, and recommended for cultivation as a soiling crop; but this, as well as other varieties, do not possess any advantages over Indian corn.

The natives of Mysore reckon three kinds, known as white, green, and red. The red ripens a month earlier than the rest, or about four months from the time of sowing. Near Bengal, Bombay, and elsewhere, in Eastern India, sowing is performed at the close of May or early in June. A gallon and a third of seed is sown per acre, and the produce averages 16 bushels. This grain, though small, and the size of its head diminutive, compensates for this deficiency by the great hulk and goodness of its straw, which grows usually to the height of 8 or 10 feet. It is sometimes sown for fodder in the beginning of April, and is ready to cut in July. It is said to be injurious to cattle, if eaten as green provender, the straw is therefore first dried, and is then preferable to that of rice.

This grain is frequently fermented to form the basis, in combination with goor or half made sugar, of the common arrack of the natives, and in the hills is fermented into a kind of beer or sweet wort, drank warm.

Holcus spicatus, the *Panicum spicatum* of Roxburgh, is cultivated in Mysore, Behar, and the provinces more to the north. From one to four seers are sown on a biggah of land, and the yield is about four maunds per acre. It is sown after the heavy rains commence, and the plough serves to cover the seed. The crop is ripe in three months, and the ears only are taken off at first. Afterwards the straw is cut down close to the surface of the soil, to be used for thatching, for it is not much in request as fodder. Being a grain of small price, it is a common food of the poorer class of natives, and really yields a sweet palatable flour. It is also excellent as a fattening grain for poultry.

The *Poa Abyssinica*is one of the bread-corns of Abyssinia. The bread made from it is called *teff*, and is the ordinary food of the country, that made from wheat being only used by the higher classes. The way of manufacturing it is by allowing the dough to become sour, when, generating carbonic acid gas, it serves instead of yeast. It is then baked in circular cakes, which are white, spongy, and of a hot acid taste, but easy of digestion. This bread, carefully toasted, and left in water for three or four days, furnishes the *bousa*, or common beer of the country, similar to the *quas* of Russia.

BROOM CORN.

The production of broom corn is rapidly extending, and corn brooms are driving broom sedge, as an article for sweeping floors, out of every humble dwelling in the United States. There are about 1,000 acres of it under culture in one county (Montgomery) alone, and it brings 30 dollars per acre in the field.

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Messrs. Van Eppes, of Schenectady, have been engaged in the broom manufactory business about eleven years. They have a farm of about 300 acres, 200 of which are Mohawk flats. A large portion of the flats was formerly of little value, in consequence of being kept wet by a shallow stream which ran through, it, and which, together with several springs that issue from the sandy bluff on the south side of the flats, kept the ground marshy, and unfit for cultivation. By deepening the channel of the stream, and conducting most of the springs into it, many acres, which were formerly almost worthless, have been made worth 125 dollars per acre. They have also, by deepening the channel, saving the water of the springs, and securing all the fall, made a water privilege, on which they have erected an excellent mill, with several run of stones, leaving besides sufficient power to carry saws for cutting out the handles of brooms, &c.

They have about 200 acres of the flats in broom-corn. The cultivation of this article has within a few years been simplified to almost as great a degree as its manufacture. The seed is sown with a seed-barrow or drill, as early in the spring as the state of the ground will admit, in rows 31/2 feet apart. As soon as the corn is above ground, it is hoed, and soon after thinned, so as to leave the stalks two or three inches apart. It is only hoed in the row, in order to get out the weeds that are close to the plants, the remaining space being left for the harrow and cultivator, which are run so frequently as to keep down the weeds. The cultivation is finished by running a small, double mould-board plough, rather shallow, between the rows.

The broom corn is not left to ripen, as formerly, but is cut when it is quite green, and the seed not much past the milk. It was formerly the practice to lop down the tops of the corn, and let it hang some time, that the brush might become straightened in one direction. Now, the tops are not lopped till the brush is ready to cut, which, as before stated, is while the corn is green. A set of hands goes forward, and lops or bends the tops to one side, and another set follows immediately and cuts off the tops at the place at which they are bent, and a third set gathers the cut tops into carts or waggons, which take them to the factory. Here they are first sorted over, and parcelled out into small bunches, each bunch being made up into brush of equal length. The seed is then taken off by an apparatus with teeth, like a hatchet. The machine is worked by six horses, and cleans the brush very rapidly. It is then spread thin to dry, on racks put up in buildings designed for the purpose. In about a week, with ordinary weather, it becomes so dry that it will bear to be packed closely.

The stalks of the corn, after the tops have been cut off, are five or six feet high, and they are left on the ground, and ploughed in the next spring. It is found that this keeps up the fertility of the soil, so that the crop is continued for several years without apparent diminution. It should be observed, however, that the ground is overflowed every winter or spring, and a considerable deposit left on the surface, which is undoubtedly equivalent to a dressing of manure.

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This may be inferred from the fact that some of the flats have been in Indian corn every year for forty or fifty years, without manure, and with good cultivation have seldom produced less than sixty bushels per acre, and with extra cultivation from eighty to ninety bushels have been obtained.

In case of need, the stalks would furnish a large amount of good food for cattle. They are full of leaves which are nutritive, and whether cut and dried for winter, or eaten green by stock turned on the ground where they grow, would be very valuable in case of deficiency of grass.

Messrs. Van Eppes employ twenty hands during the summer; and in autumn, when the brush is being gathered and prepared, they have nearly a hundred, male and female. They are mostly Germans, who come to Schenectady with their families during the broom corn harvest, and leave when it is over.

The manufacture of brooms is carried on mostly in the winter season. The quantity usually turned out by Messrs. Van Eppes is 150,000 dozen per annum.—("Albany Cultivator.”)

CHENOPODIUM QUINOA.

About twenty-eight years ago this plant was introduced into Britain from Peru, where the seeds are used as food, under the name of petty rice. Attention was drawn to it by Loudon, in his “Gardener’s Magazine,” in 1834, and in 1836 it was cultivated on a large scale by Sir Charles Lemon. This plant and the lentil are two of the most promising exotics that have been recommended for field culture. There are two varieties of quinoa, the white and the red seeded; the red has bitter properties, and is only used for medicine. In North America the seeds of the former are used as a substitute for maize and the potato. A white meal is obtained from it, having a tinge of yellow. It contains scarcely any gluten, but, like oatmeal, makes very good porridge and cakes. Its nutritive qualities are proved by the analysis of Dr. Voelcker ("Journal of Agriculture of Scotland,” October, 1850), which states it to yield 3.66 per cent. of nitrogen, equal to 2.87 per cent. of protein compounds. In this respect the meal appears to be superior to rye, barley, rice, maize, the plantain, and potato. It has long furnished the food of millions in South America; and in Scotland and Ireland the plant would find a congenial climate and rich soil.

FUNDI OR FUNDUNGI.

This is an hitherto undescribed species of African grain (probably the *Paspalum exile*), much cultivated and esteemed in Sierra Leone, and other places on the African coast, where it is known by the Foulahs, Joloffs, and other native tribes, under the local name of Hungry rice. It is a slender grass with digitate spikes, which have much of the habit of *Digitaria*, but which, on account of the absence of the small outer glume existing in that genus, Mr. Keppist, Librarian of the Linnean Society, of London, refers to *Paspalum*. It produces a semi-transparent cordiform grain, about the size of a mignionette seed; the ear consists of two conjugate spikes, the grain being arranged on the outer edge of either spike, and alternated; they are attached by a peduncle to the husk. The epicarp, or outer membrane, is slightly rugous.

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The ground is cleared for its reception by burning down the copse wood and hoeing between the roots and stumps. It is sown in the months of May and June, the ground being slightly opened, and again lightly drawn together over the seeds with a hoe. In August, when it shoots up, it is carefully weeded. It ripens in September, growing to the height of about 18 inches, and its stems, which are very slender, are bent to the earth by the mere weight of the grain. The patch of land is then either suffered to lie fallow, or is planted with yams or cassava in rotation. Experienced cultivators of this Lilliputian grain assert that manure is unnecessary, as it delights in light soils, and it is even raised on rocky situations, which are most frequent about Kissy. When cut down, it is tied up in small sheafs and placed in a dry situation within the hut; for if allowed to remain on the ground and to become wet, the grains are agglutinated to their coverings. The grain is trodden out with the feet, and is then parched or dried in the sun, to allow the more easy removal of the chaff in the process of pounding, which is performed in wooden mortars. It is afterwards winnowed with a kind of cane fanner or mats.

This grain could be raised in sufficient quantities to become an article of commerce, and I have no doubt would prove a valuable addition to the list of light farinaceous articles of food in use among the delicate or convalescent. In preparing this delicious grain for food, it is first put into boiling water, in which it is assiduously stirred for a few minutes; the water is then poured off, and the Foulahs, Joloffs, &c., add to it palm oil, butter, or milk; but Europeans and negroes connected with Sierra Leone prepare it as follows:—-To the grain cooked as above mentioned, fowl, fish, or mutton, with a piece of salt pork for the sake of flavor is added, the whole being then stewed in a close saucepan. This makes a very good dish, and thus prepared resembles “*Kous-kous*.” The grain is sometimes made into puddings, with the usual condiments, and eaten either hot or cold, with milk. By the few natives of Scotland in the colony, it is occasionally dressed as milk porridge.

The negroes also eat it in the same way as they do rice, with palaver sauce. Fundi ought to be well washed in cold water, and afterwards rewashed in boiling water. If properly prepared it will be white, and perfectly free from gritty matter.

Canary-seed, obtained from *Phalaris canariensis*, is grown rather largely in Kent, the Isle of Thanet, and other parts of the south of England, as much as 500 tons being annually consumed here for feeding singing birds. The produce is three to five quarters the acre, and it is sold at about L25 the ton. We receive foreign supplies of the seed from Germany and the Mediterranean, and the duty on imports is 2s. 6d. per bushel.

PULSE.

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There are a variety of pulses and leguminous seeds extensively cultivated as food for both man and cattle, and which form an important article in the husbandry of tropical countries. The importance of peas and beans is well appreciated, both by the horticulturists and agriculturists in Europe and our temperate colonies, where, however, they are comparatively of less importance than the smaller pulses and grains are in various tropical countries, such as haricots in the Brazils and West Indies; ground or earth nuts in South America, and especially in Western Africa; beans of different kinds amongst the miners of Peru; gram (*Ervum lens*), and dholl (*Cajanus*), with innumerable varieties of beans and small lentils among the natives of India and Egypt; and the Carob bean, or St. John’s bread (*Ceratonia siliqua*), in the Mediterranean countries.—("Jury Reports.”)

Of leguminous grains there are various species cultivated and used by the Asiatics, as the *Phaseolus Mungo*, *P. Max* and *P. radiatus*, which contain much alimentary matter; the earth-nut (*Arachis hypogaea*), which buries its pods under ground after flowering.

The gram (*Cicer arictinum*) which is mentioned by Dr. Christie ("Madras Journal of Science,” No. 13) as exuding oxalic acid from all parts of the plant. It is used by the ryots in their curries instead of vinegar. It is the chick pea of England, and *chenna* of Hindostan.

Among the most commonly cultivated leguminous plants are the lentil (*Ervum lens*), horse gram (*Dolichos biflorus*, Linn), various species of *Cytisus* and *Cajanus*, &c. Many of these are grown in India as fodder plants; others for their seeds, known as gram, dholl, &c. The *Cajanus flavus*, of Decandolle (*Cytisus Cajan*), is very generally cultivated along the Western coast of Africa, and continues to bear for three years. Several species of dolichos are used as food in various countries, as *D. ensiformus* in Jamaica, *D. tuberosus* in Martinique, *D. bulbosus* and *D. lignosus* in the East Indies.

The vessels of the North bring to Shanghae a great quantity of a dry paste, known under the name of tanping, the residuum or husk of a leguminous plant called Teuss, from which the Chinese extract oil, and which is used, after being pressed, as manure for the ground. Captain H. Biggs, in a communication to the Agri.-Hort. Soc. of India, in 1845, states that of the esculents a large white pea forms the staple of the trade of Shanghae, or nearly so, to the astonishing amount of two and a-half millions sterling. This he gives on the authority of the Rev. Mr. Medhurst, of Shanghae, and Mr. Thorns, British Consul at Ningpo. These peas are ground in a mill and then pressed, in a somewhat complicated, though, as usual in China, a most efficient press, by means of wedges driven under the outer parts of the framework with mallets. The oil is used both for eating and burning, more for the latter purpose, however, and the cake, like large Gloucester cheese, or small grindstones in circular shape, is distributed about China in every direction, both as food for pigs and buffaloes, as also for manure.

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We import on the average about 20,000 quarters of beans, peas, &c., from Ireland, 450,000 quarters of beans and 200,000 quarters of peas from foreign countries.

The land under cultivation with pulse, and the crops raised, have been estimated as follows:—

	Acres.	Quarters.
England	500,000	1,875,000
Ireland	130,000	540,000
Scotland	50,000	150,000
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	680,000	2,565,000

This is of course exclusive of garden cultivation. The average produce of beans per acre in England is 33/4 quarters, 31/2 in Ireland, and three in Scotland.

The price of beans per quarter in the last ten years has ranged from 39s. to 27s. the quarter; peas from 40s. 6d. to 27s. 6d.

Algaroba beans.—The seed pods or bean of the carob-tree (*Ceratonia siliqua*, or *Prosopis pallida*?) a tree common in the Levant and South of Europe, are used as food. The pods contain a large proportion of sweet fecula, and are frequently used by singers, being considered to improve the voice. The name of St. John’s Head has been applied to them, from the supposition that they were the wild honey spoken of in Scripture as the food of John the Baptist. About 40,000 quintals of these carobs are annually exported from Crete. During the Peninsular war, the horses of our cavalry were principally fed upon these algaroba seeds. The pods of the West India locust tree, *Hymenaea courbaril*, also supply a nutritious matter.

That well known sauce, Soy, is made in some parts of the East, from a species of the Dolichos bean (*Soja hispida*), which grows in China and Japan. In Java it is procured from the *Phaseolus radiatus*. The beans are boiled soft, with wheat or barley of equal quantities, and left for three months to ferment; salt and water are then added, when the liquor is pressed and strained. Good soy is agreeable when a few years old; the Japan soy is superior to the Chinese. Large quantities are shipped for England and America. The Dolichos bean is much cultivated in Japan, where various culinary articles are prepared from it; but the principal are a sort of butter, termed *mico*, and a pickle called *sooja*.

1,108 piculs of soy were shipped from Canton in 1844, for London, British India, and Singapore. 100 jars, or about 50 gallons of soy, were received at Liverpool in 1850. The price is about 6s. per gallon in the London market.

THE SAGO PALMS, BREAD-FRUIT, &c.

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Sago, and starchy matter allied to it, is obtained from many palms. It is contained in the cellular tissue of the stem, and is separated by bruising and elutriation. From the soft stem of *Cycas circinalis*, a kind of sago is produced in the East and West Indies. The finest is, however, procured from the stems of *Sagus laevis* (*S. inermis*, of Roxburgh), a native of Borneo and Sumatra; and *Arenga saccharifera*, or *Gomutus saccharifus*, of Rumphius. The *Saguerus Rumphii*, or *Metroxylon Sagus*, which is found in the Eastern Islands of the Indian Ocean, yields a feculent matter. After the starchy substance is washed out of the stems of these palms, it is then granulated so as to form sago. The last-mentioned palm also furnishes a large supply of sugar. Sago as well as sugar, and a kind of palm wine, are procured from *Caryota urens*.

In China sago is obtained from *Rhapis flabelliformis*, a dwarfish palm; and some sago is made from it for native use in Travancore, Mysore, and Wynaad, and the jungles in the East Indies.

The trunk of the sago palm is five or six feet round, and it grows to the height of about 20 feet. It can only be propagated by seed. It flourishes best in bogs and swampy marshes; a good plantation being often a bog, knee deep. The pith producing the sago is seldom of use till the tree is fourteen or fifteen years old; and the tree does not live longer than thirty years. Mr. Crawfurd says there are four varieties of this palm; the cultivated, the wild, one distinguished by long spines on the branches, and a fourth destitute of these spines, and called by the natives female sago. This and the cultivated species afford the best farina; the spiny variety, which has a slender trunk, and the wild tree, yield but an inferior quality of sago. The farinaceous matter afforded by each plant is very considerable, 500 lbs. being a frequent quantity, while 300 lbs. may be taken as the common average produce of each tree.

Supposing the plants set at a distance of ten feet apart, an acre would contain 435 trees, which, on coming to maturity in fifteen years, would yield at the before-mentioned rate 120,500 lbs. annually of farinaceous matter. The sago meal, in its raw state, will keep good about a month. The Malays and natives of the Eastern Islands, with whom it forms the chief article of sustenance, partially bake it in earthenware moulds into small hard cakes, which will keep for a considerable time. In Java the word “saga” signifies bread. The sago palm (*Metroxylon Sagus*) is one of the smallest of its tribe, seldom reaching to more than 30 feet in height, and grows only in a region extending west to Celebes and Borneo, north to Mindanao, south to Timor, and east to Papua. Ceram is its chief seat, and there large forests of it are found. The edible farina is the central pith, which varies considerably in different trees, and as to the time required for its attaining proper maturity. It is eaten by the natives in the form of pottage. A farina of an inferior kind is supplied by the Gomuti palm (*Borassus gomutus*), another tree peculiar to the Eastern Archipelago growing in the valleys of hilly tracts.

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At so great a distance it is difficult to decide as to which of these trees really produce the ordinary sagos of commerce, for there are several kinds. Planche, in an excellent memoir on the sagos, has described six species, which he distinguishes by the names of the places from which they come. Preferring to classify them according to their characters, M. Mayet distinguishes only three species.

The first he denominates Ancient sago, which comes from different parts, and varies much in color. It comprehends—1st, Maldivian sago of Planche, in spherical globules, of two or three millimetres in diameter, translucid, of an unequal pinkish white color, very hard and insipid. 2nd, New Guinea sago, of Planche, in rather smaller globules, of a bright red color on one side, and white on the other. 3rd. Grey sago of the Moluccas or brown sago of the English; of unequal globules, from one to three millimetres in diameter, opaque, of a dull grey color on one side, and whitish on the other. This grey color probably arises from long keeping and humidity. 4th. Large grey sago of the Moluccas, exactly resembling No. 3, only that the globules are from four to eight millimetres in diameter. 5th. Fine white sago of the Moluccas; entirely resembling No. 3, only that it is purely white, owing to the complete edulcoration of the fecula of which it is made.

Whatever may be the places of origin of these sagos, they all possess the following characters—

Rounded globules, generally spherical, all isolated, very hard, elastic, and difficult to break or powder. The globules put into water, generally swell to twice their original size, but do not adhere together.

Second sage.—This species corresponds with the pinkish sago of the Moluccas of Planche. It is in very small globules, less regular than those of the “first sago,” and sometimes stuck together to the number of two or three. Soaked in water, it swells to double its volume.

Third Species.—*Tapioca sago*.——This name has been applied to a species of sago now abundant in commerce, because it bears the same relation to the ancient or first sago, and even to the preceding sago, that tapioca bears to “Moussache,” which is the fecula of the manioc, *Janipha manihot (Manihot utilissima*).

Whilst the two preceding species of sago, whatever may have been stated to the contrary, have been neither baked nor submitted to any heating process, as is proved by the perfect state of nearly all their grains of fecula, this species has been subjected to the action of heat while in a state of a moist paste. This sago is not in spherical globules, like the two preceding species, or at least there are but few of the globules of that form; it is rather in the form of very small irregular tubercular masses, formed by the adherence of different numbers of the primary globules. The facility with which this sago swells and is divided by water, has occasioned it to be preferred as an article of food to the ancient sago. It has been described by Planche under the name of the white sago of the Moluccas, and by Dr. Pereira under the name of pearl sago.

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Bennet, in his work on “Ceylon and its Capabilities,” (1843), states that sago is procured from the granulated pith of the talipot palm, *Corypha umbraculifera*.

The *Sagus Rumphii*, Willdenow, and *S. farinifera*, Gaertner.—Before maturity, and previous to the formation of the fruit, the stem consists of a thin hard wall, about two inches thick, and of an enormous volume of tissue (commonly termed the *medulla* or *pith*), from which the farina or sago is obtained. As the fruit forms, the farinaceous medulla disappears, and when the tree, attains full maturity, the stem is no more than a hollow shell. Sago occurs in commerce in two states, pulverulent and granulated. 1. The meal or flour as imported in the form of a fine amylaceous powder. It is whitish, with a buffy or reddish tint. Its odor is faint, but somewhat unpleasant and musty. 2. Granulated sago is of two kinds, pearl and common brown. The former occurs in small hard grains, not exceeding in size that of a pin’s head, inodorous, and having little taste. They have a brownish or pinkish yellow tint, and are somewhat translucent. By the aid of a solution of chloride of lime they can be bleached, and rendered perfectly white. The dealers, it is said, pay L7 per ton for bleaching it. Common sago occurs in larger grains, about the size of pearl barley, which are brownish white.

Sago is an article of exportation to Europe, and is also shipped to India, principally Bengal, and to China. It is in its granulated form that it is usually sent abroad. The best sago is the produce of Siak, on the north coast of Sumatra. This is of a light brown color, the grains large, and not easily broken. The sago of Borneo is the next in value; it is whiter, but more friable. The produce of the Moluccas, though greatest in quantity, is of the smallest estimation. The cost of granulated sago, from the hands of the grower or producer, was, according to Mr. Crawfurd, only a dollar a picul. It fetches in the London market—common pearl, 20s. to 26s. the cwt., sago flour, 20s. the cwt. The Chinese of Malacca and Singapore have invented a process by which they refine sago, so as to give it a fine pearly lustre, and it is from thence we now principally derive our supplies of this article. The exports from Singapore in 1847 exceeded 61/2 million pounds, but are now much larger.

The following is a description of the manufacture of this important article of commerce:—The tree being cut down, the exterior bark is removed, and the heart, or pith of the palm, a soft, white, spongy and mealy substance is gathered; and for the purpose of distant transportation, it is put into conical bags, made of plantain leaves, and neatly tied up. In that state it is called by the Malays *Sangoo tampin*, or bundles of sago; each bundle weighs about 30 lbs.

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On its arrival at Singapore it is purchased by the Chinese manufacturers of sago, and is thus treated:—Upon being carried to the manufactory, the plantain-leaf covering is removed, and the raw sago, imparting a strong acid odor, is bruised, and is put into large tubs of cold spring water, where it undergoes a process of purification by being stirred, suffered to repose, and again re-stirred in newly-introduced water. When well purified thus, it is taken out of the tubs by means of small vessels; and being mixed with a great deal of water, the liquid is gently poured upon a large and slightly inclined trough, about ten inches in height and width; and in the descent towards the depressed end, the sago is deposited in the bottom of the trough, whilst the water flows into another large tub, where what may remain of sago is finally deposited. As the strata of deposited sago increases in the trough, small pieces of slates are adjusted to its lower end to prevent the escape of the substance. When by this pouring process the trough becomes quite full of sago, it is then removed to make room for a fresh one, whilst the former one is put out into the air, under cover, for a short time; and on its being well dried, the sago within is cut into square pieces and taken out to be thoroughly dried, under cover, to protect it from the sun. It has then lost the acid smell already noticed, and has become quite white. After one day's drying thus, it is taken into what may be called the manufactory, a long shed, open in front and on one side, and closed at the other and in the rear. Here the lumps of sago are broken up, and are reduced into an impalpable flour, which is passed through a sieve. The lumps, which are retained by the sieve are put back to be re-bruised, whilst that portion which has passed is collected, and is placed in a long cloth bag, the gathered ends of which, like those of a hammock, are attached to a pole, which pole being suspended to a beam of the building by a rope, one end of it is sharply thrown forward with a particular jerk, by means of which the sago within is shortly granulated very fine, and becomes what is technically termed "pearled." It is then taken out and put into iron vessels, called *quallies*, for the purpose of being dried. These quallies are small elliptical pans, and resemble in form the sugar coppers of the West Indies, and would each hold about five gallons of fluid. They are set a little inclining, and in a range, over a line of furnaces, each one having its own fire. Before putting in the sago to be dried, a cloth, which contains a small quantity of hog's-lard, or some oily substance, is hastily passed into the qually, and the sago is equally quickly put into it, and a Chinese laborer who attends it, commences stirring it with a *pallit*, and thus continues his labor during the few minutes necessary to expel the moisture contained in the substance. Thus each qually, containing about ten pounds of sago, requires the attendance

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of a man. The sago, on being taken off the fire, is spread out to cool on large tables, after which it is fit to be packed in boxes, or put into bags for shipment; and is known in commerce under the name of “pearl sago.” Thus the labor of fifteen or twenty men is required to do that which, with the aid of simple machinery, might be done much better by three or four laborers. A water-wheel would both work a stirring machine and cause an inclined cylinder to revolve over a fire, for the purpose of drying the sago, in the manner used for corn, meal, and flour in America, or for roasting coffee and chicory in England. But the Chinese have no idea of substituting artificial means, when manual ones are obtainable.

A considerable quantity of sago is exported from Singapore in the state of flour. The whole quantity made and exported there exceeds, on the average, 2,500 tons annually. The quantity shipped from this entrepot is shown by the annexed returns, nearly all of which was grown and manufactured in the settlement. The estimated value for export is set down at 14s. per picul of 11/4 cwt.

EXPORTS FROM SINGAPORE.

		Piculs
1840-41	Pearl sago	41,146
"	Sago flour	33,552
1841-42	Pearl sago	46,225
"	Sago flour	7,447
1842-43	Pearl sago	25,306
"	Sago flour	4,838
1843-44	Pearl sago	14,266
"	Sago flour	14,067
1844-45	Pearl sago	18,472
"	Sago flour	36,141
1845-46	Pearl sago	19,333
"	Sago flour	26,925
1846-47	Pearl sago	40,765
"	Sago flour	9,025

Imports of sago into the United Kingdom, and quantity retained for home consumption: —

	Imports.	Home consumption.
	Cwts.	Cwts.
1826	9,644	2,565

1830	2,677	3,385
1834	25,763	13,827
1838	18,627	28,396
1842	45,646	50,994
1846	38,595	45,671
1848	65,000	
1849	83,711	72,741
1850	89,884	83,954

THE BREAD-FRUIT TREE.

Artocarpus incisa.—This tree is less cultivated than would be supposed from its useful properties. In the West Indies and the Indian Islands, where it has been introduced from its native place, the South Sea Islands, it is held in very little consideration, the graminea, tuberous roots, and farinaceous plants being more easily and readily cultivated. There are two or three varieties known in the Asiatic regions. The properties of this tree are thus enumerated by Hooker:—The fruit serves for food; clothes are made from the fibres of the inner bark; the wood is used for building houses and making boats; the male catkins are employed as tinder; the leaves for table cloths and for wrapping provisions in; and the viscid milky juice affords birdlime.

*A. integrifolia*is the Jack or Jacca, the fruit of which attains a large size, sometimes weighing 30 lbs., but is inferior in quality to the bread-fruit.

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The nuts or fruit of *Brosimum Alicastrum*, an evergreen shrub, native of Jamaica, are nutritious and agreeable articles of food. When boiled with salt fish, pork or beef, they have frequently been the support of the negroes and poorer sorts of white people in times of scarcity, and proved a wholesome and not unpleasant food; when roasted it eats something like our common chesnut, and is called bread-nut.

Kafir Bread.—According to Thunberg, the Hottentots being very little acquainted with agriculture, or with the use of the cerealia, and subsisting principally upon wild bulbs and fruits, obtain food also from *Encephalartos caffer*, a species of *Zamia*, with a cylindrical trunk, the thickness of a man's body, and about seven feet high. Having cut down a tree, they took out the pith, that nearly fills its trunk, and which abounds in mucilage and an amylaceous fluid; after keeping this for some time buried under ground in the skin of an animal, they reduced it by pounding and kneading into a kind of paste; and then baked it in hot ashes, in the form of round cakes, nearly an inch thick. The Dutch colonists, in consequence of this practice of the natives, called the plant brood-boon, which signifies literally bread tree.

THE PLANTAIN AND BANANA.

The several varieties of the edible plantain which are known and cultivated throughout the West Indies, Africa, and in the East are all reducible to two classes, *viz*., the Plantain and the Banana (*Musa Paradisiaca*and *sapientum*). The difference between these two plants is even so slight as to be scarcely specific; it is therefore most probable that there was originally but one stock, from which they have, by cultivation and change of locality, been derived.

The tiger plantain (*M. maculata*) and the black ditto (*M. sylvestris*) are cultivated in Jamaica. The whole of the species and varieties of the tribe are what are called polygamous monoecious plants, each individual tree bearing the male and female organs of reproduction.

The plantain and its varieties invariably bear male, female and hermaphrodite flowers within the same spathe, all of them being imperfect and consequently unproductive of seed. An individual may, even from excess of culture, moisture, &c., be entirely incapable of flowering. During the prevalence of a disease or blight among the plantain walks of Demerara in the years 1844 and 1845, it was seriously proposed to introduce male plantains, or obtain fresh stock by seed.

It is, therefore, necessary to determine with exactness, if possible, whether the Plantain or Banana, (whichever be the parent stock) exists anywhere at present, or has been known to have existed as a perfect plant, that is bearing fertile seeds; or, whether it has always existed in the imperfect state, that is, incapable of being procreated by seed, the only state in which it at present exists in our colonies.

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Whether Linnaeus be right in his conjecture (Spec. Plant, 1763) that the “Bihai” (*Heliconia humilis*), a native of Caraccas, which produces fertile seeds, is the stock plant of the plantain, it is almost impossible to ascertain; but the absence of any description of a wild seed-bearing plantain, renders it highly probable that the cultivated species are hybrids produced long ago. The banana, from time immemorial, has been the food of the philosophers and sages of the East, and almost all travellers throughout the tropics have described these plants exactly as they are known to us, either as sweet fruit eaten raw, or a farinaceous vegetable roasted or boiled. It is remarkable that the plantain and banana should be indigenous, or at all events cultivated for ages both in the Old and New World. Numerous South American travellers describe some one of these plants as being indigenous articles of food among the natives, thus showing (if the plantain and its varieties be hybrids) a communication between the tropics of America, Asia and Africa, long before the time of Columbus. The older writers on the colony of Guiana, as Hartsinck, Bellin and others, consider the plantain to be a native. It is remarkable that Sir R. Schomburgk, during his travels, found a large species of edible plantain far in the interior. It appears, therefore, from all the investigations that have been made, that the plantain is either a hybrid, or its power of production from seed has been destroyed long ago by cultivation, and that it is not known to exist anywhere in a perfect state; in which case any attempt to improve the present stock by the introduction of suckers from elsewhere, must be totally futile. Mr. A. Garnett recommends the following system of cultivation, as calculated to prevent the blight. The walk or plantation is to be formed into beds 36 feet wide, divided by open drains 30 inches deep. Two rows of plantains to be planted upon each bed at 18 feet distance, both between and along the rows, to afford a clear ventilation to the enlarging plants, and so soon as the plantation has been established, the space of land between each row to be shovel-ploughed 12 inches deep; the same to be repeated annually, and upon the interspace may be planted maize, yams, sugar cane, or eddoes, and the whole kept clear at all times. Thus, with the conjoined principles of good tillage, free ventilation, and mixed crops, the blight may yet be successfully combated.

A great diminution in the cultivation of the plantain has been occasioned in British Guiana by this blight or disease, which first made its destructive appearance in Essequibo, upwards of thirty years ago, where its ravages increased with such fatal intensity as to render the profitable growth of the plant almost hopeless; and up to this hour no one has been able to discover the immediate or remote cause of this extraordinary vegetable endemic; whether arising from the action of insects among the sheathes of the petioles of the

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leaves, or in the soil, or from organic decay of the plant, remains without solution. The last-named cause seems to be rejected, by the fact that the fructification of the plant is as healthy and abundant in parts of the colony where the blight does not prevail, both in number and size of the fruit upon the spike, as at any former period. On the east coast of Demerara, both the plantain and banana have been grown for more than twenty years upon the same land, without any attack of the disease, and without any extraneous manure or even lime having been applied, and the plants still exhibit great luxuriance, and produce their former weight of fruit.

The foliage of the plantain affords food and bedding, and is used for thatch, making paper, and basket making; and from its petioles is obtained a fine and durable thread. The tops of the young plants are eaten as a delicate vegetable; the fermented juice of the trunk produces an agreeable wine.

The abundance and excellence of the nutritive food which the plants of this valuable genus supply are well known; but of the numerous uses to which they are applied I may mention, the following:—

The fruit is served up both raw and stewed; slices fried are also considered a delicacy. Plantains are sometimes boiled and eaten with salt meat, and pounded and made into puddings, and used in various other ways. In their ripe state these fruits contain much starchy matter. From their spurious stems, the fibres of the spiral vessels may be pulled out in such quantity as to be used for tinder. *M. textilis* yields a fibre which is used in India in the manufacture of fine muslins, and the coarser woody tissue is exported in large quantities from Manila, under the name of white rope or Manila hemp. Horses, cattle, swine, and other domestic animals are fed upon the fruit, leaves, and succulent trunks.

The same extent of ground which in wheat would only maintain two persons, will yield sustenance under the banana to fifty. That eminent naturalist and elegant writer, the Baron Von Humboldt, states ("Political Essay on New Spain," vol. ii.) that an acre of land cultivated with plantains produces nearly twenty times as much food as the like space sown with corn in Europe. He refers to a place in Venezuela, where the most careful tillage was rendered to a piece of land, yielding produce supporting a humble population residing in huts, each placed in the centre of an enclosure, growing the sugar cane, Indian corn, the Papaw tree, and the Musa—a tropical garden!—upon the elaborate culture of which a whole family relied for subsistence.

Although from the extensive plantain walks in our colonies—which are seldom cultivated with a garden-like care—so large an average proportion may not be obtained as twenty times the production of wheat in Europe, yet I have had practical experience of the prodigious quantity of farinaceous matter obtainable from an acre of tolerably well-cultivated plantains, and no esculent plant requires less labor in its culture upon land suitable for its production. They are readily increased by suckers, which the old plants produce in abundance.

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Lindley enumerates ten species of Musa, some of which grow to the height of 25 or 30 feet, but that valuable species *M. Cavendishii*, does not grow more than four or five feet high.

The bananas of the family of the Musaceae, appear to be natives of the southern portion of the Asiatic continent (R. Brown, "Bot. of Congo," p. 51). Transplanted at an unknown epoch into the Indian Archipelago and Africa, they have spread also into the, New World, and in general into all intertropical countries, sometimes before the arrival of Europeans.

According to Humboldt it affords, in a given extent of ground, forty-four times more nutritive matter than the potato, and 133 times more than wheat. These figures must be considered as only approximative, since nothing is more difficult than to estimate the nutritive qualities of different aliments.

Musa paradisiaca is cultivated in Syria, to latitude 34 deg. Humboldt says it ceases to yield fruit at a height of 3,000 feet, where the mean annual temperature is 68 deg., and where, probably, the heat of summer is deficient.

The banana seems, however, to be found no higher than 4,600 feet in a state of perfection.

No fruit is so easily cultivated as are the varieties of the plantain. There is hardly a cottage in the tropics that is not partly shaded by them; and it is successfully grown under other fruit trees, although it is independent of shelter. Its succulent roots and dew-attracting leaves render it useful in keeping the ground moist during the greatest heats. The plantain may be deemed the most valuable of fruits, since it will, in some measure, supply the place of grain in time of scarcity. To the negroes in the West Indian Islands the plantain is invaluable, and, like bread to the Europeans, is with them denominated the staff of life. In Jamaica, Demerara, Trinidad, and other principal colonies, many thousand acres are planted with these trees.

The vegetation of this tree is so rapid that if a line of thread be drawn across, and on a level with the top of one of the leaves, when it begins to expand, it will be seen, in the course of an hour, to have grown nearly an inch. The fruit when ripe is of a pale yellow, about a foot in length and two inches thick, and is produced in bunches so large as each to weigh 40 lbs. and upwards.

The soil best suited to the growth of the plantain is found in the virgin land most recently taken in from the forest, having a formation of clay and decomposed vegetable substances. A large portion of organic matter is required, as well as clay or other ponderous strata, to afford the greatest production of fruit. I have known good plantains produced in the West Indies, upon land considerably exhausted by the culture of cotton, but which was enriched by the application of a quantity of the decomposed seed of that shrub near the roots of the young plantains.

In the Straits' settlements of the East, the following are the most approved varieties:—-The royal plantain, which fruits in eight months; one which bears in a year, the milk plantain, the downy plantain, and the golden plantain or banana. A species termed *gindy* has been lately imported from Madras, where it is in great request. It has this advantage over the other kinds, that it can be stewed down like an apple while they remain tough.

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The Malays allege that they can produce new varieties, by planting three shoots of different sorts together, and by cutting the shoots down to the ground three successive times, when they have reached the height of nine or ten inches.

About 144 suckers of the plantain are set on an orlong (1-1/3 acres), each of which spreads into a group of six or eight stems, of about six inches to one foot in diameter, which yield each a bunch of fruit, and are then cut down, when fresh shoots succeed. In very rich soils the plant will continue to bear for twenty years, but otherwise it is dug up after the seventh or eighth year. The cost of cultivating 100 orlongs of land exclusively with plantains, will be nearly 2,000 Spanish dollars until produce be obtained. About 43,200 bunches may be had afterwards yearly, which might give a return of 2,160 dollars, or, deducting the cost of cultivation and original expenses, a profit per annum of 1,450 dollars.

The plantain has frequently been suggested as an article of export from our colonies. A few bunches are occasionally brought over by the Royal West India Mail Company's steamers running to Southampton, but more as a curiosity than as articles of commerce.

In its ripe state no unexceptionable and sufficiently cheap method of preserving it has yet been suggested.

In some districts of Mexico it is, indeed, dried in the sun, and in this state forms a considerable article of internal commerce under the name of "plantado pasado."

It is sometimes so abundant and cheap in Demerara, Jamaica, Trinidad, and other of our colonies, that it might, if cut and dried, in its green state, be exported with advantage.

It is in the unripe state that it is so largely used by the peasantry of the colonies as an article of food. It has always been believed to be highly nutritive, but Dr. Shier states that, in any sample of the dried plantain which he analysed, he could not find a larger amount than 88 per cent of nitrogen, which corresponds with about 51/2 per cent. of proteine compounds.

When dried, and reduced to the state of meal, it cannot, like wheat flour, be manufactured into maccaroni or vermicelli, or at least the maccaroni made from it falls to powder when put into hot water. The fresh plantain, however, when boiled whole, forms a pretty dense firm mass, of greater consistency and toughness than the potato. The mass, beaten in a mortar, constitutes the *foo-foo* of the negroes. The plantain meal cannot be got into this state unless by mixing it up with water to form a stiff dough, and then boiling it in shapes or bound in cloths.

Plantain meal is prepared by stripping off the husk of the plantain, slicing the core, and drying it the sun. When thoroughly dry it is powdered and sifted. It is known among the Creoles of the West Indies under the name of *Conquin tay*. It has a fragrant odour, acquired in drying, somewhat resembling fresh hay or tea. It is largely employed as the food of infants, children, and invalids. As food for children and convalescents, it would probably be much esteemed in Europe, and it deserves a trial on account of its fragrance, and its being exceedingly easy of digestion. In respect of nutritiveness, it deserves a preference over all the pure starches on account of the proteine compounds it contains.

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The plantain meal would probably be best and freshest were the sliced and dried plantain cores exported, leaving the grinding and sifting to be done in Europe. The flavor of the meal depends a good deal on the rapidity with which the slices are dried; hence the operation is only fitted for dry weather, unless indeed, when there was occasion for it, resource were had to a kiln or stove. Above all, the plantain must not be allowed to approach too closely to yellowness or ripeness, otherwise it becomes impossible to dry it. The color of the meal is injured when steel knives are used in husking or slicing, but silver or nickel blades do not injure the color. On the large scale a machine, on the principle of the turnip slicer, might be employed. The husking could be greatly facilitated by a very simple machine. Were the plantain meal to come into use in England, and bear a price in any way approaching to that of Bermuda arrowroot, it would become an extensive and very profitable export. Full-sized and well-filled bunches give 60 per cent. of core to 40 of husk and top-stem, but in general it would be found that the core did not much exceed 50 per cent., and the fresh core will yield 40 per cent. of dry meal, so that from 20 to 25 per cent. of meal is obtained from the plantain, or 5 lbs. from an average bunch of 25 lbs.; and an acre of plantain walk of average quality, producing during the year 450 such bunches, would yield a ton and 10 lbs. of meal, which, at the price of arrowroot, namely, 1s. per lb., would be a gross return of L112 10s. per acre. A new plantain walk would give twice as much. Even supposing the meal not to command over half the price of arrowroot, it would still form an excellent outlet for plantains whenever, from any cause, the price in the colony sank unusually low.

In respect of the choice of a situation for establishing a plantain walk, with a mill, boiling-house and drying ground, it will be necessary to fix upon new land with plenty of moisture, and flat if possible, in order that there may be no difficulty in making roads to carry the trees; whilst a deep river traversing the land, where there is no tide or danger of salt water—where facility would be afforded in making the basins wherein to wash the fibre; where a sea port would be near at hand for shipping the produce—where workmen, provisions, and fuel would be readily obtained, and where the climate is particularly healthy, should be especially sought after.

The plantain grows in profusion between the tropics in all parts of the world; but as it is an object to have the London market available for the prepared fibre, the following places may be mentioned as best calculated to produce a good and constant supply, viz:—the West India Colonies, the British Colonies in Africa, the South American Republics, along the Mosquito shore, and other places on the Continent of America, including Porto Rico, Hayti, and Cuba. The advantages to the paper manufacturer in employing the prepared fibre instead of rags, will be numerous, for the fibre is equal in texture, clean, and aromatic; whilst rags are dirty, full of vermin, and very often pestilential.

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A large stock of the plantain can always be secured, without fear of its being injured by keeping. The paper will be superior to that made of rags, and the process of making it will be more economical, inasmuch as the *sorting* of the material will not be required. Another advantage is, that a new article of commerce will be opened for the benefit of the colonial shipping interests, and a stimulus will be given to the cultivation of a fruit which is the favorite food of large masses of the population.

The following is a “specification” of articles requisite for making three tons of prepared fibre in a day:—

Four wooden boilers lined with lead, in the form of coolers, 7 feet deep by 6 in diameter. One hydraulic press, from 400 to 500 tons. One stout screw press, to compress the fibre before it is submitted to the hydraulic press. One iron mill with horizontal cylinders. Six waggons; twenty mules. Utensils, such as spatulas, cutlasses, hoes, rakes, &c. &c. One lever, to take out the fibre from the boilers. One steam boiler, equal to 12-horse power, to steam the four wooden boilers.

It being very desirable that the works should be in the immediate neighbourhood of a river, the machinery should be worked by water-power; but if this mode should be inconvenient, a steam engine in addition must be obtained, of about 8 or 10-horse power; or if one steam engine of 20-horse power were employed, it would be sufficient for all purposes. Thirty men are required to make three tons of fibre in a day.

Buildings.—A store, 100 feet long by 25 feet broad, in wood, covered with straw, to contain the dried fibre and the presses. One open shed of the same dimensions, covered with straw for the boilers.

Capital required.—It is ascertained that the following outlay will be sufficient:—

The materials will cost L2,000
Buildings 500
Purchase of land 1,500
Working capital 1,000

L5,000

The estimated expense in cultivating one quarree, or 5 1-5th English acres, in plantains, will be L30, as the work can be easily performed by one laborer in 300 days, at 2s. sterling per day.

A quarree will produce 18 tons of mill fibre, the cost of the preparation of which is as follows:—

For workmen’s wages, soda, lime, and fuel, at L3 per ton L54
Freight to Europe at L4 per ton 72
Managers 30
Duty, insurance, office fees, &c., at L1 per ton 18
——
L174

Thus, making the total expense of producing 18 tons of fibre L174, or L9 13s. 4d. per ton. In 1848 Manila rope, or plantain fibre of good quality, was worth L38 per ton.

A correspondent in Jamaica, who has devoted much attention to the subject, has furnished me with some very valuable detailed information, the most complete and practical that has ever yet appeared:—

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Cultivation.—The first care of a planter in superintending the cultivation of the banana tree, with the two-fold object of collecting both fibre and fruit, will be to study the nature of the tree to which he will give the preference. A number of experiments have been made upon different species of the banana with a view of obtaining therefrom the largest quantity and the best color of fibre, as well as the finest fruit. Those experiments were very tedious and minute, but were absolutely necessary, in order to arrive at the most economical and advantageous method of rendering the fibre into a state fit for shipment to Europe. At the same time, it was of the utmost importance to find out the best description of tree, for producing the strongest, the most abundant, and the most silky fibre—for containing the least quantity of juice, for producing the color sufficiently white to facilitate the operation of bleaching, for bearing fruit of the most esteemed quality, and, therefore, the most favorable for general consumption.A banana tree, which seemed at first sight to possess all those good qualities—being of a large size, with whitish or flaxen colored fibre, and producing very savoury fruit, only gave 2 per cent, of fibre after preparation; that is to say, 100 lbs. in its raw state, only gave two pounds of fibre after it was boiled. In endeavoring to find out the cause of such a small result, it was discovered that this specimen of banana (commonly called the “pig banana,”) contained a larger proportion of water than of fibre, compared with other sorts —that the heart was too large, and that the inside leaves were so tender that they almost dissolved in the process of boiling. These were the greatest inconveniences of this species of tree. There was also another disadvantage, in the quality of its fruit, which was yellow in color, and not so useful as those descriptions of banana which are generally eaten as a substitute for bread. The results of several experiments made upon various descriptions of banana, demonstrated the properties of each species, both as regarded fibre and fruit. The most profitable in both respects is undoubtedly the yellow banana, or common plantain. This tree grows to the height of about fifteen feet, it is nine or ten inches in diameter, its fibre is firm and abundant, and its fruit is used both in a green and ripe state. This plantain abounds on the continent of Spanish America and between the tropics, where the natives cultivate it as producing the most nutricious fruit of its kind. Cargoes of the fruit are frequently exported from Surinam and Demerara. On the Spanish part of the American continent, land is measured by *fanegas*, each fanega containing twelve *quarrees*, and each quarree five and one-fifth English acres. A quarree measures one hundred geometrical paces, or three hundred square feet.In the first instance, the suckers of

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the plantain (the tree being propagated by cuttings or suckers which shoot up from the bulb), should be set at ten feet distance from each other; this proposition gives 300 plants on one line of trees, or 900 on the surface of one quarree of land. Each plant propagates itself and gives upon an average ten trees of the same size and bearing. On one quarree of land, therefore there would be 9,000 trees, yielding four pounds of fibre and one bunch of fruit each, which is 9,000 bunches of fruit, and 36,000 lbs. nett of fibre, in the whole. In good ground the same plant will last fifteen years without any further trouble. Flat lands ought to be cultivated in preference to any other. The plantain thrives with the root in the water, and the head to the sun. On the borders of the river Orinoco it grows to the height of twenty feet, is one foot in diameter, and the stalks of the branches are three inches in circumference.*Cutting*.—The tree which has not produced its ripe fruit ought to be cut, for two reasons—first, that the fruit be not lost; and secondly, that the tree will not have arrived at its full growth and ordinary size, and the fibres will be too tender. In cutting it down, take it off six inches above the surface of the ground, then divide it longitudinally into four parts, take out the heart, which must be left to serve for manure, and if fermentation is decided upon, leave the pieces at the foot of the tree, otherwise take them to the mill to be crushed. The tree being very tender, may, on being bent down, be cut asunder with a single stroke of a hatchet, cutlass, or other convenient instrument. One man can cut down 800 trees, and split them in a day.*Carrying*.—The trees being thus divided, may be immediately carried to the mill to be crushed, or may remain until the fermentation separates the juice of sap from the fibres and the pith. By fermenting the trees, their weight will be so much reduced as to render their carriage considerably lighter than if taken away when first cut down. A wagon, with oxen or mules, can carry about a ton per day, and one man can load the wagon and drive the cattle.*Crushing*.—If the tree is carried from the plantation without being subjected to fermentation, it must be passed through a mill, the rollers of which, if made about three feet in length, and one foot in diameter, will be found a very convenient size. In this operation, care should be taken, first of all, to separate the tender from the harder or riper layers of fibre. The tree is composed of different layers of fibre, which may be divided into three sorts; those of the exterior, having been exposed to the atmosphere, possess a great degree of tenacity—whilst those of the interior, having been secluded from the air, are much more soft and tender. If, therefore, the layers of the plantain are passed indiscriminately through the mill, those which are hard or firm will

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not be injured by the pressure, whilst those which are soft will be almost reduced to pulp. Therefore, the rollers of the mill should be always placed horizontally, and upon passing the trees lengthways through the mill, the pressure will be uniform and the fibre uninjured. In this manner, pass the different sorts of layers separately, and the produce will be about four pounds of fibre from each tree. The stalks of the branches of the plantain give the best fibre, and a large quantity, as compared with the body of the tree; 100 lbs. of the stalk will give 15 lbs. nett of fibre. In general, if a tree will give 4 lbs. nett of fibre, the stalks will give 1 lb. out of the 4 lbs. The stalks ought also to be crushed separately, because they are harder than the exterior layers of the tree. About 3,000 trees may be passed through the mill in a day. Whilst the experiments were in progress it was ascertained that with a single horse, 100 plantain trees on an average were crushed in twenty minutes, giving five minutes rest for the horse.*Fermentation*.—This operation may be performed in several ways. If the trees are allowed to ferment upon the spot after being cut, a great saving will occur in respect of *carriage*; this matter ought to be carefully studied, because, on an extensive scale of manufacture, it is of serious importance. It is found that the trees when cut and heaped up, are subject to a drainage of juice, which, having a tanning property, discolors those pieces which lie at the bottom; hence much time is consumed in afterwards restoring the fibre to its natural color. The cut plants should be removed from the stumps of the trees, and then placed in heaps, shaded from the sun by laying the leaves over them. They will take several weeks to ferment. To pursue this process in the immediate vicinity of the establishment, would give rise to many inconveniences, in consequence of the very large space of ground that would thereby be occupied. Fermentation requires a mean temperature. A tree cut down and exposed to the sun, would be nearly dry at about 30 deg. centigrade, showing a result quite different to that which ought to be obtained; whilst a tree placed on a wet soil, and open for the fresh air to circulate between the plants, covered at the same time with its own leaves, and shaded by the foliage of the plantation, would be decomposed at the desired point of about 22 degrees. The different modes of fermentation require the same proportions. If the cut plants be covered with a thick layer of earth, they will not decompose in six *months*; but if, on the contrary, they are covered slightly, so that they may receive the freshness of the earth, and the heat of the air, they will decompose in six *weeks*. It is the same with the fermentation of alkaline baths. Baths at only *one* degree will produce decomposition, whilst baths at *three* degrees will not produce any decomposition.

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The stuff after being passed through the mill, or after fermentation, will be put into the chemical baths, or vats, or chemical liquor, and the persons in charge of the mill and boilers will do this work. Fermentation may be advantageously used, in cases where the trees are grown at a distance from the establishment—but, where they are in the immediate vicinity of the works, it will be best to crush them by the mill. The principal saving that is occasioned by fermentation, will be found in the carriage, as the substance will be much reduced in weight by that process. In an establishment where the manufacture is carried on upon a very large scale, trees cut down at a distance can be fermented, whilst those produced near the mill can be crushed.*Chemical Agents.*—-For decomposing the gluten in the trees during the process of boiling, soda, carbonate of soda, and quick lime, are used. The proportions herein given, are those requisite for making three tons of fibre per day, upon which scale the cost price of the fibre in a prepared state for bleaching, is subsequently calculated. To make three tons of fibre per day, it is necessary to have four boilers of 800 gallons each, and give five boilings in a day, or 1,650 lbs. of nett fibre for each boiler, or 6,600 lbs. for the four boilers per day. After having put into the boiler a sufficient quantity of water to cover the material, wait until the water begins to boil, and then add the chemical agents.

lbs.
To the first boiling of a copper, put of soda 60
To the 2nd, 3rd, 4th, and 5th boilings of the same
copper, 15 lbs., each making 60

120

Therefore the four boilings will take of soda 480
The same liquid will serve for two other days, by
adding 15 lbs. to each fresh boiling, say, in the
whole, 40 lbs., or 600
It will consume in soda for nine tons made in three
days 1,080
Or 360 lbs. for three tons made in one day.

On the fourth day commence again in the same manner, and go on for the two remaining days as above, producing eighteen tons in the six days. The quick lime is to be employed in each of the boilings, in the proportion of one-third less than the quantity of soda. Crude soda may be used in the boilings, without previously discarbonising it, and quick lime reduced to lime water; but, to render the action of the chemical ingredients more quick and certain, it is better to discarbonise the soda before it is put into the boiler. This may be done by preparing in a small separate boiler the quantity of liquid necessary for a day's consumption, which is prepared in about an hour. The carbonisation is effected in the following manner:—

Ten parts of salt of soda. }
Six parts of quick lime. } In weight.
Seventy parts of water (never less.) }

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Boiling.—This is a most important operation. By it the gluten and coloring matter are separated from the fibres, which separation is absolutely necessary, in order to prepare the fibre to receive the bleaching. It is necessary to observe that the three several sorts of layers which are found in the tree, and which, under the head of “crushing,” are recommended to be *pressed* separately, should be also *boiled* separately, because the outermost layer has more coloring matter than the next under it, which again has more than the innermost layer. As they are boiled so will they be dried and shipped, and each sort will have a different price in the market; that fibre which is lightest in color bearing the preference, in consequence of its not requiring more than *six* hours to bleach—-whilst the darkest will, probably from its greater tenacity, take *twelve* to *eighteen* hours. It is advisable to place over each boiler the means of lifting the mass of fibre when boiled, and suffering it to drain into the boiler before it is carried away to be washed. This is easily effected by a chain from the roof, to which may be hung a lever, having at that end over the boiler some hooks attached to it, whereby the mass is lifted out of the boiler, and the liquor thus preserved for the next boiling.*Washing*.—It is absolutely necessary that the fibre should be well washed after being taken out of the boiler, in order that all extraneous matter may be separated therefrom. In choosing the site for an establishment of this kind, care must always be taken to make choice of a spot in the immediate neighbourhood of a large river, or other plentiful supply of fresh clean water. The machinery necessary for cleansing and washing the fibre may be of various descriptions; but, perhaps a selection from one of the three following sorts will be found to answer every purpose, *viz*., those used by paper manufacturers in England, and by coffee planters and arrowroot growers in the West Indies.*Drying*.—The washed fibre, when hung over lines made of the twisted fibre, or any other convenient material, will be sufficiently dry in a few hours to be taken down, when more can be hung up, and then several batches can be dried in a day; and it will be necessary to have the drying ground as near the water as possible, in order to save weight in carriage.*Pressing*.—-When the fibre is perfectly dry, it must be well pressed, for the convenience of packing, carriage, and shipment. The hydraulic press is the best machine that can be used for the purpose; but in the absence of that, the lever and screw will make a large amount of pressure available. A hydraulic press of from 400 to 500 tons, will press bales of from four to five hundred weight each, which will not be too large for shipment.”

STARCH-PRODUCING PLANTS INVESTIGATED.

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Starch is one of the constituent parts in all mealy farinaceous seeds, fruits, roots, and other parts of plants, and is in large demand for domestic use, the arts, &c. Our common starch is made from wheat, and a good deal from potatoes. Pure fecula is separated by art from a variety of plants.

Of plants yielding starch we have the Indian arrowroot, which is the fecula in the rhizomata of several species of the Marantaceae. In the West Indies it is obtained from the *Maranta arundinacea*, *Allomyca* and *nobilis*, and also from various species of *Canna* called *Tous les mois*, and in the East Indies from species of *Curcuma*, and from *Maranta ramossissima* in Silhet.

The bread fruit (*Artocarpus incisa*), already alluded to, yields a large quantity of starch; as do the sweet potato (*Convolvulus Batatas*, or *Batatas edulis*). The pith or farinaceous part of the trunk of the *Caryota urens*, is almost equal to the finest sago. In Assam the sago of this palm is much used.

The two varieties of the Cassava afford a very superior fecula, which is imported under the name of Brazilian arrowroot. 8,354 bags of tapioca and farina were imported from Maranham in 1834. Some excellent starch from Norfolk Island was shown at the Great Exhibition.

The Cycadaceous family yields much starchy matter, along with mucilage. From the soft stems of *Cycas revoluta* and *C. circinalis*, natives of China and the East Indies, a kind of sago is made. These plants are propagated by suckers. *Zamia pumila*, a native of the Cape of Good Hope, and other species of this remarkable genus of plants, which is nearly related to both ferns and palms, supply an amylaceous matter, which has been sold as arrowroot. A similar product is obtained from *Alstroemeria pallida*, a perennial plant, with pink red flowers, growing in Chili. From the nuts of the *Cycas circinalis*, the Singalese prepare an inferior kind of starch, by pounding the fresh kernels. These are cut in slices, and well dried in the sun before they are fit for use, otherwise when eaten they are intoxicating, and occasion vomiting and purging.

The quantity of starch in a plant varies according to the period of growth. The results of examination on the comparative yield of starch in the potato, showed that while it abounded towards the latter part of the season, it decreased when the tubers began to germinate in the spring. It was found by Professor Balfour that 240 lbs. of potatoes left in the ground, contained of starch—

	lbs.		Per cent.
In August	23 to 25	or	9.6 to 10.4
September	32 " 38	"	13.3 " 16
October	32 " 40	"	13.3 " 16.6
November	38 " 45	"	16 " 18.7

April	38 "	28 "	16 "	11.6
May	28 "	20 "	11.6 "	8.3

The quantity of starch remained the same during the dormant state of winter, but decreased whenever the plant began to grow, and to require a supply of nourishment.

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Mr. Harris, of Jamaica, some years ago, made experiments upon the nutritious qualities of the principal roots and vegetables of the West Indies. These being well washed and scraped, were grated, in each case into two gallons of clear rain-water, and the whole then filtered through a clean linen strainer, after which it was left to settle; when the amylaceous matter had wholly subsided the supernatant liquor was carefully decanted, and fresh water added, which process was repeated until every foreign substance appeared to be removed; the produce of these several operations was then carefully collected and dried with a temperature of about 110 deg. Fahrenheit, and, when dry, weighed. In this manner the results given in the following table were obtained:—

PRODUCE FROM FIVE POUNDS OF THE	Oz.	Drms.	Centes. prop.
Root of the sweet cassava (*Janipha Loeflingii*)	14	1	17.27
Root of ocoes or taniers (*Caladium esculentum*)	11	17	14.29
Root of the bitter cassava (*Janipha manihot*), the Yucca amarga of the Spaniards	11	2	13.90
Full grown but unripe fruit of the plantain (*Musa paradisiaca*)	11	1	13.82
Root of the Guinea yam (*Dioscorea bulbifera*)	8	6	10.46
Root of the sweet potato (*Batatas edulis*)	8	6	10.46
Root of the arrowroot (*Maranta arundinacea*)	5	6	6.71
The full-grown but unripe fruit of the banana (*Musa sapientum*)	0	0	0.00

This table exhibits, no doubt, very unexpected results, since it places the sweet cassava at the very top, and the banana at the lowest place in the list, while the bitter cassava, which seems to be little more than a variety of the sweet, notwithstanding its being the staple material of West Indian bread, occupies two places lower down, and is followed by the plantain. The sweet potato and the yam, both of which are considered to be less nutritious than the arrowroot, rank above it in the centesimal proportion of their amylaceous produce. Upon what, then, do the nutritive properties of these various substances depend? Is it upon a gluten which was overlooked by Mr. Harris, in his experiments, or, if not, may we not suspect some inaccuracy in the proportion of starch assigned by him to each? It is to be wished that similar experiments were repeated with care in different quarters, and the list extended to other tropical products applicable to human sustenance, especially the roots which yield the farinaceous starch of the South Sea islanders, to the achira of Choco, &c.

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I shall extract largely from a very valuable report drawn up by Dr. John Shier, agricultural chemist, of Demerara, and submitted to the Governor of that colony in 1847, on the starch-producing plants, which is deserving of more widely extended publicity than the merely local circulation it has received. The remarks and results of experiments are worthy of deep consideration; and although they were meant to apply specially to British Guiana, they are equally pertinent to the West India colonies generally, our African and Australian settlements, and many other of our foreign possessions.

For many reasons it is desirable that the number of the staples of cultivation and export of our colonies should be increased. It is the general experience of British agriculturists, that the mixed system of agriculture is more profitable to the farmer and safer for the land, than the continued cultivation of any single crop, or indeed of nearly allied crops; and although fewer valid objections can be urged against the continued cultivation of the sugar cane, when properly conducted, than against that of grain crops, it is nevertheless certain that a well-arranged alternation or rotation of crops would be better. When an efficient system of covered drainage is adopted in British Guiana, there can be no doubt that the sugar cane will be replanted at shorter intervals of time than at present, and that other crops, such as provender crops for cattle, and provision crops for the colonial and perhaps the home market, will be made to alternate in cultivation with the cane. When the cane rows are as far apart as they require to be, to admit of sufficient tillage with the plough and other implements, it will also be possible to intercalate crops of rapidly growing plants; and were this done, as it easily might, in such a manner as to prevent undue exhaustion of the land, or impoverishment of the sugar crop, the returns could not fail to be materially increased. It would then probably be found that the fluctuations in prices would be less felt, for they would not likely, at the same time, affect different crops in the same manner.

It has been ascertained, in regard to some plants at least, that a much larger return can be obtained in the colonies than can be grown in temperate countries, however fertile. This is partly owing to the greater fertility of the soil under powerful tropical atmospheric influences, and partly to the fact that vegetation is continuous throughout the year, so that slow growing plants can do more within the time, from their functions not being arrested by the chill of winter; and of many rapidly growing plants, two successive crops can be grown within the year.

Starch is a substance easily manufactured, and being largely used in several of the arts, as well as an article of diet, there consequently exists a considerable demand for it in England. It may be obtained from a great variety of plants, and many of the most productive of it are natives of the tropics.

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The high prices commanded by grain and breadstuffs in Europe, renders the present a remarkably favorable time to ascertain what can be done in this branch of tropical agriculture; for should the potato disease return, or this root be less extensively planted than hitherto, starch must maintain a high price, and it will be worth ascertaining whether some of the superior starch-producing plants of the tropics might not be cultivated to such an extent as to supply the English market, and thus be at once profitable to the colonies and advantageous to the mother country.

Before entering on such a cultivation, however, various points require investigation. We ought to be able to answer such questions as the following:—

1. What differences exist between the characters of starch produced by different plants?

2. What are the qualities or properties that lead manufacturers—calico printers for example—to prefer one variety to another?

3. For culinary purposes, and as an article of diet, what qualities or characters obtain a preference?

4. Can the starches from different plants be distinguished from one another by distinct and well marked characters, so that the substitution of a less esteemed variety for a more esteemed one, or the adulteration of a high priced variety with a cheaper one, could be readily detected?

5. What plants produce the most esteemed varieties?

6. What plants produce it in the largest quantity?

7. What plants produce the largest yield per acre?

8. From what plants is it most easily manufactured?

9. Is the process attended with any particular difficulties that ought to deter the East and West India planters from engaging in it?

In the following observations (continues Dr. Shier) I shall be able to reply to several of these questions, especially those capable of being settled in the laboratory. On other points, particularly those relating to the returns per acre, I am at present but imperfectly informed, in consequence of the limited extent to which these plants have hitherto been cultivated in this colony (Demerara), and from the total absence of authentic data regarding the amount of yield.

Characters of starch produced from different plants.—Starches from different plants are best distinguished from one another by examination under a good miscroscope. The grains or globules may be examined either as transparent or opaque objects; and although in the same species there are considerable differences in size and form, the different kinds are, on the whole, quite distinguishable. One of the best ways of examining the form of the globules, under the microscope, is to lay them on a plate of glass and cover them with a drop of aqueous solution of iodine, which renders them gradually blue and opaque. When the difference in size and form between the globules of different species is considerable, as between the *Tous les mois* starch and cassava starch, or even between the arrowroot starch and cassava starch frequently used to adulterate it, it is not difficult, with a little practice, to detect the fraud.

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TABLE ILLUSTRATIVE OF THE SIZE AND FORM OF THE STARCH GLOBULES OF VARIOUS PLANTS.

1. Tous-les-mois (*Canna coccinea*).—Grown in Grenada, 1-300 to 1-2,000 of an inch; general size, 1-500; form of the globules, large, elliptical and ovate, and remarkably transparent.

2. Ditto ditto (species unknown).—From a plant grown in the garden of the Hon. J. Croal, Georgetown, but gathered before the root was fully ripe; globules spherical, shortly ovate and elliptical; size, from 1-600 to 1-1,600; general size, 1-800.

3. Buck Yam (*Dioscorea triphylla*).—Grown on the banks of the Demerara River. Form of globules, elliptical, often truncated at one end, so as to be mullar-shaped, some pear-shaped; length, twice the width; size, 1-600 to 1-2,000; general size, 1-800.

4. Common Yam (*D. sativa*).—Grown on No. 1 Canal, Demerara River. Elliptical, some long elliptical; size, 1-700 to 1-2,000; general size, 1-1,000.

5. Guinea Yam (*D. aculeata*).—Grown in the same locality. Larger globules, elliptical; smaller ditto, spherical, often truncated; some shortly ovate, with the appearance of being flattened; general size and range, same as No. 4.

6. Barbados Yam, grown on banks of Demerara river. Globules, pear-shaped and mullar-shaped; range, 1-700 to 1-1,600; general size, 1-1,000.

7. Plantain (*Musa paradisiaca*).—Grown on the banks of the Demerara river. Globules long and narrow, generally long elliptical, often more acute at the ends than in any other species, some linear ended abruptly; length, often three times the width; range, from 1-400 to 1-4,000 of an inch; general size, 1-800.

8. Potato (*Solanum tuberosum*).—Irish tubers, from Belfast Sound. Globules, 1-600 to 1-2,000; general size, 1-1,200.

9. Potato (Commercial).—Locality unknown. Range from 1-600; globules generally same as former, but a few stray ones as large as 1-40 of an inch.

10. Sweet Potato (*Convolvulus Batatas*).—Grown at the Lodge, Demerara. Form of globules, spherical aggregated; range, 1-1,000 to 1-4,000; general size, 1-2,400.

11. Arrowroot (*Maranta arundinacea*).—Specimens from Bermuda, where the highest priced and best quality is prepared. Ovate and elliptical; length in the larger globules, twice the width; range, from 1-800 to 1-2,400; general size, 1-1,400.

12. Ditto ditto, grown on plantation Turkeyen, Demerara, by J.W. King. Size and description same as No. 11.

13. Ditto ditto, grown and prepared in Barbados. Characteristics the same, but globules more uniform in size.

14. Ditto ditto, grown on plantation Enmore; not quite so uniform in size.

15. Bitter Cassava (*Janipha Manihot*).—Grown on Haagsbosch plantation. A few globules occur as large as the 1-1,000 of an inch; these are ovate, the rest are spherical. The range is from 1-2,000 to 1-8,000; general size, 1-4,000.

16. Sweet Cassava (*Janipha Loeflingii*).—Grown on No. 1 Canal, Demerara River.

17. Tannia (*Caladium sagittifolium*).—Grown at the Lodge. Globules not so truly spherical as the foregoing, but range and size the same.

18. Wheat (*Triticum sativum*).—Locality unknown. Form of globules, spherical and slightly elliptical, some very small; range, 1-2,000 to 1-6,000, the former the general size.

19. Maize (*Zea Mays*).—Grown in the colony, but locality uncertain. Globules, approaching to spherical, much aggregated; range, 1-2,000 to 1-4,000; general size, 1-3,000.

From an inspection of this list, it does not appear that the species would be easily distinguishable, and it is not easy briefly to describe the differences; in practice, however, and especially when the observer has a number of pure and authentic specimens before him, to have recourse to as standards of comparison, the discrimination is by no means difficult.

Specific gravity of starch derived from various plants.—Of many bodies the determination of the specific gravity is one of the best modes of distinguishing the purity. With the view of ascertaining whether the different varieties of starch have all the same density, as has been asserted by some, trials were carefully made of as many specimens as I could procure. The results are embodied in the following table:—

TABLE No. I.—DENSITY OF STARCH DERIVED FROM VARIOUS PLANTS.

Names of Plants	Density	Tem. at time of Obs. F.	Remarks
1. Bitter cassava	1.4 3	87.	Grown in the colony and prepared in the Colonial Laboratory.
2. Tannia	1.4773	87.	Ditto ditto
3. Arrowroot	1.4772	86.25	Ditto ditto
4. Arrowroot	1.4748	86.25	Ditto ditto
5. Common yam	1.4733	83.25	Ditto ditto
6. Sweet potato	1.4718	85.75	Ditto ditto
7. Arrowroot	1.4717	82.75	St. Vincent’s, commercial
8. Arrowroot	1.4701	84.75	Grown in the colony and prepared in C.L.
9. Tous les mois	1.4698	85.25	Ditto ditto

10. Sweet cassava |1.4692 | 86.5 |Ditto ditto
11. Wheat starch |1.4632 | 85. |Commercial, of English manufacture
12. Plantain |1.4615 | 85.75 |Grown in the colony and prepared in C.L.
13. Tous les mois |1.4611 | 84.25 |Grenada, commercial
14. Barbados yam |1.4607 | 83.5 |Grown in the colony and prepared in C.L.
15. Irish potato |1.4589 | 84.75 |Tubers from Belfast; prepared in C.L.
16. Guinea yam |1.4581 | 84.2 |Grown in the colony and prepared in C.L.
17. Potato |1.4561 | 84. |Commercial
18. Buck yam |1.4489 | 81.25 |Grown in the colony and prepared in C.L.
19. Arrowroot |1.4443 | 85.5 |Barbados, commercial

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20.  Arrowroot     |1.4158 | 86.25 |Bermuda, ditto
21.  Maize         |1.4109 | 85.5  |Grown in the colony and prepared in C.L.
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From this it will be seen that the order of density does not correspond with the order in any of the other tables. Probably those specimens prepared from dry seeds, such as wheat and maize starch, which, as commercial articles at least, are less pure than those prepared from recently dug roots, have also the lowest density.

Hygroscopic properties of starch produced from different plants.—Such of the specimens as are marked in the following table, as prepared in the colonial laboratory, were dried in the sun in shallow trays, to which they had previously been transferred in the wet state. When sun dried, the masses were broken down, and the starches freely exposed to the air in the shade for ten days. Any adherent masses were then rubbed to powder by light pressure in a glazed mortar, and the whole sifted. Portions of each of these starches, and of others for the sake of comparison, were then dried, at 212 degrees Fahrenheit, in a current of dry air, and the loss determined:—

TABLE No. II.—SHOWING THE HYGROSCOPIC WATER CONTAINED BY STARCH PRODUCED FROM DIFFERENT PLANTS.

	Per centage of water.	Remarks.
1. Potato	20.27	Commercial, locality unknown
2. Sweet potato	19.57	C., C.L.**
3. Buck yam	19.43	C., C.L.
4. Barbados yam	19.40	C., C.L.
5. Arrowroot	18.81	Bermuda, commercial
6. Irish potato	17.28	Tubers from Belfast, C.L.
7. Guinea yam	17.14	C., C.L.
8. Tous les mois	16.74	Grenada, commercial
9. Arrowroot	16.43	Barbados, ditto
10. Common yam	16.36	C., C.L.
11. Plantain	16.23	C., C.L.
12. Arrowroot	15.65	C., C.L.
13. Arrowroot	14.84	C., Plantation Enmore
14. Tous les mois	14.64	C., C.L.
15. Tannia	14.60	C., C.L.
16. Sweet cassava	14.30	C., C.L.
17. Maize	14.22	C., C.L.

18.	Arrowroot	13.36	C., C.L.
19.	Bitter cassava	11.88	C., C.L.
20.	Wheat starch	11.16	Commercial, of English manufacture

[** The initial C. throughout these tables indicates that the plant was grown in the colony; C.L., that the starch was prepared in the colonial laboratory.]

That the extremes in this table should occur in the case of the starches of commerce, was, perhaps, to be expected; nevertheless the difference between the starch of the sweet potato and that of the bitter cassava is nearly as great, and both these specimens were prepared in the laboratory, by the same process, and subject to the same temperature and exposure.

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Characters of the jellies formed by various starches.—Tenacity.—I have met with no very precise results on this subject, except the well-known fact that it takes a much larger quantity of some starches, the arrowroot for instance, to form a jelly of equal tenacity with that formed by others, such as the *Tous les mois*; and hence in the West Indies the latter is universally preferred to the cassava starches.

After trying various plans, the method which I found best fitted for comparing the tenacity of different starch jellies, was the following:—Of each of the kinds of starch, 24 grains were weighed out and mixed with 400 grains of distilled water, in a porcelain capsule of suitable size. The mixture was then heated and boiled briskly for three minutes, with constant stirring, and was immediately poured into a conical test-glass, [45] which the jelly nearly filled. The time at which each glass was filled was noted, and exactly two hours were allowed for the contents to cool in a current of air. The glass is then set on a plate of glass, supported on a ring of a retort stand, and the weight ascertained, which was necessary to force a metallic disc, of ascertained size, through the jelly. The most convenient way of doing this was by using a piece of apparatus of the form rudely represented on the margin. The rectangular frame is of thin brass wire, and the slightly cup-shaped disc, *d d*, is soldered to a wire, attached to the upper short side of the rectangle. From the opposite or lower side of the rectangle a small glass cup, *c.*, is suspended, into which weights are put as soon as the disc has been made to rest on the surface of the jelly, *pp* is the plate of glass on which the test-glass is set. Whenever the disc tears the skin of the jelly and begins to sink in it, no further addition, of weights is made, and the weight of the disc, framework, and cup being known, we have an estimate of the tenacity of the jelly. This process is but approximative, and some practice is necessary before the operator succeeds in getting uniform results from the same series of specimens.

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The following statement shows the results on such specimens as I could procure. The disc was exactly 7/10ths of an inch in diameter.

TABLE NO. III.—TENACITY OF STARCH IN JELLIES.

No. Names of specimens. Weight in grains required
to break the jelly.
1. Tous les mois, C., C.L. 2,446*
2. Tous les mois, Grenada, Commercial 1,742
3. Maize, C., C.L. 955
4. Barbados yam, C., C.L.

895
5. Irish potato, from Belfast, C.L. 756
6. Tannia, C., C.L. 630
7. Bermuda arrowroot, finest Commercial 627
8. Common yam, C., C.L. 657
9. Guinea yam, C., C.L. 571
10. Plantain, C., C.L. 467
11. Potato starch, Commercial 467
12. Arrowroot, C., C.L. 393
13. Sweet potato, C., C.L. 368
14. Arrowroot, C., C.L. 340
15. Arrowroot, C. 301
16. Arrowroot, St. Vincent's, Commercial 289
17. Barbados arrowroot, Commercial 273
18. Wheat starch, Commercial 183
19. Buck yam, C., C.L. 151
20. Bitter cassava, C., C.L. 150
21. Sweet cassava, C., C.L. 78

[* In this instance the weight stated detached the jelly from the side of the glass, but the skin of the jelly was not torn as in the other cases.]

From this list it is obvious that, in respect of tenacity, there is a very great difference between the jellies prepared from the different starches—greater, indeed, than exists in regard to any other character. At first I thought it probable that the tenacity of the jelly would bear some relation to the size of the globules, and it is true that we find the Grenada Tous les mois, the largest globule, next the top, and the cassava among the smallest, at the bottom of the scale. But, on the other hand, we have the Buck yam starch, a large sized globule, very high; together with many other exceptions.

As an article of diet, the most tenacious varieties of starch are preferred, on account of the economy of employing an article of which a less quantity will suffice; and the same is true when applied to starching linen, provided the jelly be not deficient in clearness.

Clearness of jellies.—When starch jelly is used for the purpose of starching, or glazing linen, or cotton goods, those varieties that are most transparent are understood to be preferred, provided, at the same time, they possess the requisite tenacity. This and other matters will be best determined by practical men in England; but having had occasion many times to prepare specimens for trying the tenacity, the opportunity was always taken of arranging the specimen of jellies in the order of their clearness, or, to speak more accurately, of their translucency. In this respect also they exhibit considerable differences, varying, when prepared according to the formula described under the head of tenacity, from very translucent approaching to opaque. The order is shown in the annexed list, which begins with the clearest.

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TABLE NO. IV.—SHOWING THE ORDER OF CLEARNESS OR TRANSLUCENCY OF UNIFORMLY PREPARED STARCH JELLIES.

Order.	Names of specimens.
1.	St. Vincent Arrowroot, Commercial
2.	Arrowroot, C., C.L.
3.	Sweet cassava, C., C.L.
4.	Bitter cassava, C., C.L.
5.	Bermuda arrowroot, Coml.
6.	Arrowroot, C., C.L.
7.	Irish potato, C.L.
8.	Potato starch, Coml.
9.	Buck yam, C., C.L.
10.	Arrowroot, C.
11.	Plantain, C., C.L.
12.	Tannia, C., C.L.
13.	Sweet potato, C., C.L.
14.	Common yam, C., C.L.
15.	Tous les mois, Grenada, Cml.
16.	Barbados arrowroot, Coml.
17.	Tous les mois, C., C.L.
18.	Barbados yam, C., C.L.
19.	Guinea yam, C., C.L.
20.	Wheat starch, Coml.
21.	Maize, C., C.L.

On comparing this list with the former one, and taking a general view of the subject, it will be seen that the jellies that are most tenacious are generally the least translucent, and that the order of the two lists is more nearly the converse than occurs in regard to any other properties.

Percentage of starch yielded by different plants.—On this point no two writers do or can agree. The quantity of starch, even in the same plants, the potato for instance, varies with the season, the soil, climate, age, ripeness, length of time the roots have been out of the ground, &c.

In the following table I have given the result of a series of trials made in the Colonial Laboratory, Demerara. The roots were all fresh dug, and, with two exceptions, noticed in the remarks, were fair average specimens. The process was the common one. The grater or rasping machine was of copper, to avoid injuring the color of some of the starches, which an iron grater is liable to do:—

TABLE NO. V.—PERCENTAGE OF STARCH YIELDED BY DIFFERENT PLANTS.

No.	Names of plants.	Percentage of starch.
1.	Sweet cassava	26.92
2.	Bitter cassava	24.84
3.	Another sample	20.26
4.	A third	16.02
5.	Common yam	24.47
6.	Arrowroot (roots scarcely ripe)	21.43
7.	Another sample	17.28
8.	Barbados yam	18.75
9.	Tannia	17.05
10.	Another sample	15.35
11.	Guinea yam	17.03
12.	Plantain	16.99
13.	Sweet potato	16.31
14.	Buck yam	16.07
15.	Another sample	15.63
16.	A third, from a dark colored variety	14.83

From the foregoing list it appears that the sweet and bitter cassava merit attention as starch-producing plants. They are occasionally grown for this purpose in the colonies, and yield a large per centage of starch; but there exists an opinion, whether well

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or ill founded, that it is liable to rot linen, and the preference is given here to the starch of arrowroot. It remains to be seen, however, what estimate will be formed of this starch in England, for if it should prove an esteemed variety, there can be no doubt of its proving a highly profitable cultivation. Cassava grows readily in almost any soil, and when the drainage is tolerable, two crops of the sweet variety can, it is stated be grown in a year. I have seen it growing luxuriantly in the light soils of the interior, as well as in the stiff clay soils of the coasts. It is considered an excellent preparatory crop in new and stiff land, on account of its tendency to loosen the soil. Were the bitter variety fixed on, the preparation of *Casareep* might be combined with the preparation of starch; and as that substance is one of the most esteemed bases for the preparation of various sauces, it is probable that this might turn out the most profitable part of the produce. At all events, bitter cassava would have this advantage over all other starch-producing roots, that the juice of the roots could be turned, to account as well as the starch.

Of all the plants mentioned in the list, starch is most readily separated from the arrowroot, in consequence of the tissue being more fibrous, and yielding little or no cellular tissue requiring to be run off the starch. Time and water are thus saved in the process, and were the fibrous residue pressed and dried, it could probably be turned to good account in the manufacture of paper.

In respect of facility of preparation, the plantain starch, though of excellent quality, ranks lowest, for the flesh-colored tissue in which the starch is embedded is somewhat denser than the starch, and settles down under it, and it is not a little difficult to arrange the process so as completely to separate the finer parts of this matter from the starch, and hence its color is never perfectly white.

Yield of starch-producing plants per acre.—On this subject, as already remarked, I do not at present possess sufficiently accurate data.

In England ten tons of potatoes are not unfrequently produced per acre; now assuming 15 the per centage of starch, there would be a yield of one-and-a-half tons per acre, which, at the-lowest quotation, 28s. a cwt., would give L42 per acre; and were the starch to rank with that prepared from wheat, it would produce L40 per ton, or L60 per acre. In the thorough drained land of Demerara, and under a good system of cultivation, I have no doubt that ten tons of cassava could easily be grown, and if it yielded 25 per cent. of starch, it would be a return of 21/2 tons, or of L62 10s. per acre, reckoned at the price of potato starch.

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Of the yield of the plantain we possess much more accurate information. A new plantain walk in this colony (British Guiana) will yield 450 bunches, of 50 lbs. each, of which, as nearly as possible, 50 per cent. will be of core, containing 17 per cent. of starch, thus producing 17 cwt. of starch per acre. But an old plantain walk, even when free from disease, could not be reckoned to yield more than half this quantity, namely, 81/2 cwt. per acre. Considering the value that is set on the plantain as an article of food, and the difficulties incident to the process of making starch from it, it is by no means probable that it will ever be used as a source from which to obtain starch.

Of the quantity of arrowroot that can be grown per acre, I have been able (continues Dr. Shier) to procure no information; but from the price it commands in the market, the facility with which it can be grown, and the ease with which the process of separating the starch can be carried on, it deserves a fair trial here. To cultivate it to advantage it ought to be done on thorough-drained and well-tilled land, planted at the proper season, and not dug till ripe and in dry weather.

Of the Tous les mois, I have only been able to procure a single plant, for which I am indebted to the kindness of the Hon. John Croal. As the root was immature, it would be unfair to deduce from the quantity of starch obtained, the per centage generally contained by the plant. Its immaturity was also indicated by the globules being smaller than in the specimen obtained from Grenada; in other respects, however, such as the tenacity of its jelly, it stands highest. It is altogether one of the most promising starch-producing plants, and obviously deserves a careful trial. It is a plant that expends a good deal of matter in maturing a considerable quantity of dense and bulky seeds, but as it propagates both by root and seed, it is probable that, as a root-crop, it would be highly advantageous to procure a variety that does not flower.

Both the tannia and the sweet potato can be readily grown, and the produce per acre is large; but from the foregoing tables it would appear that there are other plants whose starch is likely to be held in greater estimation.

Difficulties attendant on the process of preparing starch.—Were the manufacture of superior starch to be carried out in this colony (British Guiana) on a large scale and profitably, recourse would require to be had to all the well-known means of economising labor. In the cultivation as much as possible would require to be done by cattle and implement labor, and this would be the easier to accomplish, inasmuch as, to grow roots to great advantage, the land would require to be thorough drained. When the produce was brought to the buildings, machinery similar to what is already in use in Europe, for the purpose of washing and rasping roots, and of separating and washing starch, would suffice with comparatively little

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manual labor. An ordinary amount of judgment being exercised in determining the proper period of ripeness of the roots, and in selecting seasons when the weather is usually most suitable for conducting the process of manufacture, it does not appear that any unusual difficulty would have to be encountered by growers or manufacturers, unless as regards the obtaining of a sufficient supply of good water; for that is essential to the production of good starch.

The creek water of the colony is generally too brown, and the trench water too muddy, and contains often too much salt to produce starches of the finest color, hence recourse would require to be had to rain water, or Artesian water. The first is remarkably pure, and it certainly does not appear that were sufficiently capacious reservoirs built, or ponds dug, and protected from infiltration by the usual well-known means, there would be great difficulty in getting a sufficient supply of rain water. It is done in Bermuda, and why not here? On the other hand, almost all the Artesian wells in the colony contain a large quantity of oxide of iron held in solution by carbonic acid, and which separates as an ochrey deposit on free exposure to the air. Were this water used in the starch process, it would certainly injure the color materially; but by a chemical process, exceedingly simple, inexpensive, and easy of application, it is possible to purify the Artesian water, and render it almost as fit as rain water for the purpose of manufacturing starch.

In some of the other colonies a great deal of the best starch is produced by the holders of small lots of land, and many parts of the labor being light, and suited for women and children, it is one of the most desirable cultivations for small holders, and would be very beneficial for Demerara, where the lands of the peasantry too generally lie in a state of utter neglect; yet small holders could not be expected to be able to compete with those who should grow starch on the large scale, and prepare it with the best machinery.

Cassava meal, plantain meal, &c., as articles of export.—It may soon become an important question whether the plantain, or some of the edible roots grown in the tropics, might not be sent to Europe in a fresh state as a substitute for the potato. Many of them, the buck yam and the cassava, for instance, ought to be used when fresh dug, for every day they are out of the ground they deteriorate. This, however, is not so much the case with some of the larger yams. It is worth trying whether the finer sorts that deteriorate by keeping, might not, after being sliced and dried in the sun, become articles of export, either in that state or when ground to meal. For this purpose the bitter cassava, the plantain, and the buck yam are the most promising.

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Of the bitter cassava mention has already been made as a substance from which the starch and *casareep* might be prepared. In this case, however, the woody and cellular tissue, with the small quantity of starch left in it by the ordinary starch process, would form far too poor an article of diet to constitute part of the food of man. But the roots might be used as a medium from which to prepare cassava meal, *casareep*, and the very small quantity of starch which is expressed along with the juice, leaving all the rest of the starch to form part of the meal. It is of such meal that the cassava cakes of the Indians are prepared; and although by no means so nutritive as Indian corn meal[46], there can be little doubt that in the Scotch and Irish markets the cassava meal would obtain a preference; and were it exported in quantity it would probably come into extensive use among all classes.

The process would be as follows:—After washing in a revolving apparatus, by which means the adherent earth would be got quit of, and almost the whole of the thin dark colored cuticle become detached, the roots could be reduced to pulp in a rasping-mill, without the use of water; the pulp might be compressed in bags by hydraulic pressure, whereby the juice, together with a small portion of the starch, would be expressed. After allowing the starch to subside, the juice should be concentrated to about the density of 1.4. The starch would be washed, purified, and dried. The contents of the bags would then be broken up and dried in the sun or in a current of air, after which the meal would be sifted through a coarse sieve to separate the coarser parts, which, if their amount was considerable, could be ground and added to the rest. In this state of rough meal it is fit for making the cassava cakes. If ground to flour it might be used to mix with wheat, rye, or barley flour.

The process is usually conducted as follows:—The squeezed pulp is broken up, sifted, and exposed to the sun on trays or mats till it is fully more than half dry. An iron hoop of the size and thickness of the cake to be made is then laid on a griddle or hot plate, and the space within the hoop is filled evenly with the somewhat moist meal, no previous kneading or rolling having been employed. As soon as the coarse meal coheres, the ring is lifted and the cake is turned and heated on the opposite side. The heat should not be sufficient to brown the cake. The cakes are finally dried by exposure to the sun. From the dry cassava meal cakes may be prepared by sprinkling it with as much cold water as to moisten it to the proper point, and then proceeding as above. Hot water cannot be employed, neither can kneading, or any considerable degree of compression be used, otherwise the water does not evaporate readily enough; the starch gets too much altered by the heat, and the cake becomes tough.

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If an acre of well-tilled thorough-drained land yield 10 tons of fresh roots, and I have every reason to believe that such a return might be obtained, I have ascertained that the produce would be 31/2 tons of meal, 598 lbs. of *casareep*, and 2 cwt. of starch; and estimating the meal at 1d. per lb., the *casareep* at 1s. 5d. per lb., and the starch at 40s. per cwt., the gross amount would be L78 13s. 4d. per acre. In ascertaining these proportions, very simple machinery was employed, and had the pulp been better pressed the quantity of *casareep* would have been considerably greater.

From the table given in a former note it will be seen that the cassava meal prepared in this way contains but a very small proportion of matter nutritive in the sense of contributing to the formation of blood, and that the expressed juice carries off fully one-half of the proteine compounds contained in the plant.

Lichenin is a variety of starch occurring in *Cetraria islandica*, or Iceland moss.

Indian corn starch.—The advance of science has recently brought to our knowledge the preparation and use of another article, not only important as food, but also essential in the arts. I have had occasion to mention the high value of the Indian corn, and I might with advantage allude to many of its uses and properties; at present I must confine my remarks to a product from this valuable grain, known as corn starch, and yet another as the fecula of maize. In the close of 1849, Mr. Willard and his associates, of Auburn, established extensive works at Oswego, for the preparation of these important products, their establishment covering an area of 49,000 square feet. As the proprietors have to some extent held unrevealed the process by which they produce a starch more pure than the starch of commerce, we may not indulge in speculative curiosity; yet I can hardly doubt their great success is mainly attributable to perfect machinery, guided by science and talent. The rapid and extended demand for these new products presents sufficient evidence of their character, as we are told that about three millions of pounds of this corn starch are demanded annually by the trade, notwithstanding the usual supply of wheat starch is undiminished. A remarkable feature of maize starch is the absence of impurities; upon being subjected to analysis, it is found that only 2 76-100 parts in 1000 are of other matter than pure starch. According to Dr. Ure, wheat yields only 35 to 40 per cent, of good starch, a material extensively used in arts and manufactures.

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In addition to starch, the Oswego starch-factory produces from Indian corn a fecula, peculiarly adapted to culinary purposes, presenting to our domestic economy one of the most acceptable, pure, and nutritious articles of food. Already has it become an indispensable household article, and is consumed largely at home and abroad. The factory, though in its infancy, consumes annually 150,000 bushels of corn, equal to about nine millions of pounds in weight. Hitherto the quantities of starch used for laundry purposes and in the manufactories of America, have been produced from costly wheats, though it may be found in many vegetable substances, such as potatoes, the horse chesnut and other seeds. In England, where breadstuffs, particularly wheat, have been raised in quantities inadequate to the demand for food, attempts have been made to convert the viscid matter of lichens into a gum, for the use of calico printers, paper-makers, and ink makers; for the stiffening of silks, crapes, and the endless variety of dry goods, which, by means of these gums or starch, are made to appear of greater consistency. Most of these attempts had partial success, yet the making of starch from wheat has not been arrested.

The Oswego starch factory has happily introduced the use of Indian corn, as a grain producing a larger proportion of pure amylaceous properties than any other known vegetable substance, proffering to the American manufacturer another economic advantage, sustaining, in a most legitimate matter, sound rivalry and competition with all the world. I am not aware whether the Oswego factory has converted its starch into gum—a process easily accomplished by heat, and thus rendered soluble in cold water, which cannot be done while in its condition of starch. Here is another result of vast importance derivable from Indian corn; and we can well conceive that, in a short period of time, the advantages now derived from the production of corn starch, may have grown into a national benefit.

Rice (according to Prof. Solly) contains on an average about 84 per cent of starch; but till comparatively a few years ago, no starch was manufactured from it, notwithstanding its low price, and the large quantity of starch which exists in it. The reason of this was, that the old process of fermentation, by means of which starch is procured from grain, was not found to be applicable to rice; and hence the latter only became available as a source of starch in 1840, when Mr. Orlando Jones introduced his new process, for which he obtained a patent. This process consisted in macerating the rice for about 20 hours in a dilute solution of caustic potash, containing about 200 grains of the alkali in every gallon; the liquor is then drawn off, the rice dried, reduced to powder by grinding, then a second time digested in a similar alkaline lye for 24 hours, repeatedly agitated. After this it is allowed to settle, and well washed with pure cold water. A prize medal was awarded for this rice starch at the Great Exhibition.

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Mr. S. Berger, of Bromley, also received a prize medal. He adopts a different mode of preparation. In place of employing a dilute solution of caustic potash to dissolve the gluten and other insoluble matters of the grain, Mr. Berger uses a solution of carbonate of soda, containing half a pound to the gallon. The rice is steeped, in cold water for 48 hours, levigated in a suitable mill, and the pulp thus formed is treated with the solution of carbonate of soda for 60 or 70 hours, being repeatedly stirred; it is then allowed to settle for some hours, the alkaline liquor is drawn off, and the starch is washed and purified. This process was patented by Mr. Berger, in December, 1841. A third process was patented in February, 1842, by Mr. J. Colman; he uses dilute muriatic acid for the same purpose as Messrs Jones and Berger.

ARROWROOT, EAST AND WEST INDIAN.

The genuine arrowroot of commerce is the produce of the tuberous rhizomata of *Maranta arundinacea*, a native of South America, and *M. indica*, indigenous to the West Indies, but also cultivated in the East. The best West Indian arrowroot comes from Bermuda. Its globules are much smaller and less glistening than those of *Tous-les-mois*, or potato starch.

The peculiar characteristics of the starch obtained from various plants has been particularised and described already in the elaborate investigation of the commercial yield and value of the starch-producing plants. Amylaceous matter of a similar kind to arrowroot is obtained from other species of Maranta, as from some species of *Canna*, well known under the popular name of Indian shot, from the similarity of their round black seeds.

The arrowroot plant (*M. arundinacea*) is a perennial, its root is fleshy and creeping, and very full of knots and numerous long white fibres. Arising from the root are many leaves, spear-shaped, smooth on the upper surface and hairy beneath. The length of the leaf is about six or seven inches, and the breadth about three towards their base, the color and consistence resembling those of the seed. From the root arise slender petioles upon which the leaves stand, and several herbaceous erect stalks come out between them, rising to the height of about two feet. A loose bunch of small white flowers is succeeded by three-cornered capsules, each containing one hard rough seed.

The propagation and culture of this plant are of the simplest kinds. The roots should be parted, and the most suitable soil is a rich loam.

In the Bermudas, a deep rich soil, or one in which marsh or peat prevail, is alone adapted for growing arrowroot in perfection.

A correspondent from the Bermudas, (where arrowroot forms the great staple crop of the islands), informs me that he ploughed up a small piece of land, twenty rods (or the eighth part of an acre), with a small plough and one horse. He ploughed it over three times, and the third time planted the arrowroot as he ploughed it. The land had not been turned up before for twenty years.

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The expenses and profits stand thus:—

EXPENSE.
L. s. d.
To the ploughman, harrowing and planting the
arrowroot 1 0 0
Arrowroot plants 16 0
Digging it up L1 0 0
Deduct half, as the land was planted for the next
year 0 10 0 0 10 0
Balance carried down, being net profit 5 14 0
----
8 0 0
PRODUCE.
By 2,000 lbs. of root at 8s. per 100 lbs. 8 0 0
By balance brought down as net profit 5 14 0

The above L5 14s. clear profit on the 20 rods, is at the rate of L45 12s. profit for one acre. Now, if a small cultivator were to plant three or four acres, and get only one-half of the above profit, it would give a good return, and would be well worth the trial.

Arrowroot requires a good rich red soil, of which there is still much lying waste. The best time for planting it is in April, but it can be planted in March, or indeed at any time after the first of the year, till May: though if taken up and planted before Christmas, you may depend it will not come to any perfection. Arrowroot can be planted in many ways; either in holes made with a hoe, ploughed under, or in drills like Irish potatoes. Now the way I prefer is to prepare the land, then strike the line at two feet apart, and make holes with a pointed stick or dibble six inches apart, putting in each hole one strong plant or two small ones, then cover them up. This is more trouble than the old way, but it gives an excellent crop. It can also be planted like Irish potatoes in drills, two feet apart in the rows, and six inches between the plants. It should be hand-weeded in the spring, because if it is hoed, most likely you will cut some of it off which may be springing under ground, and it will never come up so strong again. Arrowroot requires very strong ground and plenty of manure. Farm yard manure is the best; next to that green seaweed dripping with salt water—this is an excellent manure, and should be dug in the ground as the arrowroot is taken up. I have no doubt that it would be of great advantage to the planter, if he were to put a cask in a cart, fill it with salt water, and put it on the land a few weeks before it is planted. Some people say that arrowroot does not pay so well, because it has to stay in the ground a whole year; but then if you have onions you can plant them over it, and so obtain a crop which will pay much better than the arrowroot itself. If you have a large piece of arrowroot ground, take up one half early, and plant it out with Irish potatoes; then take up the other half later, and with the plants set out your potato ground, that is if you have taken up your potatoes; if not, plant the arrowroot between the rows, in holes; so that when you take up the potatoes, you clean the arrowroot and loosen the ground, which will give a good crop; or you can plant Indian corn very thin over the arrowroot ground (if you have nothing else), but be sure to cut it up before it ripens corn, or it will injure your arrowroot crop; or you may plant a few melon seeds over it, and you will have a fine crop of fruit.

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In 1845 I planted, in the months of January and February, a quarter of an acre of good land, in arrowroot and onions.

The expense and profit stand as follow.—

EXPENSE	L.	s.	d.
To digging the ground	1	0	0
Planting arrowroot	0	6	0
Twelve load of seaweed, at 1s.	0	12	0
Rotten manure for onions, 10 loads, at 2s.	1	0	0
One bottle onion seed	0	16	0
Sowing onion seed and keeping the plants clean	0	10	0
Planting out onions	1	0	0
Cleaning onions after set out	0	15	0
Tops and making basket	1	8	0
Pulling, cutting, and basketing	0	18	0
Carting and shipping	0	8	0
Digging arrowroot	2	0	0

	10	13	0
Clear profit on quarter acre	22	13	9

	33	6	9
PRODUCE			
By onions sold	20	16	0
By arrowroot	12	10	9

	33	6	9

This is at the rate of L90 15s. clear profit per acre, which is more than double the worth of the land. I have not named the arrowroot plants, because I have planted my land with them again, but they might be fairly put to the credit of the account. The above statement shows what may be done with good land and good management; but even if a man can only clear L10 on an acre of land, he ought not to grumble.

Dr. Ure gives a most interesting and lucid account of the mode of manufacture in the island of St. Vincent, where the plant is now cultivated with great success, and the root manufactured in a superior manner.

It grows there to the height of about three feet, and it sends down its tap root from twelve to eighteen inches into the ground. Its maturity is known by the flagging and falling down of the leaves, an event which takes place when the plant is from ten to twelve months' old. The roots being dug up with the hoe, are transported to the washing-house, where they are thoroughly freed from all adhering earth, and next taken individually into the hand and deprived, by a knife, of every portion of their skins, while every unsound part is cut away. This process must be performed with great nicety, for the cuticle contains a resinous matter, which imparts color and a disagreeable flavor to the fecula, which no subsequent treatment can remove. The skinned roots are thrown into a large cistern, with a perforated bottom, and there exposed to the action of a copious cascade of pure water, till this runs off quite unaltered. The cleansed roots are next put into the hopper of a mill, and are subjected to the powerful pressure of two pairs of polished rollers of hard brass; the lower pair of rollers being set much closer together than the upper. The starchy matter is thus ground into a pulp, which falls into the receiver placed

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beneath, and is thence transferred to large fixed copper cylinders, tinned inside, and perforated at the bottom with numerous minute orifices, like a kitchen drainer. Within these cylinders, wooden paddles are made to revolve with great velocity, by the power of a water-wheel, at the same time that a stream of pure water is admitted from above. The paddle-arms beat out the fecula from the fibres and parenchyma of the pulp, and discharge it in the form of a milk through the perforated bottom of the cylinder. This starchy water runs along pipes, and then through strainers of fine muslin into large reservoirs, where, after the fecula has subsided, the supernatant water is drawn off, and fresh water being let on, the whole is agitated and left again to repose. This process of ablution is repeated till the water no longer acquires anything from the fecula. Finally, all the deposits of fecula of the day's work are collected into one cistern, and being covered and agitated with a fresh change of water, are allowed to settle till next morning. The water being now let off, the deposit is skimmed with palette knives of German silver, to remove any of the superficial parts, in the slightest degree colored; and only the lower, purer, and denser portion is prepared by drying for the market.

On the Hopewell estate, in St. Vincent, where the chief improvements have been carried out, the drying-house is constructed like the hot-house of an English garden. But instead of plants it contains about four dozen of drying pans, made of copper, 71/2 feet by 41/2 feet, and tinned inside. Each pan is supported on a carriage having iron axles, with *lignum vitae* wheels, like those of a railway carriage, and they run on rails. Immediately after sunrise, these carriages, with their pans, covered with white gauze to exclude dust and insects, are run out into the open air, but if rain be apprehended they are run back under the glazed roof. In about four days the fecula is thoroughly dry and ready to be packed, with German silver shovels, into tins or American flour barrels, lined with paper, attached with arrowroot paste. The packages are never sent to this country in the hold of the ship, as their contents are easily tainted by noisome effluvia, of sugar, &c.

Arrowroot is much more nourishing than the starch of wheat or potatoes, and the flavor is purer. The fresh, root consists, according to Benzon, of 0.07 of volatile oil; 26 of starch (23 of which are obtained in the form of powder, while the other 3 must be extracted from the parenchyma in a paste, by boiling water); 1.48 of vegetable albumen; 0.6 of a gummy extract; 0.25 of chloride of calcium; 6 of insoluble fibrine; and 65.6 of water.

Arrowroot is often adulterated in this country with potato flour and other ingredients.

Dr. Lankester asserts that the value of arrowroot starch, as an article of diet, is not greater than that of potato starch, and that the yield of starch is not greater from the arrowroot than from potatoes; but this I must decidedly deny. Chemical analysis and experience are proofs to the contrary.

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The analogy arrowroot has to potato starch, has induced many persons to adulterate the former substance with it; and not only has this been done, but I have known instances in which potato starch alone has been sold for the genuine foreign article. There is no harm in this, to a certain extent; but it certainly is a very great fraud upon the public (and one for which the perpetrators ought to be most severely punished), to sell so cheap an article at the same price as one which is comparatively costly. There is, moreover, in potato starch, a peculiar taste, bringing to mind that of raw potatoes, from which the genuine arrowroot is entirely free. This fraud, however, can be readily detected; arrowroot is not quite so white as potato starch, and its grains are smaller, and have a pearly and very brilliant lustre; and further, it always contains peculiar clotted masses, more or less large, which have been formed by the adhesion of a multitude of grains during the drying. These masses crush very readily when pressed between the fingers, and as before stated, arrowroot is free from that peculiar odor due to potato starch. This may be most readily developed by mixing the suspected sample with hot water; if it be genuine arrowroot, the mixture is inodorous, if potato starch, the smell of raw potatoes is immediately developed. If a mixture of arrowroot and potato starch be minutely observed by means of a good microscope, the grains of arrowroot may be readily detected; they are very small and exceedingly regular in shape, whilst those of potato starch are much larger, and very irregular in shape. But the most convenient and delicate test of all, is that proposed by Dr. Scharling, of Copenhagen. After mentioning the test by the microscope, he goes on to state that he has obtained more favorable results by employing diluted nitric acid; and that, if arrowroot or potato starch be mixed with about two parts of concentrated nitric acid, both will immediately assume a tough gelatinous state. This mass, when potato starch is employed, is almost transparent, and when arrowroot is used, is nearly opaque, as in the case above mentioned, in which hydrochloric acid is substituted. A mixture of nitric acid and water, however, operates very differently on these two kinds of starch. The glutinous mass yielded by the potato starch, becomes in a very brief period so tough that the pestle employed for stirring the mixture is sufficiently agglutinated to the mortar, that the latter may be lifted from the table by its means. Arrowroot, on the other hand, requires from twenty-five to thirty minutes to acquire a like tenacity.

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The *Lancet* recently stated that, on a microscopical analysis of 50 samples of arrowroot, purchased indiscriminately of various London tradesmen, 22 were found to be adulterated. In 16 cases this adulteration consisted in the addition of a single inferior product much cheaper in price, such as potato flour, sago meal, or tapioca starch, while in other instances there was a combination of these articles, potato flour being usually preponderant. Ten of the mixtures contained scarcely a particle of the genuine Maranta or West India arrowroot, for which they were sold. One consisted almost wholly of sago meal; two of potato flour and sago meal; two of potato flour, sago meal, and tapioca starch; one of tapioca starch; and four of potato arrowroot, or starch entirely. The worst specimens were those which were done up in canisters especially marked as "Genuine West India arrowroot," or as being "warranted free from adulteration;" and one, which contained a considerable quantity of potato flour, was particularly recommended to invalids, and certified as the finest quality ever imported into this country. The profits to the vendors of the inferior compounds are to be estimated from the fact that the price of sago meal and potato starch is about 4d. per lb., while the genuine Maranta arrowroot is from 1s. to 3s. 6d. per lb.

The arrowroot of Bermuda has long borne a high reputation, being manufactured on a better principle and being therefore of superior quality to that produced in Antigua, St. Vincent, and other West Indian islands. The process is tedious and requires a good deal of labor. There is no doubt, however, that the quality of the water has a great deal of influence on the fecula. Bermuda arrowroot is necessarily made from rain water collected in tanks or reservoirs, and the lime and the deposit from houses, &c., may alter its properties. After the root is taken from the ground it is placed in a mill, and is thereby cleansed of its exterior excrescences; it is then thoroughly washed, when it is ready for the large machine, the principle of which is similar to the "treadmill." A horse is placed on something like a platform, and as he prances up and down, the machinery is set in play. A person stands at the end, and places the root in the wheel of the machine, which, after being ground, falls into a trough of water. After going through this process, it is rewashed and then placed in vessels to dry in the sun. It is packed in boxes lined with blue paper or tin, and sent to the markets in England and America, where it generally meets with ready sale.

At a meeting of the Agricultural Society of Bermuda, held in May, 1840, Mr. W.M. Cox submitted a new arrowroot strainer which he had invented. It consists of two cloth strainers fixed to hoops from 15 to 20 inches in diameter. The strainers working one within the other, are kept in motion by a lever, moved by hand. The whole apparatus is not an expensive one, and is well adapted for aiding the manufacture of arrowroot upon an expeditious and economical plan.

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A simple method by which starch may be extracted from the fecula with much purity consists in enclosing the flour in a muslin bag and squeezing it with the fingers while submerged in clean water, by which process the starch passes out in a state of white powder and subsides. Two essential constituents of flour are thus separated from each other; a viscid substance remains in the bag, which is called gluten, and the white powder deposited is starch.

The principal quarters from whence the supply is derived, are the Bermudas, St. Vincent, Barbados and Grenada, in the West Indies; Ceylon, and some other parts of the East—and a few of our settlements on the West coast of Africa. The annual imports for home consumption average 500 tons.

The cultivation of arrowroot for the production of starch in St. Vincent has increased enormously of late years. In 1835, the island produced 41,397 lbs.; in 1845 it exported 828,842 lbs. The exports to 15th June, 1851, were, 2,934 barrels, 2,083 half barrels, 5,610 tins. The culture is year by year extending, and as, unlike that of the sugar cane, it may be carried on on a small scale with very little outlay of capital, we may reasonably anticipate a still further progressive extension for some years to come. Arrowroot, when once established in virgin soil, produces several crops with very little culture. In the first half of 1851, 25,027 lbs. were shipped from Montego Bay, Jamaica. The quantity of arrowroot on which duty of 1s. per cwt. was paid in the six years ending 1840, was as follows:—

Cwts.	
1835	3,581
1836	3,280
1837	2,858
1838	2,538
1839	2,264
1840	2,124

The imports in the last few years have been in

	Cwt.
1847	8,040
1848	10,580
1849	9,252
1850	15,980
1851	

About 500 cwt. are re-exported.

East India arrowroot is procured in part from *Curcuma angustifolia*, known locally as Tikoor in the East, and a similar kind of starch is yielded by *C. Zerumbet*, *C. rubescens*, *C. leucorhiza*, and *Alpinia Galanga*, the Galangale root of commerce. *C. angustifolia* grows abundantly on the Malabar coast, and is cultivated about the districts of Patna, Sagur and the south-west frontier, Mysore, Vizigapatam, and Canjam, Cochin and Tellicherry. It was discovered but a few years ago growing wild in the forests extending from the banks of the Sona to Nugpore.

The particles of East India arrowroot are very unequal in size, but on the average are larger than those of West India arrowroot.

Dr. Taylor, in his Topography of Dacca, speaks of fecula or starch being obtained from the Egyptian lotus (*Nymphaea lotus*), which is used by the native practitioners as a substitute for arrowroot.

Chinese arrowroot is said to be made from the root of *Nelumbium speciosum*.

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The original Indian arrowroot is extracted at Travancore, according to Ainslie, from the root of the *Curcuma angustifolia*. It is easily distinguished by its form, which is sometimes ovoid, sometimes elongated, of considerable size, rounded at one of the extremities, and terminating in a point at the other, often resembling a grain of rice.

The manufacture of arrowroot on the southern borders of the Everglades, at Key West, Florida, bids fair to become as extensive and as profitable as at Bermuda, whence, at present, we receive the bulk of our supplies. The wild root, which the Indians call Compti, grows spontaneously over an immense area of otherwise barren land. It is easily gathered, and is first peeled in large hoppers ingeniously contrived, and thrown into a cylinder and ground into an impalpable pulp. It is then washed and dried in the sun, baked and broken into small lumps, when it is ready for the market. The article is extensively used in the Eastern woollen and cotton establishments, as well as for family use. Arrowroot is cultivated in the interior of East Florida with great success. It is also cultivated to a considerable extent in Georgia, and is, I understand, a profitable crop.

The following is the process of manufacture:—The roots, when a year old, are dug up, and beaten in deep wooden mortars to a pulp; which is then put into a tub of clean water, well washed, and the fibrous part thrown away. The milky liquor being passed through a sieve or coarse cloth, is suffered to settle, and the clean water is drawn off; at the bottom of the vessel is a white mass, which is again mixed with clean water, and drained; lastly the mass is dried in the sun, and is pure starch. Arrowroot can be kept without spoiling for a very long time.

A considerable quantity of arrowroot is now produced in the Sandwich Islands. In 1841 arrowroot to the value of 3,320 dolls. was shipped, and in 1843, 35,140 lbs., valued at L1,405, was exported, principally to Tepic and San Blas, where it is used as starch for linen.

A kind of arrowroot of very good quality was sent to the Great Exhibition of 1851, by Sir R. Schomburgk, which is obtained in St. Domingo from the stems of a species of Zamia, called there Guanjiga; and the *Zamia Australis*, of Western Australia, yields even better fecula. The taste was unpleasant and salt, as if it had been immersed in lime. The other starch, from the Western Australian Zamia, in quality rivalled arrowroot. This fecula hangs together in chains, quite unlike the ordinary appearance of arrowroot when seen under the microscope.

The following figures show the exports of arrowroot from Bermuda:—

	lbs.	Value of the exports.
1830	18,174	—
1831	77,153	—
1832	34,833	—

1833	44,651	—
1834	54,471	—
1835	65,500	—
1836	—	—

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1841	91,230	—
1842	136,610	—
1843	151,757	L8,682
1844	173,275	10,974
1845	224,480	8,084
1847	—	4,716
1848	—	4,747
1849	—	6,760
1850	854,329	—

In the spring of 1851, 201,130 lbs. were shipped from Bermuda.

In 1843 the quantity of arrowroot in the rough state made in Bermuda was 1,110,500 lbs.

ARROWROOT EXPORTED FROM ANTIGUA TO

	Great Britain	B.N. America	B.W. Indies
	Boxes	Boxes	Boxes
1835	1,075	20	—
1836	581	43	—
1837	100	42	—
1838	472	20	—
1839	682	—	32
1840	453	—	30
1841	289	—	10
1842	582	—	—
1843	744	—	—
1844	376	—	—
1845	402	5	—

Barbados exported in 1832, 16,814 lbs., value L469; in 1840, 387 packages; in 1843, 302; in 1844, 790 packages; in 1851, 306 packages; these average about 30 lbs. each.

Ceylon now produces excellent arrowroot. In 1842, 150 boxes were exported; in 1843, 200; in 1844, 300; in 1845, 600 boxes.

From Africa we now import a large quantity: 250 boxes were received in 1846. Not unfrequently arrowroot from Africa has been sent to the West Indies in the ships with the liberated Africans, and thence re-exported to England, as of St. Vincent or Bermuda growth. The duty on arrowroot, under the new tariff, is equalised on all kinds to 41/2d. per lb.

The imports and home consumption of arrowroot have increased very largely, as may be seen from the following figures:—

	Imports	Retained for home consumption
	lbs.	lbs.
1826	318,830	358,007
1830	449,723	516,587
1834	837,811	735,190
1835	287,966	895,406
1838	404,738	434,574
1839	303,489	224,792
1840	408,469	330,490
1841	—	454,893
1842	890,736	846,832
1846	905,072	981,120
1847	1,185,968	1,211,168
1848	906,304	933,744
1849	1,036,185	1,032,992
1850	1,789,774	1,414,669
1851	2,083,681	1,848,778
1852	2,139,390	2,024,316

SALEP is the prepared and dried roots of several orchideous plants, and is sometimes sold in the state of powder. Indigenous salep is procured, according to Dr. Perceval from *Orchis mascula*, *O. latifolia*, *O. morio*, and other native plants of this order. On the continent it is obtained from *O. papilionaceo*, and *militaris*. Oriental salep is procured from other orchideoe. Professor Royle states that the salep of Kashmir is obtained from a species of Eulophia, probably *E. virens*. Salep is also obtained from the tuberous roots of *Tacca pinnatifida*, and other species of the same genus, which are principally natives of the East Indies and the South Sea Islands.

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The large fleshy tubers of tacca, when scraped and frequently washed, yield a nutritious fecula resembling arrowroot.

Salep consists chiefly of bassorin, some soluble gum, and a little starch. It forms an article of diet fitted for convalescents when boiled with water or milk. The price of salep is about eight guineas per cwt. in the London market. A little is exported from Constantinople, as I noticed a shipment of 66 casks in 1842; excellent specimens from this quarter were shown in the Egyptian department of the Great Exhibition in 1851. It was formerly a great deal used, but has latterly been much superseded by other articles.

Major D. Williams ("Journal of the Agri. and Hort. Soc. of India," vol. iv., part I), states that the tacca plant abounds in certain parts of the province of Arracan, where the Mugs prepare the farina for export to the China market.

After removing the peel, the root is grated on a fish-skin, and the pulp having been strained through a coarse cloth, is washed three or four times in water, and then dried in the sun.

According to a recent examination of the plant by Mr. Nuttall ("American Journal of Pharmacy," vol. ix., p. 305), the Otaheite salep is obtained from a new species of tacca, which he names *T. oceanica*.

For many years we have obtained from Tahiti, and other islands of the South Seas, this fecula, known by the name of Tahiti arrowroot, probably the produce of *Tacca pinnatifida*. It is generally spherical, but also often ovoid, elliptic, or rounded, with a prolongation in the form of a neck, suddenly terminated by a plane.

The tacca plant grows at Zanzibar, and is found naturalised on the high islands of the Pacific. The art of preparing arrowroot from it is aboriginal with the Polynesians and Feejeeans.

At Tahiti the fecula is procured by washing the tubers, scraping off their outer skin, and then reducing them to a pulp by friction, on a kind of rasp, made by winding coarse twine (formed of the coco-nut fibre) regularly round a board. The pulp is washed with sea water through a sieve, made of the fibrous web which protects the young frond of the coco-nut palm. The strained liquor is received in a wooden trough, in which the fecula is deposited; and the supernatant liquor being poured off, the sediment is formed into balls, which are dried in the sun for twelve or twenty-four hours, then broken and reduced to powder, which is spread out in the sun further to dry. In some parts of the world cakes of a large size are made of the meal, which form an article of diet in China, Cochin-Caina, Travancore, &c., where they are eaten by the natives with some acid to subdue their acrimony.

Some twenty varieties of the Ti plant (*Diacaena terminalis*) are cultivated in the Polynesian islands. There is, however, but one which is considered farinaceous and edible. In Java the root is considered a valuable medicine in dysentery.

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Within the last three or four years, considerable quantities of a feculent substance, called Tous les mois, have been imported from the West Indies. It is cultivated in Barbados, St. Kitts, and the French islands, and is said to be prepared by a tedious and troublesome process from the rhizomes of various species of *Canna Coccinea*, *Achiras*, *glauca*, and *edulis*. It approaches more nearly to potato starch than to any other fecula, but its particles are larger. Like the other amylaceous substances, it forms a valuable and nutritious article of food for the invalid.

The large tuberous roots of the Canna are equal in size to the human head. The plant attains in rich soils a stature of fourteen feet, and is identical, it is supposed, with the Achira of Choco, which has an esculent root highly esteemed; and my friend, Dr. Hamilton, of Plymouth, has named it provisionally, in consequence, *Canna achira*. The starch of this root, he asserts, is superior to that of the *Maranta*.

ROOT CROPS.

Amongst tuberous rooted plants, which serve as food for man in various quarters of the globe, the principal are the common potato, yam, cocoes or eddoes, sweet potatoes, taro, tacca, arrowroot, cassava, or manioc, and the Apios (*Arracacha esculenta*). There are others of less importance, which may be incidentally mentioned. The roots of *Tropaeolum tuberosum* are eaten in Peru, those of *Ocymum tuberosum* in Java. In Kamschatka they use the root of the *Lilium Pomponium* as a substitute for the potato. In Brazil the *Helianthus tuberosus*. The rhizomae and seed vessels of the Lotus form the principal food of the aborigines of Australia. As a matter of curious information, I have also briefly alluded to many other plants and roots, furnishing farinaceous substance and support in different countries.

The comparative amount of human food that can be produced upon an acre from different crops, is worthy of great consideration. One hundred bushels of Indian corn per acre is not an uncommon crop. One peck per week will not only sustain life, but give a man strength to labor, if the stomach is properly toned to the amount of food. This, then, would feed one man 400 weeks, or almost eight years! 400 bushels of potatoes can also be raised upon an acre. This would give a bushel a week for the same length of time; and the actual weight of an acre of sweet potatoes (*Convolvulus batatas*) is 21,344 lbs., which is not considered an extraordinary crop. This would feed a man (six pounds a day) for 3,557 days, or nine and two-third years!

To vary the diet we will occasionally give rice, which has been grown at the rate of 93 bushels to the acre, over an entire field. This, at 45 lbs. to the bushel, would be 4,185 lbs.; or, at 28 lbs. to the bushel when husked, 2,604 lbs., which, at two pounds a day, would feed a man 1,302 days, or more than three-and-a-half years!

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POTATOES.

The common English or Irish potato (*Solanum tuberosum*), so extensively cultivated throughout most of the temperate countries of the civilised globe, contributing as it does to the necessities of a large portion of the human race, as well as to the nourishment and fattening of stock, is regarded as of but little less importance in our national economy than wheat or other grain. It has been found in an indigenous state in Chili, on the mountains near Valparaiso and Mendoza; also near Monte Video, Lima, Quito, as well as in Santa Fe de Bogota, and more recently in Mexico, on the flanks of Orizaba.

The history of this plant, in connection with that of the sweet potato, is involved in obscurity, as the accounts of their introduction into Europe are somewhat conflicting, and often they appear to be confounded with one another. The common kind was doubtless introduced into Spain in the early part of the sixteenth century, from the neighbourhood of Quito, where, as well as in all Spanish countries, the tubers are known as papas. The first published account of it we find on record is in "*La Cronica del Peru*," by Pedro de Cieca, printed at Seville, in 1553, in which it is described and illustrated by an engraving. From Spain it appears to have found its way into Italy, where it assumed the same name as the truffle. It was received by Clusius, at Vienna, in 1598, in whose time it spread rapidly in the South of Europe, and even into Germany. It is said to have found its way to England by a different route, having been brought from Virginia by Raleigh colonists, in 1586, which would seem improbable, as it was unknown in North America at that time, either wild or cultivated; and besides, Gough, in his edition of Camden's "Britannia," says it was first planted by Sir Walter Raleigh, on his estate at Youghal, near Cork, and that it was cultivated in Ireland before its value was known in England. Gerarde, in his "Herbal," published in 1597, gives a figure of this plant, under the name of *Batata Virginiana*, to distinguish it from the *Batata edulis*, and recommends the root to be eaten as a "delicate dish," but not as a common food. "The sweet potato," says Sir Joseph Banks, "was used in England as a delicacy, long before the introduction of our potatoes. It was imported in considerable quantities from Spain and the Canaries, and was supposed to possess the power of restoring decayed vigor." It is related that the common potato was accidentally introduced into England from Ireland, at a period somewhat earlier than that noticed by Gerarde, in consequence of the wreck of a vessel on the coast of Lancashire, which had a quantity on board. In 1663 the Royal Society of England took measures for the cultivation of this vegetable, with the view of preventing famine.

Notwithstanding its utility as a food became better known, no high character was attached to it; and the writers on gardening towards the end of the seventeenth century, a hundred years or more after its introduction, treated of it rather indifferently. "They are much used in Ireland and America as bread," says one author, "and may be propagated with advantage to poor people."

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The famous nurserymen, Loudon and Wise, did not consider it worthy of notice in their "Complete Gardener," published in 1719. But its use gradually spread as its excellencies became better understood. It was near the middle of the last century before it was generally known either in Britain or North America, since which it has been most extensively cultivated.

The period of the introduction of the common potato into the British North American colonies, is not precisely known. It is mentioned among the products of Carolina and Virginia in 1749, and by Kalm as growing in New York the same year.

The culture of this root extends through the whole of Europe, a large portion of Asia, Australia, the southern and northern parts of Africa, and the adjacent islands. On the American continent, with the exception of some sections of the torrid zone, the culture ranges from Labrador on the east, and Nootka Sound on the west, to Cape Horn. It resists more effectually than the cereals the frosts of the north. In the North American Union it is principally confined to the Northern, Middle, and Western States, where, from the coolness of the climate it acquires a farinaceous consistence highly conducive to the support of animal life. It has never been extensively cultivated in Florida, Alabama, Mississippi, and Louisiana, probably from the greater facility of raising the sweet potato, its more tropical rival. Its perfection, however, depends as much upon the soil as on the climate in which it grows; for in the red loam, on the banks of Bayou Boeuf, in Louisiana, where the land is new, it is said that tubers are produced as large, savory, and as free from water as any raised in other parts of the world. The same may be said of those grown at Bermuda, Madeira, the Canaries, and numerous other ocean isles.

The chief varieties cultivated in the Northern States of America are the carter, the kidneys, the pink-eyes, the mercer, the orange, the Sault *Ste*. Marie, the merino, and Western red; in the Middle and Western States, the mercer, the long red, or merino, the orange, and the Western red. The yield varies from 50 to 400 bushels and upwards per acre, but generally it is below 200 bushels.

Within the last ten years an alarming disease, or "rot," has attacked the tubers of this plant, about the time they are fully grown. It has not only appeared in nearly every part of America, but has spread dismay, at times, throughout Great Britain and Ireland, and has been felt more or less seriously in every quarter of the globe.

To the greater uncertainty attending its cultivation of late years, must be attributed the deficiency of the United States crop of 1849, as compared with that of 1839. This is one of the four agricultural products which, by the last census, appears smaller than ten years since.—("American Census Reports for 1850.")

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The crops in Ireland, where the potato is the principal object of culture, vary from 11/2 to 101/2 tons per acre, according to the season; but in the average of three years ending 1849, the annual growth of Great Britain and Ireland amounted to nine million tons, which, at L3 per ton, exhibits the value at L27,000,000 sterling. Ireland produced in 1847 a little over two million tons, the yield being 71/4 tons per acre. In 1848 the produce was 2,880,814 tons, averaging only four tons to the acre. In 1849, 4,014,122 tons, averaging 51/2 tons to the acre. In 1850, 3,954,990 tons; and in 1851, 4,441,022 tons; the average yield per acre not stated. In many parts of Scotland 24 tons to the acre are raised. The sales of potatoes in the principal metropolitan markets exceed 140,000 tons a year, which are irrespective of the sales which take place at railway stations, wharfs, shops, &c. The imports into the United Kingdom average about 70,000 tons annually. Potatoes are exported to the West Indies, Mediterranean, and other quarters. For emigrant ships, preserved or dried potato flour is now much used.

The following quantities of potato flour were imported from France in the last few years:—

	Cwts.
1848	17,222
1849	3,858
1850	12,591
1851	2,631

We also imported the following quantities of potatoes in the last five years:—

	Cwts.
1848	940,697
1849	1,417,867
1850	1,348,867
1851	636,771
1852	773,658

Thoroughly dried potatoes will always produce a crop free from disease. Such is the positive assertion of Mr. Bollman, one of the professors in the Russian Agricultural Institution, at Gorigoretsky. In a very interesting pamphlet[47] by this gentleman, it is asserted, as an unquestionable fact, that mere drying, if conducted at a sufficiently high temperature, and continued long enough, is a complete antidote to the disease.

The account given by Professor Bollman of the accident which led to this discovery is as follows:—He had contrived a potato-setter, which had the bad quality of destroying any sprouts that might be “on the sets, and even of tearing away the rind. To harden the potatoes so as to protect them against this accident, he resolved to dry them. In the spring of 1850, he placed a lot in a very hot room, and at the end of three weeks they were dry enough to plant. The potatoes came up well, and produced as good a crop as that of the neighbouring farmers, with this difference only, that they had no disease, and the crop was, therefore, upon the whole, more abundant. Professor Bollman tells us that he regarded this as a mere accident; he, however, again dried his seed potatoes in 1851, and again his crop was abundant and free from disease, while everywhere on the surrounding land they were much affected. This was too remarkable a circumstance not to excite attention, and in 1852 a third trial took place. All Mr. Bollman’s own stock of potatoes being exhausted, he was obliged to purchase his seed, which bore unmistakable marks of having formed part of a crop that had been severely diseased; some, in fact, were quite rotten. After keeping them about a month in a hot room, as before, he cut the largest potatoes into quarters, and the smaller into halves, and left them to dry for another week. Accidentally the drying was carried so far that apprehensions were entertained of a very bad crop, if any. Contrary to expectation, however, the sets pushed promptly, and grew so fast that excellent young potatoes were dug three weeks earlier than usual. Eventually nine times the quantity planted was produced, and although the neighbouring fields were attacked, no trace of disease could be found on either the herbage or the potatoes themselves.

This singular result, obtained in three successive years, led to inquiry as to whether any similar cases were on record. In the course of the investigation two other facts were elicited. It was discovered that Mr. Losovsky (living in the government of Witebsk, in the district of Sebege), had for four years adopted the plan of drying his seed potatoes, and that during that time there had been no disease on his estate. It was again an accident which led to the practice of this gentleman. Five years ago, while his potatoes were digging, he put one in his pocket, and on returning home threw it on the stove (poele), where it remained forgotten till the spring. Having then chanced to observe it, he had the curiosity to plant it, all dried up as it was, and obtained an abundant, healthy crop; since that time the practice of drying has been continued, and always with great success. Professor Bollman remarks that it is usual in Russia, in many places, to smoke-dry flax, wheat, and rye; and in the west of Russia, experienced proprietors prefer, for seed, onions that have been kept over the winter in cottages without a chimney. Such onions are called *dymka*, which may be interpreted smoke-dried.

The second fact is this:—Mr. Wasileffsky, a gentlemen residing in the government of Mohileff, is in the habit of keeping potatoes all the year round, by storing them in the place where his hams are smoked. It happened that in the spring of 1852 his seed potatoes, kept in the usual manner, were insufficient, and he made up the requisite quantity with some of those which had been for a month in the smoking place. These potatoes produced a capital crop, very little diseased, while at the same time the crop from the sets which were not smoke-dried was extensively attacked by disease. Professor Bollman is of opinion that there would have been no disease at all if the sets had been better dried.

The temperature required to produce the desired result is not very clearly made out. Mr. Bollman's room, in which his first potatoes were dried, was heated to about 72 degrees, and much higher. By way of experiment he placed others in the chamber of the stove itself, where the thermometer stood at 136 degrees, and more. He also ascertained that the vitality of the potato is not affected, even if the rind is charred. Those who have the use of a malt-kiln, or even a lime-kiln, might try the effect of excessive drying, for a month seems to be long enough for the process.—(Gardener's Chronicle.)

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A Mr. Penoyer, of Western Saratoga, Illinois, publishes the following, which he recommends as a perfect cure and preventive of the potato rot, having tested it thoroughly four years with perfect success; while others in the same field, who did not use the preventive, lost their entire crop by the rot. It not only prevents the rot, but restores the potato to its primitive vigor, and the product is not only sound, but double the size, consequently producing twice the quantity on the same ground, and the vines grow much larger, and retain their freshness and vitality until the frost kills them. Aside from the cure of the rot, the farmers would be more than doubly compensated for their trouble and expense in the increase and quality of the crop. The remedy or preventive is as follows:—"Take one peck of fine salt and mix it thoroughly with half a bushel of Nova Scotia plaster or gypsum (the plaster is the best), and immediately after hoeing the potatoes the second time, or just as the young potato begins to set, sprinkle on the main vines, next to the ground, a tablespoon full of the above mixture to each hill, and be sure to get it on the main vines, as it is found that the rot proceeds from a sting of an insect in the vine, and the mixture coming in contact with the vine, kills the effect of it before it reaches the potato." I cannot but consider Professor Bollman's as the most important of the two remedies suggested.

The potato crop of the United States exceeds 100 million bushels, nearly all of which are consumed in the country; the average exports of the last eight years not having exceeded 160,000 bushels per annum.

According to the census returns of 1840, the quantity of potatoes of all sorts raised in the Union, was 108,298,060 bushels; of 1850, 104,055,989 bushels, of which 38,259,196 bushels were sweet potatoes.

Last year (1852) there was under cultivation with potatoes in Canada, the following extent of land:—

Acres.	Bushels.		
Upper Canada	77,672	Produce	498,747
Lower Canada	73,244	Produce	456,111

About 782,008 cwts. of potatoes are annually exported from the Canary Islands. In Prussia, 153 million hectolitres of potatoes were raised in 1849. In 1840 Van Diemen's Land produced 15,000 tons of potatoes, on about 5,000 acres of land.

The potato is not yet an article of so much importance in France, as in England or the Low Countries, but within the last twenty years its cultivation has increased very rapidly. It is mostly grown where corn is the least cultivated. The quantity raised in 1818, was 29,231,867 hectolitres, which had increased in 1835 to 71,982,814 hectolitres. About 2,000,000 hectolitres of chesnuts are also annually consumed in France, a portion of the rural population in some of the Central and Southern Departments living almost entirely on them for half the year.

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In Peru dried potatoes are thus prepared:—Small potatoes are boiled, peeled, and then dried in the sun, but the best are those dried by the severe frosts on the mountains. In the Cordilleras they are covered with ice, until they assume a horny appearance. Powdered, it is called *chimo*. They will keep for any length of time, and when used required to be bruised and soaked. If introduced as a vegetable substance in long sea voyages, the potato thus dried would be found wholesome and nourishing. A large and profitable business is now carried on, in what is called "preserved potatoes," for ships' use, prepared by Messrs. Edwards and Co., which are found exceedingly useful in the Royal Navy, in emigrant ships, for troops and other services, from their portability, nutritious properties, and being uninjured by climate.

Few persons are probably aware of the quantity of potatoes used in England, America and the Continent, in the manufacture of starch, arrowroot, and tapioca, &c., A starch manufactory in Mercer, Maine, United States, grinds from 16,000 to 24,000 bushels annually of potatoes, and makes 140,000 to 240,000 lbs. of starch, which finds a ready market at Boston, at four dollars the hundred pounds. The New England manufacturers prefer it to Poland starch. Another starch manufacturer, in Hampden, America, consumes 2,500 bushels per day. In a single district in Bavaria, in Germany, 400,000 lbs. of sago and starch are manufactured from potatoes; 100 lbs. of potatoes are said to yield 12 lbs. of starch. From experiments made in America, with three varieties of potatoes, the long reds, Philadelphia, and pink-eyes, it was found that the former yielded the most starch, *viz*., about 6 lbs. to the bushel. A bushel of potatoes weighs about 64 lbs. The following table from Accum, gives the rate of starch and component parts per cent. in different varieties:—

Sort.	Fibrine.	Starch.	Vegetable Albumen.	Gum.	Acids and Salts.	Water.
Red potatoes	7.0	15.0	1.4	4.1	5.1	75.0
Ditto germinated	6.8	12.2	1.3	3.7		73.0
Potato sprouts	2.8	0.4	0.4	3.3		93.0
Kidney potatoes	8.8	9.1	0.8			81.3
Large red ditto	6.0	12.9	0.7			78.0
Sweet ditto	8.2	15.1	0.8			74.3
Potato of Peru	5.2	15.0	1.9	1.9		76.0
Ditto of England	6.8	12.9	1.1	1.7		77.5
Onion potato	8.4	18.7	0.9	1.7		70.3
Voigtland	7.1	15.4	1.2	2.0		74.3
Cultivated in the						

environs of Paris	6.8	13.3	0.9	3.3	1.4	73.1

The first six varieties were analysed by Einhoff, the next four by Lamped, and the last named by Henry.

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YAMS.

The different species of yams have a wide range. In the West Indies there are several varieties, having distinctive names, according to quality, color, &c., as the white yam, the red yam, the negro yam, the creole yam, the afoo yam, the buck yam (*Dioscorea triphylla*), which is found wild in Java and the East; the Guinea yam, the Portuguese yam, the water yam, and the Indian yam, &c. The last is considered the most farinaceous and delicate in its texture, resembling in size the potato; most of the other sorts are coarse, but still very nutritive and useful. The common yam (*Dioscorea sativa*) is indigenous to the Eastern Islands and West Indies. The Guinea yam (*D. aculeata*) is a native of the East. The Barbados or winged yam (*D. alata*?) has a widely extended range, being common to India, Java, Brazil, and Western Africa. The yam species are climbing plants, with handsome foliage, of the simplest culture, which succeed well in any light, rich, or sandy soil, and are readily increased by dividing the tuberous roots. The Indian, Barbados, and red yams are planted in the West Indies early in May, and dug early in the January following. If not bruised, they will keep well packed in ashes, the first nine, and the second and last twelvemonths. The Portuguese and Guinea yams are planted early in January and dug in September. Creole yams and Tanias are dug in January. Sweet potatoes from January to March. In most of our colonies large crops of the finest descriptions of yams, cocos, &c., could be obtained, but the planting of ground provisions is too much neglected by all classes. From the tubers of yams of all sorts, and particularly the buck yam, starch is easily prepared, and of excellent quality. Some varieties of the buck yam are purple-fleshed, often of a very deep tint, approaching to black, and although this is an objection, because it renders more washing necessary, yet even from these the starch is at last obtained perfectly white.

As an edible root the buck yam, especially when grown in a light soil, is equal to the potato, if not superior to it. It does not, however, keep for any length of time, and therefore could not be exported to Europe, unless the roots were sliced and dried.

Yams and sweet potatoes thrive well in the northern parts of Australia; indeed the former are indigenous there, and constitute the chief article of vegetable food used by the natives. The yam was introduced into Sweden, where it succeeded well, and bread, starch, and brandy were made from it, but it prefers a warmer climate.

Yams are occasionally brought to this country. When cooked, either by roasting or boiling, the root is even more nutritious than the potato, nor is it possessed of any unpalatable flavor, the pecularity being between that of rice and the potato. Dressed in milk, or mashed, they are absolutely a delicacy; and from the abundance in which they are cultivated in the West Indies and other parts, they promise to become a most economical and nutritious substitute for the potato.

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The yam frequently grows to the enormous size of forty or fifty pounds weight, but in this large state it is coarse-flavored and fibrous.

An acre of land is capable of producing 41/2 tons of yams, and the same quantity of sweet potatoes, within the twelve months, or nine tons per acre for both, being nearly as much as the return obtained at home in the cultivation of potatoes; and I have the authority of all analytical chemists for saying that in point of value, as an article of food, the superiority is as two to one in favor of the tropical roots.

The kidney-rooted yam (*D. pentaphylla*), is indigenous to the Polynesian islands, and is sometimes cultivated for its roots. It is called *kawaii* in the Feejee islands. *D. bulbifera*, a native of the East, is also abundantly naturalised in the Polynesian islands, but is not considered edible.

There are seven or eight kinds of yams grown in India. Two are of a remarkably fine flavor, one weighing as much as eighteen pounds, the other three pounds. These are found in the Tartar country.

COCOS OR EDDOES

Arum esculentum.—This root has not hitherto been considered of sufficient importance to demand particular care in its cultivation, except by those who are engaged in agricultural pursuits, and derive their subsistence from the production of the soil. But though the cultivation of the root is almost unknown to the higher classes in society, and little regarded by planters in the colonies, it is a most valuable article of consumption. Amongst the laboring population it is the principal dependence for a supply of food. Long droughts may disappoint the hopes of the yam crop, storms and blight may destroy the plantain walks, but neither dry or wet weather materially injure the coco; it will always make some return, and though it may not afford a plentiful crop, it will yield a sufficiency until a supply can be had from other sources. For this reason the laborer in the West Indies always takes care to put in a good plant of cocos to his provision ground as a stand by, and knowing their value, is perhaps the only person who bestows any degree of care or attention upon them. Previous to their emancipation, whole families of negroes lived upon the produce of one provision ground, and the coco formed the main article of their support. Where the soil is congenial to the white and black Bourbon coco, the labor of one industrious person once a fortnight will raise a supply sufficient for the consumption of a family of six or seven persons. The coco begins to bear after the first year, and with common care and cultivation the same plant ought to give annually two or three returns for several years. In Jamaica, a disease something similar to that affecting the potato, has been found injurious to the coco root. This disease, which has baffled all inquiry as to its origin, affects the plants in and after the second year of their being planted. The first indication of it is the change in the leaves, which gradually turn to a yellow hue, have a sickly appearance, and at length drop off at the surface of the earth. The stock or “coco head,” as it is called, below ground, having become rotten, nothing but a soft pulpy mass remains. In some fields every third or fourth root is thus affected, in others much greater numbers are destroyed, so much so that the field requires to be almost entirely replanted, by which not only an expense is entailed, but a heavy loss sustained, from the field being thrown out of its regular bearing. The black coco seems to suffer less than the white.

Another species, the Taro (*Arum Colocasia*, *Colocasia esculenta* and *macrorhizon*), is an important esculent root in the Polynesian islands. In the dry method of culture practised on the mountains of Hawaii, the roots are protected by a covering of fern leaves. The cultivation of taro is hardly a process of multiplication, for the crown of the root is perpetually replanted. As the plant endures for a series of years, the tuberous roots serve at some of the rocky groups as a security against famine. It is also extensively cultivated in Madeira and Zanzibar, and has even withstood the climate of New Zealand. It is grown also in Egypt, Syria, and some of the adjacent countries, for its esculent roots. A species is cultivated in the Deccan, for the sake of the leaves, which form a substitute for spinach. Farina is obtained from the root of *Arum Rumphii* in Polynesia.

SWEET POTATOES.

The batatas, or camote of the Spanish colonies (*Convolvulus batatas*, Linn; *Batatas edulis*, of Choisy, and the *Ipomaea Batatas* of other botanists), belongs to a family of plants which has been split into several genera. It is a native of the East Indies, and of intertropical America, and was the “potato” of the old English writers in the early part of the fourteenth century. It was doubtless introduced into Carolina, Georgia, and Virginia soon after their settlement by the Europeans, being mentioned as one of the cultivated products of those colonies as early as the year 1648. It grows in excessive abundance throughout the Southern States of America, and as far north as New Jersey, and the southern part of Michigan. The varieties cultivated there are the purple, the red, the yellow, and the white, the former of which is confined to the South.

The amount of sweet potatoes exported from South Carolina in 1747-48, was 700 bushels; that of the common potato exported from the United States, 1820-21, 90,889,000 bushels; in 1830-31, 112,875,000 bushels; in 1840-41, 136,095,000 bushels; in 1850-51, 106,342,000 bushels.

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The sweet potato is cultivated generally in all the intertropical regions, for the sake of its roots, and as a legume in temperate countries. In the Southern States of North America, the culture ceases in Carolina under latitude 36 degs.; in Portugal and Spain it reaches to latitude 40 and 42 deg.; and as a legume its cultivation is attempted to the vicinity of Paris. In India it is a very common crop; its tubers are very similar to the potato, but have a sweeter taste, whence the common name; but it must not be confounded with the topinambur (*Helianthus tuberosus*), a native of Brazil, which is less cultivated. The root contains much saccharine and amylaceous matter.

Several marked varieties of the sweet potato are raised in the Polynesian groups. In some islands it forms the principal object of cultivation.

It is grown in the Northern districts of New Zealand, at Zanzibar, Monomoisy, Bombay, and other parts of the East Indies. They are raised on the bare surface of the rock in some parts of the Hawaiian islands, and a sourish liquor is procured from them. It was early cultivated on the Western Coast of Africa, for the Portuguese Pilot (who set out on his voyages to the colony at St. Thomas, in the Gulf of Guinea) speaks of this plant, and states that it is called “batata” by the aboriginals of St. Domingo. They are abundant at Mocha and Muscat. Sweet potatoes form a principal and important crop in the Bermudas.

A valuable addition has lately been made to the votaries of the sweet potato in Alabama, supposed to be from Peru. A letter describing it says:—“It is altogether different and equally superior to any variety of this root hitherto known. It is productive, and attains a prodigious size, even upon the poorest sandy land, and the roots remain without change from the time of taking them out of the ground until the following May. The plant is singularly easy of cultivation, growing equally well from the slip or vine, the top or vine of the full-grown plant being remarkably small; the inside is as white as snow. It is dry and mealy, and the saccharine principle contained resembles in delicacy of flavor fine virgin honey.”

There is in general a great error in cultivating this root, as most people still plant in the old way, two or three sets in the hole, which is a great deal too close.

When a piece of land is to be planted in sweet potatoes, it should be top-dressed with some manure, to be dug or ploughed under a week or two before it is to be planted. Drills should be made two feet apart, and the potatoes placed in the drill about one foot asunder. From eight to twelve to the pound are the best size for planting. The “white upright” kind, when intended for sets, should be taken up early in March, and kept about a month, so as to be quite dry before planting. Abundant crops can rarely be raised from the stem of the “uprights;” the old potato, however, grows to a large size. I have planted a potato weighing about an ounce, and dug it up in August, weighing over two pounds. The drills can be made with a small plough to great advantage, when a person understands it.

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The best manure for the sweet potato is anything green, such as fresh seaweed, green oats, bushes, or anything of the kind, put in in abundance.

Care should be taken to get early and good strong slips. A slip with about six joints is quite long enough; three or four joints to be put under ground, and the rest above. For slips, the land must be prepared as already described for the potatoes; this should be done before the slips are ready to cut.

The best way to plant slips is to drill, the same way as for the potatoes, only a little closer; then put the end of the slip in, leaving about two joints out of ground, placing them one foot apart. The drills can be made in dry weather, so as not to have any delay when it rains; by this means a great many can be planted in a day.

The best land for sweet potatoes is the light sandy kind; a rich friable black mould, or a rocky substratum; for hill sides, rocky ravines, and places which would be called barren and unprofitable for other crops, are found to yield a good return when planted with sweet potatoes. The best time to plant slips to get stock from, is the latter end of August or early in September, as the season may suit.

The sweet potato of Java, says Mr. Crawfurd, is the finest I ever met with. Some are frequently of several pounds weight, and now and then have been found of the enormous weight of 50 lbs. The sweetness is not disagreeable to the palate, though considerable, and they contain a large portion of farinaceous matter, being as mealy as the best of our own potatoes. In Java it is cultivated in ordinary upland arable, or in the dry season as a green crop in succession to rice.

A tuberous root (*Ocymum tuberosum*), an inhabitant of the hot plains, is frequently cultivated in Java. It is small, round, and much resembling in appearance the American potato, but has no great flavor. Its local name is *kantang*.

CASSAVA OR MANIOC.

Of this plant, which is a shrub about six feet high, extensively grown for its farinaceous root, there are several species, nearly all natives of America, principally of Brazil, whence it derives one of its common names of Manihot or Mandioc. Two species of Manihot have been found indigenous in South Australia. The varieties commonly cultivated for their roots, are the sweet and the bitter.

1. Sweet cassava (*Janiphi* (or *Jatropha*,) *Loeflingii*, Kunth; *Manihot Aipi*, of Pohl).—This species has a spindle-shaped root brown externally, about six or seven ounces or more in weight, which contains amylaceous matter, without any bitterness, and is used as food, after being rasped and washed, so as to cleanse it from the fibrous matter, in the same manner as arrowroot is prepared. It is distinguished from the bitter cassava by a

tough ligneous fibre, which runs through the heart of the tuber. Manihot starch is sometimes imported into Europe under the name of Brazilian arrowroot. The cassava is known in Peru as *yucca*.

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A dry mixed soil is best suited to its culture. So exhausting is this crop, that it cannot be raised more than two or three times successively on the same land. The roots arrive at maturity in eight or nine months after planting, but may be kept in the ground a much longer time without injury. Sweet cassava might be sliced, dried in the sun, and sent to Europe in that state. In dry weather the process succeeds remarkably well, and the dried slices keep for a considerable time. Dr. Shier ascertained that when these sliced and dried roots were first steeped and then boiled, they return to very nearly their original condition, and make an excellent substitute for the potato.

The plant thrives on even the poorest soil; the mode of planting is simple. It consists in laying cuttings a foot long in square pits a foot deep, and covering them with mould, leaving the upper ends open. From two to four pieces may be placed in each square. The planting ought to be in the rainy season. The cuttings must be made from the full-grown stem. A humid soil causes the root to decay, a dry soil is therefore more adapted for its cultivation. As blossoms are occasionally plucked from potato plants, so the manihot or cassava is deprived of its buds to increase the size of its roots. The raw root of the bitter species, when taken out of the ground, is poisonous—if exposed, however, to the sun for a short time, it is innocuous, and when boiled is quite wholesome.

The starch of the root of the manioc is prepared in the following manner, as described by Dr. Ure:—” The roots are washed and reduced to a pulp by means of a rasp or grater. The pulp is put into coarse strong canvas bags, and thus submitted to the action of a powerful press, by which it parts with most of its noxious juice. As the active principle of this juice is volatile, it is easily dissipated by baking the squeezed cakes of pulp upon a plate of hot iron. The pulp thus dried concretes into lumps, which become hard and friable as they cool. They are then broken into pieces, and laid out in the sun to dry. In this state they are a wholesome nutriment. These cakes constitute the only provisions laid in by the natives, in their voyages upon the Amazon. Boiled in water, with a little beef or mutton, they form a kind of soup similar to that of rice.

The cassava cakes sent to Europe are composed almost entirely of starch, along with a few fibres of the ligneous matter. It may be purified by diffusion in warm water, passing the milky mixture through a linen cloth, evaporating the straining liquid over the fire, with constant agitation. The starch, dissolved by the heat, thickens as the water evaporates, but on being stirred it becomes granulated, and must be finally dried in a proper stove.

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2. Bitter cassava (*Janipha Manihot*, of Kunth; *Jatropha Manihot*, of Linnaeus; and *Manihot utilissima*, Pohl).—This species has a knotty root, black externally, which is occasionally 30 lbs. in weight. In the root there is much starchy matter deposited, usually along with a poisonous narcotic substance, which is said to be hydrocyanic acid. The juice of the plant, when distilled, affords as a first product a liquor which, in the dose of thirty drops, will cause the death of a man in six minutes. It is doubted whether this acid pre-exists in the plant; some suppose it to be generated after it is grated down into a pulp. It can be driven off by roasting, and then the starch is used in the form of cassava bread. It is principally from the starch of the bitter cassava that tapioca is prepared by elutriation and granulating on hot plates. This serves to agglutinate it into the form of concretions, constituting the tapioca of commerce. This being starch very nearly pure, is often prescribed by physicians as an aliment of easy digestion. A tolerably good imitation of it is made by beating, stirring, and drying potato starch in a similar way.

The grated starch of the roots, floated in water, is spontaneously deposited, and when repeatedly washed and dried in the sun, forms cassava flour, called “Moussache” by the French.

The juice of the bitter cassava, mixed with molasses and fermented, has been made into an intoxicating liquor, which is much relished by the negroes and Indians.

The concentrated juice of the bitter cassava, under the name of cassareep, forms the basis of the West India dish, “pepper pot.” One of its most remarkable properties is its highly antiseptic power, preserving meat that has been boiled in it for a much longer period than can be done by any other culinary process. Cassareep was originally an Indian preparation.

The manioc or cassava is cultivated in America, on both sides of the equator, to about latitude 30 degrees north and south. Among the mountains of intertropical America, it reaches to an elevation of 3,200 feet. It is cultivated also in great abundance on the island of Zanzibar, and among the negro tribes of Eastern Africa to the Monomoesy, inclusive; on the west coast of Africa, in Congo and Guinea. It appears not to have been introduced into Asia. The farina of the manioc is almost the only kind of meal used in Brazil, at least in the north, near the equator. An acre of manioc is said to yield as much nutriment as six acres of wheat. Meyen states, “It is not possible sufficiently to praise the beautiful manioc plant.” The Indians find in this a compensation for the rice and other cerealia of the Old World. It has been carried from Brazil to the Mauritius and Madagascar.

The following quantities of Brazilian arrowroot, or tapioca, were imported in the undermentioned years:—

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Cwts.	
1833	942
1834	888
1835	1,663
1836	3,735
1837	2,142
1838	462
1839	402
1840	983
1841	1,870
1843	2,325

St. Lucia grows a considerable quantity of manioc; it exported of cassava flour in—

Barrels.	
1827	8
1828	814
1829	279
1830	99
1831	59
1834	713

The cassava root grows abundantly in most of the West India islands and tropical America; the trouble of planting is inconsiderable, and the profit arising from its manufacture, even by the common process of hand-grating, is immense. I should be glad if I could induce the enterprising of our colonial settlers to give this a fair trial, as well as encourage the present growers to increase their crops and improve the quality of the article, so as to render it suitable for the English market. The manufacture of starch will one of these days become a productive source of colonial wealth. Since cassava was first grown in the West, its capabilities as a starch-producer have, to a certain extent, been known, and for that purpose it has been in limited use.

Mr. James Glen, of Haagsbosch plantation, Demerara, has recently tested its value as an article of export, and added it to the other industrial resources of that colony.

This gentleman, by erecting machinery on his plantation for grinding the root and preparing the starch of the bitter cassava, has already shipped the article in considerable quantities to Europe, and it has been sold at a price which puts the profit upon sugar cultivation completely to the blush. His agent in Glasgow writes, that any quantity (like that already shipped) can command a ready sale at 9d. per lb. Its use is co-extensive, or nearly so, with that of sugar. The productive capabilities of the soil are not perhaps generally known; nor is it necessary that, to pay the grower there, it should bring even half that price. A sample of a ton, which was prepared at Haagsbosch in 1841, was submitted for examination to Dr. Shier, at the colonial laboratory, Georgetown, who admitted it to be a beautiful specimen of starch, although it had undergone but *one* washing. The root from which it was made, was planted eight or nine months previously, upon an acre of soil, which had never undergone any preparation of ploughing, or been broken and turned up in any way. The plants were never weeded after they had begun to spring, nor were they tended or disturbed until they were ripe and pulled up. The expense of planting the acre was five dollars, and reaping this crop would, I suppose, amount to as much more, say L2 in all. The green cassava was never weighed, but the acre yielded fully a ton of starch—equal, at 9d. per lb., to L84.

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The experimental researches of Dr. Shier have led him to believe that the green bitter cassava will give one-fifth its weight of starch. If this be the case the return per acre would, under favorable circumstances, when the land is properly worked, be enormous. On an estate at Essequibo, a short time ago, an acre of cassava, grown in fine permeable soil, was lifted and weighed; it yielded 25 tons of green cassava. Such a return as this per acre would enable our West India colonies to inundate Great Britain with food, and at a rate which would make flour to be considered a luxury. Dr. Shier is convinced that, in thorough drained land, where the roots could penetrate the soil, and where its permeability would permit of their indefinite expansion, a return of 25 tons an acre might uniformly be calculated upon. What a blessing, not only for those colonies, but for the world, would the introduction be of this cheap and nutritious substitute for the potato.

NEW TUBEROUS PLANTS RECOMMENDED AS SUBSTITUTES FOR THE POTATO.

In the present disturbed state of the grain markets of Europe, the advantage of cultivating plants which directly or indirectly can form a substitute for the potato, admits of no doubt. It appears to me, moreover, that when the way is once opened up, even under ordinary circumstances, the tropical colonies of Great Britain, without diminishing the quantity of sugar and coffee they produce, could advantageously supply the British market with the purest starches, and possibly also with various other articles of farinaceous food. Anything that will lead the planters to a more varied cultivation than the present uniform and persistent one, will be advantageous to our colonies; and the growth of farinaceous root crops for exportation, cannot fail to produce most beneficial effects on that class of the peasantry in the British possessions, who are owners of small lots of land, which at present they either totally neglect, or cultivate most imperfectly.

In 1846, Dr. A. Gesner, one of my correspondents, called attention, in my “Colonial Magazine,” to two indigenous roots of North America, which he thought deserving special attention. These were *Apios tuberosa*, and *Claytonia acutiflora*, *or Virginiana*.

1. *A. tuberosa* (Boerhave), or *Glycine Apios*.—This plant is common throughout the Northern and Southern States of America, and is also met with in the lower British North American Provinces. It is known under the native name of *Saa-ga-ban* by the Micmac Indians, by whom the pear-shaped roots are used as an article of food. Like the *Arachis hypogaea*, it belongs to the Leguminosae family. The fruit and flower resemble those of the wood vetch. It is thus described in Professor Eaton’s “Manual of Botany for North America,” published in 1836:—“Color of corolla, blue and purple; time of flowering, July (and August in Nova Scotia), perennial; stem, twining; leaves, pinnate, with seven

lance-ovate leaflets; racemes shorter than the leaves, axillary; root, tuberous. Root very nutritive; ought to be generally cultivated."

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The average size of the tubers is that of cherries, but a few are found of much larger dimensions. In their appearance they resemble the common potato, having apparently the peculiar indentations called eyes. The skin of the tuber is of a rusty or blackish brown color. The interior is very white, and the root has the taste and odor of the common potato. The Indians state that the roots, if kept either in a dry or moist state, will not suffer any decay for a lengthened period. They are very farinaceous, and contain a large per centage of starch, which resembles that of wheat; by being dried the tuber shrinks a little, but it immediately expands on being thrown into warm water. It contains much nutritive matter, is wholesome, and I have no doubt, if properly cultivated, it will prove to be very prolific. The tubers are situated a few inches below the surface of the soil, and are strung together like beads by a strong ligament.

A similar kind of earth-nut, or tuberous root, probably the *Glycine subterranea* of Linnaeus, the Voandzou of Madagascar, is extensively cultivated in various parts of Africa.

2. *Claytonia acutiflora* or *Virginiana*, the Musquash of the Micmac Indians, is found throughout the Northern and Southern States of North America. It is thus described by Prof. Eaton, "Man. Bot. N.A."—"Color of corolla, white and red; situation, alpine, perennial; leaves, linear, lance-ovate; petals, obovate, retuse; leaves of the calyx, somewhat acute; root, tuberous. It blossoms in May. The seed is ripe in June, when the plant disappears."

These roots may be collected along the sea coasts and principal lakes and rivers of Nova Scotia, New Brunswick, and Prince Edward's Island, although they are not plentiful, for they are greedily devoured by some of the wild animals, and wherever swine have been permitted to run at large they have been destroyed.

Dr. Gesner shipped several bushels of the saa-ga-ban to the principal agricultural societies in Great Britain, also to Halifax, and Nova Scotia. The ordinary potato of this country does not yield more than 14 per cent. of starch, and it contains 76 per cent. of water. From the best saa-ga-ban Dr. Gesner obtained 21 per cent. of starch, and the quantity of water is reduced to 50 per cent. It also contains vegetable albumen, gum, and sugar. From these facts it is evident that the saa-ga-ban is much more nutritive than the potato, and the weight of the tubers, in their wild state, compared with the weight of the slender vine in the best samples, is equal in proportion to the common cultivated potato in its ordinary growth. The starch is very white, and closely resembles that made from the arrowroot. It is not improbable that the quantity of water in the tuber will be increased by cultivation; yet the fibrous parenchyma will be reduced, and taken altogether, the nutritive properties will be increased; if the plant improve as much by cultivation as the potato and many others have done, its success is certain.

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The North American Indians have several wild roots which they dig up for sustenance when other food is exhausted. Among these are—1st, the mendo, or wild sweet potato; 2nd, the tip-sin-ah, or wild prairie turnip; 3rd, the omen-e-chah, or wild bean. The first is found throughout the valleys of the Mississippi and St. Peter's, about the basis of bluffs, in rather moist but soft and rich ground. The plant resembles the sweet potato, and the root is similar in taste and growth. It does not grow so large or long as the cultivated sweet potato, but I should have thought it the same, were it not that the wild potato is not affected by the frost. A woman will dig from a peck to half a bushel a day.

The Indians eat them, simply boiled in water, but prefer them cooked with fat meat.

The wild potato, of the north-west of America, is a general article of food; it is called by them wabessepin; it resembles the common potato, is mealy when boiled, and grows only in wet clay ground, about one and a half feet deep. The crane potato, called sitchauc-wabessepin, is of the same kind, but inferior in quality. The Indians use these for food as well as the memomine, and another long and slender root called watappinee. Probably it is the first of these that is referred to by Nicollet, as the prairie potato. "All the high prairies (he says) abound with the silver-leafed *Psoralia*, which is the prairie turnip of the Americans, the *pomme des prairies* of the Canadians, and furnishes an invaluable food to the Indians." There are several species of *Psoralia*, *viz*., *esculenta*, *argophylla*, *cuspidata*, and *lanceolata*.

The prairie turnip grows on the high dry prairies, one or two together, in size from that of a small hen's egg to that of a goose egg, and of the same form. They have a thick black or brown bark, but are nearly pure white inside, with very little moisture. They are met with four to eight inches below the surface, and are dug by the women with a long pointed stick, forced into the ground and used as a lever. They are eaten boiled and mashed like a turnip, or are split open and dried for future use. In this state they resemble pieces of chalk. It is said that when thus dried they may be ground into flour, and that they make a very palatable and nutritious bread. M. Lamare Picot, a French naturalist, has lately incurred a very considerable expense to obtain the seed, which he has carried to France, believing that it is capable of cultivation, and may form a substitute both for potato and wheat.

The wild bean is found in all parts of the valleys where the land is moist and rich. It is of the size of a large white bean, with a rich and very pleasant flavor. When used in a stew, I have thought it superior to any garden vegetable I had ever tasted. The Indians are very fond of them, and pigeons get fat on them in spring. The plant is a slender vine, from two to four feet in height, with small pods two to three inches long, containing three to five small beans. The pod dries and opens, the beans fall to the ground, and in spring take root and grow again. The beans on the ground are gathered by the Indians, who sometimes find a peck at once, gathered by mice for their winter store.

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There are also several kinds of edible roots growing in the ponds or small lakes, which are gathered by the Indians for food.

The *psui-cinh-chah*, or swamp potato, is found in mud and water, about three feet deep. The leaf is as large as the cabbage leaf. The stem has but one leaf, which has, as it were, two horns or points. The root is obtained by the Indian women; they wade into the water and loosen the root with their feet, which then floats, and is picked up and thrown into a canoe. It is of an oblong shape, of a whitish yellow, with four black rings around it, of a slightly pungent taste, and not disagreeable when eaten with salt or meat.

The *psui-chah*, with a stem and leaf similar to the last, has a root about the size of a large hickory-nut. They grow in deep water, and being smaller are much more difficult to get, but the Indians prefer them; they have an agreeable taste, and are harder and firmer when cooked. Both these roots are found in large quantities in the musk-rat lodges, stored by them for winter use.

The *ta-wah-pah*, with a stem, leaf, and yellow flower, like the pond-lily, is found in the lakes, in water and mud, from four to five feet deep. The Indian women dive for them, and frequently obtain as many as they are able to carry. The root is from one to two feet in height, very porous; there are as many as six or eight cells running the whole length of the root. It is very difficult to describe the flavor. It is slightly sweet and glutinous, and is generally boiled with wild fowl, but is occasionally roasted.

In his exploring expedition into the interior of Guiana, in the region of the Upper Essequibo, Sir E. Schomburgk notices the discovery of a variety of Leguminosae, whose tubers grow to an enormous size, fully equal to the largest yam. These roots were not, at the time he was there, in full perfection, but their taste was somewhat between the yam and the sweet potato. The Taruma Indians called them Cuyupa. The roots are considered fit for use when the herb above ground dies. Sir Robert brought a few of the seeds of the plant with him on his return to Demerara.

Two interesting productions have been recently introduced into the Jardin des Plantes, at Paris, from the Ecuador, by M. Bourcier, formerly Consul-General of France in that country. One is the red and yellow *ocas*, which is of the form of a long potato, and has the taste of a chesnut; the other is the *milloco*, which has the taste and form of our best potatoes. These two roots, which are found in great abundance in the neighbourhood of Quito, grow readily in the poorest land. The *oca* is cultivated in the fields of Mexico, but only succeeds in the warmer districts. From the bulbous roots of the cacomite, a species of *Tigridia*, a good flour is also prepared there.

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Stevenson ("Travels in South America," vol. ii., p. 55) says, a root called the oca is cultivated in several of the colder provinces of Peru. "This plant," he states, "is of a moderate size, in appearance somewhat like the acetous trefoil; the roots yellow, each about five or six inches long, and two in circumference. They have many eyes, and the roots, several of which are yielded by one plant, are somewhat curved. When boiled it is much sweeter than the camote or batata; indeed it appears to contain more saccharine matter than any root I ever tasted; if eaten raw it is very much like the chesnut. The roots may be kept for many months in a dry place. The transplanting of the oca (he adds) to England, where I am persuaded it would prosper, would add another agreeable and useful esculent to our tables."

The Brussels paper, *L'Emancipation*, mentions that a root has been discovered by the Director of the Museum of Industry, in that place, destined to take the place of the potato. It is the *Lathyrus tuberosus*, called by the peasants the earth mouse, on account of its form, and the earth chesnut on account of its taste. This plant exists only in some localities of Lorraine and Burgundy. The Lathyrus has never been cultivated, and it is thought that it will attain, with cultivation, the size of the potato. The French peasants have a prejudice against cultivating it, because they say it walks under ground, and leaves the place it is planted in to go into the neighbouring field. The fact is, that it grows in a chaplet, of which the bulbs are arranged along a root running horizontally, of which the two extremities are very rarely found, so that on taking up the hinder tubercles it continues its growth in front, which gives rise to the saying that if the plant had only time enough, it would make the tour of the world.

The bulb of *Gastrodia sesamoides* (R. Brown), a curious herbaceous species of orchis, native of New Holland, is edible, and preferred by the aborigines to potatoes and other tuberous roots. Some of my accredited informants believe it might be turned to profitable account, but being a parasitic plant, it could scarcely be systematically cultivated. It flourishes in its wild state on loamy soil in low or sloping grounds. The first indication of its vegetation in the spring, is the appearance of a whitish bulb above the sward, of an hemispherical shape, and about the size of a small egg. The dusky white covering resembles a fine white net, and within it is a pellucid gelatinous substance. Again within this is a firm kernel, about as large as a Spanish nut, and from this a fine fibrous root descends into the soil. It is known in Van Diemen's Land, and other parts of Australia, by the common name of native bread. Captain Hunter, in his Journal of the Transactions at Port Jackson on the first settlement of the Convict Colony, speaks of finding large quantities of "wild yams," on which the natives fed, but the roots were not bigger than a walnut; therefore it was probably this plant.

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Arracacha esculenta, of Bancroft and Decandolle (*Conium Arracacha*).—This perennial herb is a native of South America, which, from its salubrious qualities, is extensively cultivated in the mountains of Venezuela and other parts of tropical and Southern America, for culinary purposes. It is propagated by planting pieces of the tuberous root, in each of which is an eye or shoot. The late Baron de Shack introduced it into Trinidad, from Caraccas, and it has thence been carried to the island of Grenada. It throve there remarkably well, but has been unaccountably neglected. He also sent roots of this valuable plant to London, Liverpool, and Glasgow. Although it bears cold better than the potato, it requires a warmer and more equal temperature than most of the countries of Europe afford. It would, however, make an excellent addition to the culinary vegetables of many tropical countries, uniting the taste of the potato and parsnip, but being superior to both.

The arracacha has been introduced into the South of Europe, not as a substitute for, but as a provision against a failure of the potato crop. It is highly recommended by the Rev. J.M. Wilson, in the "Rural Encyclopaedia."

Stevenson ("Travels in South America," vol. ii., p. 383) says the yucas (cassava), camotes (sweet potatoes), and yams cultivated at Esmeraldas and that neighbourhood, were the finest he ever saw. "It is not uncommon for one of these roots to weigh upwards of twenty pounds. At one place I saw a few plants of the yuca that had stood upwards of twenty years, the owner having frequently bared the bottom of the plants and taken the ripe roots, after which, throwing up the earth again, and allowing a sufficient time for new roots to grow, a continual succession of this excellent nutritious food was procured."

The Aipi grows in Brazil, and according to T. Ashe, may be eaten raw, and, when pressed, yields a pleasant juice for drink; or being inspissated by the heat of the sun, is kept either to be boiled and eaten, or dissolved and drank. The tapinambar grows in Chili, and is used by the Indians.

The tapioca, or bay rash, a plant which grows about the out-islands of the Bahamas group, was found of great use as a food plant to the inhabitants of Long Island, during a scarcity of food occasioned by the drought in 1843. This root grows in the form of a large beet, and is from twelve to sixteen inches in length. It is entirely farinaceous, and, when properly ground and prepared, makes good bread. It fetches there four to six cents a pound.

The root of the kooyah plant (*Valeriana edulis*) is much used by some of the North American Indians as food. The root is of a very bright yellow color, with a peculiar taste and odor, and hence is called "tobacco root." It is deprived of its strong poisonous qualities by being baked in the ground for about two days. A variety of other roots and tubers furnish them with food. Among these are kamas root (*Camassia esculenta*), which is highly esteemed; the bulb has a sweet pleasant flavor, somewhat of the taste of preserved quince. It is a strikingly handsome bulbous plant, with large beautiful purple flowers. Yampah root (*Anethum graveolens*) is a common article of food with the Indians of the Rocky Mountains.

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The roots of a thistle (*Cersium virginianium*, or *Carduus virginianus*), which are about the ordinary size of carrots, are also eaten by them. They are sweet and well flavored, but require a long preparation to fit them for use.

The people of Southern India and Ceylon have for many hundred years been in the habit of eating the bulb or root, which is the first shoot from the Palmyra nut, which forms the germ of the future tree, and is known locally as *Pannam kilingoes*. It is about the size of a common carrot, though nearly white. It forms a great article of food among the natives for several months in the year; but Europeans dislike it from its being very bitter. Recent experiments have proved that a farina superior to arrowroot can be obtained from it, prepared in the same way; and 100 roots, costing 21/2d., yield one and a-half to two pounds of the flour.

From the boiled inner bark of the Russian larch, mixed with rye flour, and afterwards buried a few hours in the snow, the hardy Siberian hunters prepare a sort of leaven, with which they supply the place of common leaven when the latter is destroyed, as it frequently is by the intense cold. The bark is nearly as valuable as oak bark. From the inner bark the Russians manufacture fine white gloves, not inferior to those made of the most delicate chamois, while they are stronger, cooler, and more pleasant for wearing in the summer.

The fruit of the *Cycas angulata* forms the principal food of the Australian aborigines during a portion of the year. They cut it into thin slices, which are first dried, afterwards soaked in water, and finally packed up in sheets of tea-tree bark. In this condition it undergoes a species of fermentation; the deleterious properties of the fruit are destroyed, and a mealy substance with a musty flavor remains, which the blacks probably bake into cakes. They appear also to like the fruit of the *Pandanus*, of which large quantities were found by Dr. Leichardt in their camps, soaking in water, contained in vessels formed of stringy bark.

The flour obtained from the seeds of Spurry (*Spergula sativa*), when mixed with that of wheat or rye, produces wholesome bread, for which purpose it is often used in Norway and Gothland. In New Zealand, before the introduction of the potato, the roots of the fern were largely consumed.

Many species of *Bolitus* are used as food by the natives in Western Australia, according to Drummond.

The thick tuberous roots of a climbing species of bean (*Pachyrhizus angulatus*, or *Dolichos bulbosus*) are cultivated and eaten in some parts of the Polynesian islands. The bulbous roots of some species of Orchideae are eagerly sought after in New South Wales by the natives, being termed “boyams,” and highly esteemed as an article of food for the viscid mucilage which they contain. The root of the Berar (*Caladium costatum*) is eaten by the natives of the Pedir coast (Achin), after being well washed.

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The pignons or edible seeds of *Pinus Pinea* are consumed occasionally in Italy. In Chili the cone or fruit of the *pehuen*, or *pino de la tierra*, are considered a great delicacy. The *pinones* are sometimes boiled, and afterwards, by grinding them on a stone, converted into a kind of paste, from which very delicate pastry is made. The pine is cultivated in different parts of this province on account of its valuable wood and the pinones. The seeds from the cones of the Auracanean pine, collected in autumn, furnish the Pawenches (from *pawen* pine) and Auracanians with a very nutritious food. When cooked, the flavor is not unlike that of the chesnut, and as they will keep for some time, they constitute, when the gathering season has been favorable, a great part of their diet.

The seeds of the cones of the nut pine (*Pinus monophyllus*), a new species described by Dr. Torrey, and alluded to by Col. Fremont in his exploring expedition to the Rocky Mountains, are largely used by the North American Indians. The nut is oily, of a most agreeable flavor, and must be very nutritious as it constitutes the principal subsistence of many of the native tribes.

The cone of another magnificent pine (*Auracaria Bidwillii*), indigenous to the Eastern coast of Australia, about the Moreton Bay district, is frequently met with twelve inches in diameter, and containing 150 edible seeds as large as a walnut. The aborigines roast these seeds, crack the husk between two stones, and eat them hot. They taste something like a yam or hard dry potato. The trees bear cones only once in four years, during a period of six months. This season is held as a great festival by the aborigines of that locality, called by them Bunga Bunga, and they congregate in greater numbers than is known in any other part of Australia, frequently coming from a distance of 300 miles. They grow sleek and fat upon this diet. An Act has been passed by the legislature of the colony, prohibiting, under heavy pains and penalties, the demolition of those trees, being the natural food of the natives.

The common people eat the seeds of the red sandal wood (*Adenanthera Pavonina*) in the South of India. The pulp of the fruit of the *Adansonia digitata*, or monkey bread, is also used as an article of food.

SINGHARA OR WATER NUTS.—The large seeds of *Trapa bicornis*, a native of China, and of *T. bispinosa* and *natans*, species indigenous to India, are sweet and eatable, and the aquatic plants which furnish them are hence an extensive article of cultivation. In Cashmere and other parts of the East they are common food, and known under the name of Singhara nuts. In Cashmere the government obtains from these nuts L12,000 of annual revenue. Mr. Moorcroft mentions that Runjeet Sing derived nearly the same sum. From 96,000 to 128,000 loads of this nut are yielded annually by the lake of Ooller

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alone. The nut abounds in fecula. In China the kernel is used as an article of food, being roasted or boiled like the potato. The seeds of various species of *Nelumbium*, natives of the East Indies, Jamaica, and the United States, also form articles of food. The fruit of *N. speciosum* is supposed to be the Egyptian bean of Pythagoras. The petioles and peduncles contain numerous spiral vessels, which have been used for wicks of candles. The fruit of *Willughbeia edulis*, a native of the East, as its name implies, is eatable. The kernel of the mango can be reduced to an excellent flour for making bread.

Not only from the Lichen tribe, but also from the Algae, fungi, mosses and ferns man derives nutriment and valuable products. Some of the cryptogamic plants form considerable articles of commerce, particularly as food plants, affording gelatinous and amylaceous matter, and being useful in medicine and the arts.

Nostoe eduli is used in China as food; *Gelidium corneum* enters into the formation of the edible swallows' nests of the Japanese islands. Agar-agar moss is shipped from Singapore to the extent of 13,000 tons a-year. Irish moss, Iceland moss, Ceylon moss, and some others, are also of some importance. Iodine and kelp are prepared to a considerable extent from sea weeds; one species (*Fucus tenax*) furnishes large supplies of glue to the Canton market, and the orchilla weed is of great importance to the dyer. It is principally as food that I have to speak of them in this section.

In some of the islands off the Scotch coasts, sea-wrack (*Fucus vesiculosus*) forms the chief support of horses and cattle in the winter months. *F. serratus* is similarly employed in Norway.

The *Laminaria saccharina* is interesting from the fact of its containing sugar. It is highly esteemed in Japan, where it is extensively used as an article of diet, being first washed in cold water and then boiled in milk or broth.

CARRAGEEN, or IRISH ROCK MOSS, *Sphaeroccus* (*Chondus*) *crispus*, abounds on the Western Coast of Ireland, round the Orkneys, Hebrides, Scilly Islands, &c. It is purplish white, and nearly transparent, and is largely imported to feed cattle and pigs in Yorkshire. It is also used for dressing the warp of webs in the loom, and mixing with the pulp for sizing paper in the vat. It swells up like tragacanth in water; and, by long decoction, affords a considerable quantity of a light, nutritious, but nauseous jelly. It is sometimes sold as pearl moss, and is employed in the place of gelatine or isinglass for preparing blanc-manges, jellies, &c. It fetches about L7 the ton.

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AGAR-AGAR, a sort of edible seaweed, or tripe de roche, is found growing on the rocks about the eastern islands that are covered by the tide. It is much used for making a kind of jelly, which is highly esteemed both by Europeans and natives for the delicacy of its flavor. The first quality is worth about 30s. the picul (133 lbs.). An inferior kind is collected on the submerged banks in the neighbourhood of Macassar (Celebes), by the Bajow Laut, or Sea Gipsies. It is also collected on the rocks about the settlement of Singapore, for export to China, where it is much used as a size for stiffening silks and for making jellies. It constitutes the bulk of the cargoes of the Chinese junks on their return voyage. The quantity shipped from Singapore is about 10,000 piculs (12,500 tons) annually.

ICELAND MOSS (*Cetraria islandica*) combines valuable alimentary and medicinal properties. It is imported in bags and barrels from Hamburg and Gothenburg, and is said to be the produce of Norway and Iceland. The quantity consumed varies; in 1836, 20,599 lbs. paid duty; in 1840, 6,462 lbs. In Carniola, swine, oxen, and horses, are fattened on it. Boiled in water or milk, and flavored to the palate with sugar, wine, and aromatics, it forms a very agreeable diet for invalids.

CEYLON MOSS (*Gracelaria*, or *Gigartina, lichenoides*), a small and delicate fucus, is well known for the amylaceous property it possesses, and the large proportion of true starch it furnishes. The fronds are filiform; the filaments much branched, and of a light purple color. It grows abundantly in the large lake or back-water which extends between Putlam and Calpentyr, Ceylon. It is collected by the natives principally during the south-west monsoon, when it becomes separated by the agitation of the water. The moss is spread on mats and dried in the sun for two or three days. It is then washed several times in fresh water, and again exposed to the sun, which bleaches it, after which it is collected in heaps for exportation.

Professor O'Shaughnessy has given the best analysis of this moss, which he described under the name of *Fucus amylaceus*; 100 grains weight yielded the following proportions:—

Vegetable jelly 54.50
True starch 15.00
Ligneous fibre 18.00
Sulphate and muriate of soda 6.50
Gum 4.00
Sulphate and phosphate of lime 1.00

Total 99.00
With a trace of wax and iron.

I observe among the imports into New Orleans, 911 bushels of Spanish moss in 1849, and 1,394 bushels in 1848. I do not know precisely its use, or from whence derived, but I believe it is chiefly used for stuffing cushions, mattresses, &c.

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FERN.—The rhizome of *Pteris esculenta* is used as food in Australia, and that of *Marattia alata* in the Sandwich Islands. The trunks of the *Alsophila*, or tree fern, of the western side of Van Diemen's Land, and of the common tree fern, *Cibotium Billardieri* (the *Dicksonia antarctica*, of Labillardiere), contain the edible pith or bread-fruit eaten by the natives. Many other species of ferns are esculent. Typha bread is prepared in Scinde from the pollen of the flowers of the *Typha elephantina*, and in New Zealand from another species of bulrush (*Typha utilis*).

"It must not be supposed, as some have believed, that the fern root, wherever it grows, is fit for food. On the contrary, it is only that found in rich loose soils which contains fecula in sufficient quantity for this purpose: in poorer ground the root contains proportionally more fibre. We were now encamped on an alluvial flat in the valley of the river, thirty or forty feet below the general level of the plain; and I observed that, even in this favourable spot, a great deal of discrimination was used in selecting the best roots, which was discoverable by their being crisp enough to break easily when bent: those which would not stand this test being thrown aside. Here a quantity sufficient for several days was procured, and was packed in baskets, to last till another spot equally favourable could be reached.

"The process of cooking fern root is very simple; for it is merely roasted on the fire, and afterwards bruised by means of a flat stone similar to a cobbler's lap-stone, and a wooden pestle. The long fibres which run like wires through the root are then easily drawn out; and the remainder is pounded till it acquires the consistence of tough dough, in which state it is eaten, its taste being very like that of cassava bread. Sometimes it is sweetened with the juice of the 'tutu.'

"The natives consider that there is no better food than this for a traveller, as it both appeases the cravings of hunger for a longer period than their other ordinary food, and renders the body less sensible to the fatigue of a long march. It is in this respect to the human frame, what oats or beans are to the horse. They have a song in praise of this root, which I have once or twice heard chanted on occasions of festivals, by a troop of young women who carry baskets of the food intended for the guests."—("Shortland's New Zealand.")

I ought not to omit noticing the *Tuber cibarium*, a plant of the mushroom family, growing under ground, which furnishes the famous truffle, so celebrated in the annals of cooking, of which immense quantities are imported, chiefly from the South of France. It is common also in Italy and Germany, and is often found in Northamptonshire, and some other of our own counties. The "kemmayes," a desert plant of the truffle kind, is a great favorite with the Arabs.

In Terra del Fuego the only vegetable food of the natives, besides a few berries of a dwarf arbutus, is a species of globular bright yellow fungus (*Cyttaria Darwinii*), which grows in vast numbers on the beech trees. In its tough and mature state it is collected in large quantities by the women and children, and eaten uncooked. It has a slightly sweet mucilaginous taste, with a faint smell like that of a mushroom.

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SECTION III.

SPICES, AROMATIC CONDIMENTS, FRAGRANT WOODS, &c.

The various spices and condiments which form so large an item in our commercial imports, are obtained from the barks, the dried seeds, the fruit, flower-buds, and root-stocks, of different plants. The chief aromatic barks comprise the cinnamon, cassia lignea, cascarilla, and canella alba. The medicinal barks will be noticed elsewhere. The seeds and fruits include pepper, pimento, cardamoms, anise, nutmegs, chillies. The flower-buds of some furnish cloves and cassia buds; the roots supply ginger, galangale, turmeric, and ginseng. A few other useful substances, such as vanilla, the costus, or putchuk, mace, soy, and some of the odoriferous woods I have included under this section.

CINNAMON.

The true cinnamon of commerce is obtained from the inner bark of *Cinnamonum verum*, R. Brown; or *C. zeylanicum*; the *Laurus cinnamonum*, of Linnaeus, a handsome looking tree, native of the East Indies. The island of Ceylon is the chief seat of its cultivation, and for a long time the Dutch depended solely for their supply of this bark for the home market on the produce of the wild cinnamon trees in the King of Kandy's territories there. At last, from the increasing demand, they resorted to the growth and more careful culture of the tree themselves. About the year 1794, the cultivation had succeeded so well that they were enabled to meet the demand for the spice from trees of their own growth, independent of any supplies from the Kandian monarch's territory.

In 1796, when this island fell into our hands, the local government endeavoured, after the former fashion of the Dutch, to restrain the production of this article of commerce within due bounds, by destroying all above a certain quantity.

General Maitland, in 1805, and his successors in the government, seeing the folly of such a ridiculous policy, very wisely fostered and promoted the extended cultivation of cinnamon plantations.

In the island of Java, and in Cochin-China, cinnamon culture has within the last few years made considerable progress.

The leaves of the cinnamon tree are more or less acuminated, from five to eight inches long, by about three broad, growing in pairs opposite each other. They have three principal ribs, which come in contact at its base, but do not unite. The leaves, when first developed, are of a bright red hue, then of a pale yellow, and lastly of a dark shining green; when mature, they emit a strong aromatic odor if broken or rubbed in the hands, and have the pungent taste of cloves. The young twigs of the true cinnamon tree are not downy, like those of the cassia bark. The plant blooms in January and February, and the seeds ripen in July and August.

The blossoms grow on slender foot-stalks, of a pale yellow color, from the axillae of the leaves and the extremity of the branches. They are numerous clusters of small white flowers, having a brownish shade in the centre, about the same size as the lilac, which it resembles. The fruit is a drupe, about the size of a small hedge strawberry, containing one seed, and of the shape of an acorn, which when ripe is soft and of a dark purple color.

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The roots are fibrous, hard, and tough, covered with an odoriferous bark; on the outside of a greyish brown, and on the inside of a reddish hue. They strike about three feet into the earth, and spread to a considerable distance. Many of them smell strongly of camphor, which is sometimes extracted from them.

The trees in their wild state will grow ordinarily to the height of 30 feet. The trunk is about three feet in circumference, and throws out a great number of large spreading horizontal branches, clothed with thick foliage. When cultivated for their bark, the trees are not permitted to rise above the height of ten feet.

The true cinnamon tree (according to Mr. Crawfurd) is not a native of the islands of the Eastern Archipelago; but Marshall, in his description and history of the tree ("Annals of Philos," vol. x.) assigns very extensive limits to its cultivation. He asserts that it is found on the Malabar coast, in Cochin-China, and Tonquin, Sumatra, the Soolo Archipelago, Borneo, Timor, the Nicobar and Philippine Islands. It has been transplanted, and grows well in the Mauritius, Bourbon and the eastern coast of Africa; in the Brazils, Guiana, in South America, and Guadaloupe, Martinique, Tobago, and Jamaica; but produces in the West a bark of very inferior quality to the Oriental.

Rumphius has remarked, that the trees which yield cinnamon, cassia, and clove bark (*Cinnamonum Culilaban*), though so much alike, are hardly ever found in the same countries.

The term clove bark has been applied to the barks of two different trees belonging to the natural order *Laurineae*. One of these barks is frequently called "Culilaban bark." It consists of almost flat pieces, and is obtained from *Cinnamonum Culilaban*, a tree growing in Amboyna, and probably other parts of the Moluccas.

The other bark, known as clove bark, occurs in quills, which are imported from South America. Murray says it is produced by the *Myrtus carophyllata*, a tree termed by Decandolle *Syzgium carophyllaeum*. It appears, however, that this is an error, for both Nees and Von Martius declare it to be the produce of *Dicypellium caryophyllatum*; and the last quoted authority states that this tree is the noblest of all the laurels found in the Brazils, where it is called "Pao Cravo." It grows at Para and Rio Negro.

Cinnamon may be propagated by seeds, plants, or layers; roots also, if carefully transplanted, will thrive in favorable localities, and yield useful shoots in twelve months. It is usually cultivated from suckers, which should not have more than three or four leaves, and require continual watering. If raised from seed, the young plants are kept in a nursery for a year or two, and then transplanted; but the trees from seeds are longer arriving at maturity. The plants are kept well earthed about the roots to retain the moisture, and coco-nut husks are placed above them, which in time form an excellent compost.

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A cinnamon plantation, even in a favorable locality, seldom yields much return until eight or nine years have elapsed.

The mode of cultivation pursued by the natives differs from that followed in the plantations of the Europeans. The native system is to allow the cinnamon to grow large before cutting; the European practice is to cut it young. The result is that the native produces quantity, but coarse; the European produces quality, but less in quantity. I have found, in conversation with the native growers, that they consider the bush or tree decidedly weakened by its being kept down by constant cutting twice a year; and that their plants are stronger and better. It is not absolutely an original opinion, but I think the two systems might be judiciously blended. In cutting the cinnamon sticks for peeling, as the Europeans do it twice a year, there is always risk of losing much valuable young wood, which is destroyed in slashing into the bushes with *catties* (bill-hooks) to take out that which is in a fit state for peeling, all of which is so much loss from the next cutting; and on this ground I should be inclined to advocate cutting once a year. There are, I know, other considerations than the mere growth of the sticks to be taken into account. Of these may be named the time when the bark peels best from the stick, which of course must depend upon age as well as season, the excited or unexcited state of the shoots, and their several effects upon the quality of the spice.

Weeding the plantations does not seem to be of so much consequence, if the shrub gets plenty of free air all round it.

Cinnamon land continues to yield abundantly crop after crop, not for years, but for scores of years. The greater portion of the late preserved plantations in Ceylon were planted by the Dutch, one hundred years ago, and the bushes are stated to be as vigorous as ever, and quite likely to go on yielding crops till the year 2000. This productiveness can only be accounted for on Liebig's principle of returning to the soil a portion of what we take from it. In the operation of peeling cinnamon, the tops and lateral branches are cut off, and left by the peelers on the ground close to the bushes. These, no doubt, furnish a considerable quantity of manure to the plants.

The general appearance of the plantation is that of a copse, with laurel leaves and stems, about the thickness of hazel; occasionally a tree may be seen which, having been allowed to grow for seed, has reached a height of forty or fifty feet, with a trunk eighteen inches in diameter. When in full bloom, the cinnamon bushes have a very beautiful appearance, the small white petals affording a most agreeable contrast with the flame-colored extremities of the upper, and the dark green of the inferior foliage, with the blossoms of various lovely parasitical plants.

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The cinnamon tree flourishes only in a small portion of the island of Ceylon. It is chiefly confined to the south-west angle, formed by the sea coast, from Tangalle in the south to Chilaw on the west. It is in a climate of agreeable temperature, which is at once hot and moist; hot from its tropical position, and moist from the frequency and plentifulness of rains. The general level of the country is low, in the midst of fresh-water lakes, divided from the sea by a narrow riband of land. And the water in the soil of the cinnamon gardens is of extraordinary purity, so as to be for that reason much in request in the neighbouring city as a beverage. This exact combination of influences does not occur anywhere else in the island, at least not in the same degree.

The cultivation principally centres round Colombo, the capital and principal port.

On the hills and valleys, in the neighbourhood of Kandy, which have a temperate climate, the tree flourishes well; a rather elevated situation, with shelter, contributing to the luxuriance of the plants. The best soil for it appears to be a pure quartz sand, which in some places rests on black moss or mould. From the surface to the depth of a few inches, this sand is as fine in its nature and as pearly white in its appearance as the best table salt; but below that depth, and near the roots of the bushes, the sand is greyish.

A specimen of this soil being carefully dried by Dr. Davy, was found to consist of 98.5 silicious sand, 0.5 vegetable matter, and 1.1 water—in 100 parts. This circumstance impresses one very strongly on visiting the cinnamon gardens; it seems so strange to see a plain of pure quartz sand whitened in the sun, and yet covered over with a luxuriant growth of trees. In richer soils the aroma does not seem to develop itself in the same concentrated form.

A mixture of loam and peat, with sand, is said, however, to form a good soil in some localities. These plantations may well suggest a doubt as to the truth of the proposition so unqualifiedly laid down by some authors, that “earth destitute of organic matter cannot sustain vegetation.” Certainly it is not organic matter which supports the cinnamon trees of Colombo.

Peeling.—The best cinnamon is obtained from the stalks or twigs, which shoot up in a cluster of eight or ten together from the roots, after the parent bush or tree has been cut down. These shoots are cut once in about three years, close to the ground. Great care is requisite, both as to the exact size and age; for if the bark is too young, it has a green taste, if too old it is rough and gritty. These shoots yield an incomparably fine cinnamon bark. When cut for peeling they are of various sizes and lengths, depending on the texture of the bark. These rods afford the hazel-like walking-sticks so much esteemed by strangers, and which, though difficult to be procured during the prevalence of the oppressive

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cinnamon regulations, may now be very easily obtained from proprietors of grounds producing that spice. Cinnamon is barked at two periods of the year, between April and December. Those suckers which are considered fit for cutting, are usually about three-fourths of an inch in diameter, and five feet or more long. The first operation is to strip them of the outside pellicle of bark. The twigs are then ripped up lengthwise with the point of a knife, and the liber or inner bark gradually loosened, till it can be entirely taken off. While drying they are cut up into long narrow rolls, called “quills,” then stuck into one another, so as to form pipes about three or four feet long, which are afterwards made up in round bundles.

During the first day the cinnamon is suspended under shelter upon open platforms, and on the second day it is placed on wicker-work shelves, and exposed to the sun until sufficiently dry to be examined and sorted for shipment.

It is brought home in bags or bales of 80 or 90 lbs. weight, and classed before export into three sorts; first, second, and third quality. The different kinds of cinnamon bark may be thus classified, according to quality—

1. That which ranks above all others in quality, is known by the Singhalese name of *penne* or *rasse kuroondu*, sharp sweet, or honey cinnamon.

2. *Naya kuroondu*, snake cinnamon.

3. *Kapoorn kuroondu*, camphorated cinnamon, from the very strong smell of camphor which it possesses. This variety is principally obtained from the plantations of the interior.

4. *Kahate* or *canalle kuroondu*, astringent cinnamon. In this species the bark peels off very easily, and smells agreeably when fresh, but it has a bitter taste.

5. *Savel kuroondu*, mucilaginous or glutinous cinnamon. This sort acquires a very considerable degree of hardness, which the chewing of it sufficiently proves. It has otherwise little taste, and an ungrateful smell; but the color is very fine, and it is often mixed with the first and best sort; the color being much alike, excepting only that in the good sort some few yellowish spots appear towards the extremities.

6. *Dawool kuroondu*, or drum cinnamon. The wood of this tree, when grown hard, is light and tough, and the natives make some of their vessels and drums of it. The bark is of a pale color.

7. *Nika kuroondu*, wild cinnamon, whose leaf resembles that of the nicasol (*Vitex Negundo*). The bark of this tree has neither taste or smell when peeled, and is made use of by the natives only in physic, and to extract an oil from to anoint their bodies.

8. *Mal kuroondu*, flowering cinnamon, because this tree is always in blossom. The substance of the wood never becomes so solid and weighty in this as in the other named species, which are sometimes nine or ten feet in circumference. If this ever-flowering cinnamon be cut or bored, a limpid water will issue out of the wound; but it is of use only for the leaves and bark.

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9. *Toupat kuroondu*, trefoil cinnamon, of which there are three varieties, which grow in the mountains and valleys of the interior about Kandy.

10. *We kuroondu*, white ant's cinnamon.

The first-named four of these are, however, alone varieties of the *Cinnamonum verum*.

Good cinnamon is known by the following properties:—It is thin and rather pliable; it ought to be about the substance of royal paper, or somewhat thicker. It admits of a considerable degree of pressure, and bends before it breaks; the fracture is then splintering. It is of a light color, approaching to yellow, bordering but little upon the brown; it possesses a sweetish taste, at the same time it is not stronger than can be borne without pain, and is not succeeded by any after-taste. The more cinnamon departs from these characteristics, the coarser and less serviceable it is esteemed; and it should be rejected if it be hard, and thick as a half-crown piece; if it be very dark colored or brown; if it be very pungent and hot on the tongue, with a taste bordering upon that of cloves, so that it cannot be suffered without pain. Particular care should be taken that it is not false-packed, or mixed with cinnamon of a common sort.

The following remarks, by Mr. Dunewille, of Malacca, as to the suitability of the Straits' Settlements for cinnamon culture, are interesting, although in some instances a repetition of previous observations:—

It appears, from experience, that the soil of Ceylon is more favorable to the growth of cinnamon than to that of any other aromatic plant, and I find the climate of Ceylon, if at all, differs but in a very slight degree from that of the Straits. I therefore conclude that the spice, if cultivated in the Straits, will prove superior to that of Ceylon, if one may judge from the various spices that grow here almost wild, and it would moreover yield a better return than in Ceylon. My supposition is confirmed from having seen the spice which was prepared last year in Pringet by the Honorable Resident Councillor of Malacca, and which I found to be equally as good in every respect as that grown and cultivated in the maritime provinces in Ceylon.A sandy soil is that which is generally selected for cinnamon, but other soils may be chosen also, such as a mixture of sandy with red soil, free from quartz, gravel, or rock, also red and dark brown soils. Such land in a flat country is preferable to hilly spots, upon which, however, cinnamon also grows, and are known by the name of the "Kandyan Mountains." The soil that is rocky and stony under the surface is bad, and not adapted for the cultivation of cinnamon, as the trees would neither grow fast, nor yield a remunerative return.When a tract of land of the above description is selected, the whole of the ground should be cleared, leaving a few trees for shade, to which the laborers might return for rest and relaxation;

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these may be from 50 to 60 feet apart. The trees felled should be well lopped, burnt and cleared away, the stumps should be removed with roots, after which they may be allowed to remain, in order to save expense of carriage, merely by observing some degree of order in the disposition, by forming regular rows, of which the intervening spaces are planted with cinnamon. The ground being thus cleared, holes may be dug at eight to ten feet apart, and of one foot square; the distance from each plant will depend upon the nature of the soil—that is, the poorer the soil, the nearer to each other should the trees be planted, and *vice versa*.When this operation is over, should the holes be intended for cinnamon roots, or stumps, the latter must be carefully removed with as much earth as can be carried up with them and placed in the holes, taking care not to return the earth removed originally in digging the holes, which are to be filled with the soil scraped from the surface, which has been previously burnt, exposed, and formed into manure. Should no rain have fallen after the placing of the roots in the holes, the stumps should be well covered, and watered morning and evening, until such time as the sprouts shoot out fresh buds, which will be in a fortnight or so from the time they were transplanted, when the watering may be discontinued. In a month the new shoots will be three or four inches high; this much depends upon the weather.If the holes be intended for young plants or seedlings, the plants must be removed with boles of earth from the nurseries, and placed in the holes, taking the same care as with the stumps, both in watering and covering, in the event of its being dry weather. When the seedlings take root, the coverings should not be removed until the plants throw out a new pair of leaves from the buds, which is a sign of their having taken root.When a plantation is formed of old stumps, all the branches should be cut down within six inches from the ground; this should be done with one stroke of a sharp instrument, in order to avoid the splitting of the stem. From these stumps cinnamon may be cut and peeled within eighteen months from the time of transplanting. Often this is done after the lapse of twelve months from the time of transplanting.From seedlings one cannot expect to gather a crop before two or three years from the time the plants were transplanted, when there will be but one or a single tree, which, when cut down as already shown, four or six inches to the ground, ought to be covered with fresh earth gathered from the space between the rows, and formed in a heap round the plant. The next crop will be three or four times as much as the first, from the number of sprouts the stem will throw out, and so on every year, the crop increasing according to the number of sprouts each stem will throw out yearly from the cuttings. In the course of seven or eight

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years, the space left between the rows will only admit the peelers and others to go round the bushes, weed, clear and remove cuttings, as the branches from each bush will almost touch each other at their ends.It is essentially necessary to take every care not to allow any creepers or other weeds to grow, the former interfere with the growth of the bushes by entangling, because it not only takes out so much of the support feeding the cinnamon trees, but interferes with the peelers during the cutting season, and prevents the branches growing up straight with a free circulation of air. The plantation ought to be kept clean and free from weeds; the cinnamon requires no manuring, but when the plantation is weeding the bushes should be covered with the surface soil and raising the ground round the bush by making a heap of the earth, which answers well in lieu of manure. This operation must be attended to as soon as the cinnamon sticks are removed for peeling. The plantation requires weeding three or four times a year during the first two or three years, then twice a year will answer the purpose; as by that time the trees will form into bushes and destroy the seeds of the weeds on the ground.The forming of a nursery is necessary, for which a space of ground, say an acre, should be selected in a rich bit of soil free from stones. Clear the whole brushwood, only leaving the large trees for shade, remove all stones, stumps, and roots, dig the place well six or eight inches deep, then form into long beds of three or four feet wide, put the seeds down nine or twelve inches apart, cover them eight or twelve inches above the ground by a platform, and water them every other day until the seeds grow up and give one pair of leaves, then leave off watering (unless great dry weather prevail, then it ought to be continued) but not uncover until the plants grow up six or eight inches high, and can bear the sun; these seedlings will be ready for transplanting after three months from the time they were sown.The forming of nurseries is done at the close of the year, before December. When this is done first, the party commences clearing and preparing the land during the dry season, which is from the beginning of December up to the end of March following. April will set in with heavy rain (it is generally so in Ceylon), and it will continue wet weather till the end of August, very often till September and October, and you have the benefit of four or five months rain.The cinnamon seeds are to be gathered when they are fully ripe, they must be heaped up in a shady place, to have the outside red pulp rotted, when it turns quite black, then have the seeds trampled or otherwise freed from the decomposed pulp, without injuring the seeds, and well washed in water (just as is done to cherry coffee, before they are made into parchment in the whole shell). Finally, have the seeds[48] well dried in the air without exposing them to the sun, and then put them in on the ground prepared for their reception. In washing the seeds, those that float on the surface should be rejected.

There are five different sorts of cinnamon, *viz*.:—

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1st is called Panny Meers Carundoo. 2nd Tittha " " 3rd Kahatte " " 4th Wallee " " 5th Savell " "

> Of these, the first kind is the best of all, the 2nd and 3rd, although inferior, are peeled likewise, the 4th and 5th are spurious.
>
> The distinction in the cinnamon can be known both by taste, the shape of the leaves on the tree, and an experienced “Challya” man will judge the cinnamon by first sight.

The quality of the bark depends upon its situation in the branch, that peeled from the middle of the bush or branch being the *most superior*, and classed as 1st sort, that taken from the upper end is the 2nd quality, while the bark removed from the base of the branch, or the thickest end, is the inferior, and called the 3rd sort.From the cinnamon bark refused in the sorting store of all kinds, in separating the first, second and third qualities and in making bales for exportation, the refuse is collected, and by a chemical process cinnamon oil is extracted, which sells very high, with an export duty of 3s. or l1/2 rupees on each ounce, exclusive of the British duties payable in England for importation, which is at present one shilling and three pence per pound.[49] Of the cinnamon roots camphor is made, which sells well both in Ceylon and other parts of the world.

Cinnamon, as a medicine, is a powerful stimulant, but it is not much used alone. It is generally united with other tonics and stimulants, but its ordinary use is to mask the disagreeable odor and taste of other medicines. The oil of cinnamon is prepared by being grossly powdered and macerated in sea water for two days and two nights, and both are put into the still. A light oil comes over with the water, and floats on its surface; a heavy oil sinks to the bottom of the receiver, four hours before the light oil separates from the water, and whilst the heavy oil continues to be precipitated for ten, twelve, or sometimes fourteen days. The heavy oil, which separates first, is about the same color as the light oil, but sometimes the portion which separates last has a browner shade than the supernatant oil. The same water can be used advantageously in a second distillation. Professor Duncan informs us that 80 lbs. of newly-prepared cinnamon yield about 21/2 ozs. of oil, which floats upon the water, and 51/2 of heavy oil. The same quantity of cinnamon, if kept in store for many years, yields 2 ozs. of light oil and 5 ozs. of heavy oil.

Cinnamon oil is obtained from the fragments of bark which remain after peeling, sorting, and packing. It is distilled over with difficulty, and the process is promoted by the addition of salt water, and the use of a low still. The oil thus obtained by distillation is at first of a yellow color, but soon assumes a reddish brown hue. It has an odor intermediate between that of cinnamon and vanilla, but possesses in a high degree both the sweet burning taste and the agreeable aromatic smell of cinnamon. It is heavier than water, its specific gravity being 1.035.

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The ripe fruit of this tree yields a concrete oil called cinnamon suet, which was formerly employed to make candles for the Kandian kings. An oil, called clove oil, is also distilled from the leaf, which is said to be equal in aromatic pungency to that made from the clove at the Moluccas.

The following were the quantities sold, and the average prices realised during the Dutch rule in Ceylon:—

			s.	d.	
1690	3,750	bales sold at	4	8	all round.
1709	3,750	"	4	6	"
1710	3,500	"	4	4	"
1720	5,000	"	4	4	"
1740	4,000	"	9	3	"
1760	5,000	"	8	5	"
1780	2,500	"	12	6	"
1784	2,500	"	17	4	"

The last quotation appears to have been the highest ever obtained for cinnamon, for 17s. 8d. average would give about 22s. for the first sort. In later years we find the deliveries and prices to have been as follows:—

			s.	d.	
1824	5,934	bales sold at	6	6	all round.
1828	3,918	"	6	0	"
1830	5,849	"	7	8	"
1842	1,018	"	——		"
1845	3,245	"	——		"

The comparative exports of cinnamon from Ceylon in the first six months of 1853, as compared with the same period last year, are as follows:—

	1853.	1852.
	lbs.	lbs.
Quarter ending 5th January	99,778	93,291
" 5th April	73,815	135,248
	-------	-------
Total	173,593	228,539

The diminished export was caused by the prospective abolition of the export duty, which came into operation on the 1st July last. The quantity that will be sent to the English market by the close of the year (1853) will be something prodigious compared with the average consumption. From October 10, 1852, to July 22, 1853, the shipments were 406,326 lbs.

RETURN OF CINNAMON EXPORTED FROM CEYLON, SHOWING THE QUANTITY AND
VALUE.

	Quantity.	Value.
Year.	lbs.	L
1836	724,364	—
1837	558,110	—
1838	398,198	—
1839	596,592	—
1840	389,373	—
1841	317,919	24,857
1842	121,145	15,207
1843	662,704	66,270
1844	1,057,841	105,784
1845	408,211	40,821
1846	491,656	49,165
1847	447,369	44,736
1848	491,688	49,168
1849	733,782	73,378
1850	644,857	64,485
1851	500,518	50,051
1852	427,667	42,766

The question of the export duty on cinnamon has, during the last twenty years, occupied a considerable space in Ceylon correspondence and the Island journals. This duty was first imposed in 1832, on the abolition of the Grovernment monopoly, and was then fixed at

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the rate of 3s. per lb. on all qualities. From the 19th April, 1835, it was fixed at 3s. per lb. on the best, and 2s. on the second quality. It was reduced in January, 1837, to 2s. 6d. on the first and second sorts, and 2s. on the third; and in June, 1841, to 2s. on all qualities; in 1843, to 1s.; and in September, 1848, to 4d. per lb. Such a rate of export duty could be maintained only on an article for which there was a considerable demand, and which could not be supplied from other places, and this was for a long time the case. The circumstances are now different, and the abolition of the duty, which has so repeatedly been brought under the notice of the Treasury, has at length been determined on. The quantity of cinnamon, &c., taken for consumption in the United Kingdom, scarcely amounts to 2,800 bales per annum. The sale and consumption is nearly stationary, and cinnamon is only in demand for those finer purposes for which cassia, its competitor, cannot be used. Whilst we imported the large amount of 700,095 lbs. in 1850, only 28,347 lbs. went into consumption. The consumption has declined in the last two years to about 21,500 lbs. Cinnamon is now imported into the United Kingdom duty free.

The land under cultivation with cinnamon in Ceylon is about 13,000 acres, principally in the western and southern provinces. The number of gardens being eleven at Kaderane, seven at Ekelli, seven at Morotto, six at Marandham, and two at Willisene. Several enterprising planters have recently commenced the cultivation of this spice at Singapore and Malacca. The plants already promise well. Indeed there can be little doubt of its thriving, as the tree has been long grown in gardens and pleasure grounds in those settlements, as an ornamental plant, and has always flourished.

The Ceylon article is being supplanted in the continental markets by a cheaper one, of China and Malabar growth. The Javanese, tempted by the fatally high prices caused by the excessive duties on our Colonial spice, smuggled a quantity of seed, and with it a cinnamon cultivator, out of the island, and have since paid considerable attention to its growth. The Dutch have at present more than five millions of plants, equal to upwards of 5,000 acres, the greater part of which are in tolerably full bearing.

The cinnamon trees in Java begin to blossom in the month of March. They do not all flower at the same time, but in succession. The fruit begins to ripen in October in the same manner, so that the crop lasts from October to February. In Ceylon the blossom begins to appear in November. The seeds when plucked ought to be fully ripe, and after being separated from the outer pulpy covering, should be dried in the shade. They can be kept for two or three months in dry sand or ashes, but must not be exposed to the sun, as they would split, and thus be rendered useless.

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The plants in nurseries must be well sheltered from the sun and heavy rains, but the plants are strengthened by the covers being removed at night when heavy rains are not expected to fall, and in the day time when only light rains prevail. The mode of planting out, cultivation, preparing the bark, &c., appears to be the same in Java as that practised in Ceylon. The only difference is, that while in Ceylon the cinnamon, when ready for market, is packed in “gunny” or canvass bags, in Java it is put into boxes, made of wood free from any smell or flavor which would injure the spice. The inferior cinnamon, however, is packed in straw mats.

The following is a return of the extent of cinnamon culture in Java :—

	In 1840.	In 1841.
Residencies in which cinnamon is cultivated	10	10
Number of plantations	48	49
" families devoted to this culture	7,901	9,688
" paid *budjans*	294	345
Extent of ground occupied by the cultivation, in *bahus* of 71 decametres	1,690	1,880
	---------	---------
Cinnamon trees of which the bark can be taken	1,106,566	1,407,213
Young trees in the parks	2,478,427	2,565,774
For renewing	307,000	86,800
	---------	---------
Total	3,891,998	4,059,787
	---------	---------
Cinnamon crop, in Dutch lbs.	57,074	38,219
" refuse	23,283	82,803

The number of trees peeled in 1842 was taken at 1,824,599, and the crop reckoned at 108,905 lbs.

In the residency of Bantam, four trees suffice to produce a pound of cinnamon, whilst in the other residencies eleven trees must generally be stripped to furnish the same quantity; in 1839 one pound could scarcely be obtained from thirteen trees.

This cultivation increases each year, and the quality of the produce improves, whilst the expenses diminish. However, the Dutch Government has judged it proper not to extend it, although the soil of Java appears favorable to this culture.

From 200,000 to 300,000 lbs. of true cinnamon, not freed from its epidermis, is exported annually from Cochin-China.

JAVA CINNAMON SOLD IN HOLLAND.

	lbs.
In 1835	2,200
" 1836	1,300
" 1837	1,600
" 1838	2,100
" 1839	4,700
" 1840	7,900
" 1841	23,900
" 1842	13,000
" 1843	23,000
" 1844	101,400
" 1845	134,500
" 1848	250,550

STATISTICS OF PACKAGES IN LONDON.

	1842.	1843.	1844.	1845.
Imported	2,196	4,458	9,197	8,909
Exported	3,661	3,964	6,712	6,081
Duty paid	838	738	801	1,012
Stock	2,709	2,622	4,230	5,549

CASSIA BARK.

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Cinnamonum Cassia, or *aromaticum*, the *Laurus cassia* of Linnaeus, seems to be the chief source of the “cassia lignea” of commerce. It differs from the true cinnamon tree in many particulars. Its leaves are oblong-lanceolate; they have three ribs, which coalesce into one at the base; its young twigs are downy, and its leaves have the taste of cinnamon.

Malabar cassia appears to be the produce of another species of *Cinnamonum*, probably *C. eucalyptoides*, or *Malabatrum*.

Dr. Wight, of the Madras Medical Service, in a report to the East India Company, expresses his belief that the cassia producing plants extend to nearly every species of the genus. “A set of specimens (he observes) submitted for my examination, of the trees furnishing cassia on the Malabar coast, presented no fewer than four distinct species; including among them the genuine cinnamon plant, the bark of the older trees of which, it would appear, are exported from the coast as cassia. Three or four more species are natives of Ceylon, exclusive of the cinnamon proper, all of which greatly resemble the cinnamon plant, and in the woods might easily be mistaken for it and peeled, though the produce would be inferior. Thus we have from Western India and Ceylon alone, probably not less than six plants producing cassia; add to these nearly twice as many more species of *Cinnamonum*, the produce of the more eastern states of Asia, and the Islands of the Eastern Archipelago, all remarkable for their striking family likeness; all, I believe, endowed with aromatic properties, and probably the greater part, if not the whole, contributing something towards the general result, and we at once see the impossibility of awarding to any one individual species the credit of being the source whence the *Cassia lignea* of commerce is derived; and equally the impropriety of applying to any one of them the comprehensive specific appellation of cassia, since all sorts of cinnamon-like plants, yielding bark of a quality unfit to bear the designation of cinnamon in the market, are passed off as cassia.”

The cassia tree, according to Mr. Crawfurd, is found in the more northern portion of the Indian isles, as in the Philippines, Majindanao, Sumatra, Borneo, and parts of Celebes. It is also grown on the western coast of Africa. The principal seat of its culture is, however, the Malabar coast, and the provinces of Quantong and Kingse, in China.

The famous cassia of China is incomparably superior in perfume and flavor to any spice of its class. Its native place is unknown, though supposed to be the interior provinces of China. The market price is said to be L5 per lb.

The Malabar sort brought from Bombay is thicker, darker colored, and coarser than that from China, and is more subject to foul packing. A small quantity of cassia is brought from Mauritius and Brazil, and a large amount from the Philippine Islands.

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Cassia bark fetches from 80s. to 105s. per cwt. in the London market, according to quality. The imports appear on the decline. In 1843 and 1844 we imported nearly two millions of pounds. The quantity imported and retained for home consumption in the past four years are shown in the following figures:—

	Imported.	Retained for consumption.
	lbs.	lbs.
1848	510,247	76,152
1849	472,693	83,500
1850	1,050,008	97,178
1851	267,582	82,467

The cheaper Indian barks, as well as the cinnamon of the East, seemed at one time to be fast driving out of the market the superior class cinnamon of Ceylon.

In 1841 Java exported 400 cwts. of cinnamon; and the quantity of cassia imported into the United Kingdom from India and the Philippine Islands, in the five years ending with 1844, was—

	lbs.
1840	329,310
1841	1,261,648
1842	1,312,804
1843	2,470,502
1844	1,278,413

40,000 lbs. were received from India in 1848; and 3,795 arrobas of cassia were exported from Manila in 1847. In 1852, 2,806 cwts. of cassia were received at Singapore from China, and 1,380 cwts. exported from that settlement to the Continent, against 903 cwts. shipped in the previous year.

What the Ceylon spice-grower wants, is an extended field of operation—a larger class of consumers to take off his cinnamon, and this can only be obtained by bringing it within the means of the great mass of cassia buyers.

Look at the quantity of cinnamon exported by the Dutch in the middle of the eighteenth century. Eight or nine thousand bales a year were exported, and now, after a lapse of a hundred years, Ceylon hardly sends away half that quantity. Yet the consumption of spice must have kept pace with the increased population of countries using it, and so it has. But the difference is made up, and more than made up, by cassia from China, Java, Sumatra, Malabar Coast, &c., and though the new article is not equal to the cinnamon of Ceylon, yet the vast difference in the price obtains for it the preference. Now what the Ceylon planter wants, is to be allowed to produce a spice on equal terms, and of a superior quality to cassia, which might be done under an *ad valorem* export duty of 5 per cent. Spice of this description of course could not afford the high cultivation bestowed on the fine qualities, neither would it be required. In fact little or no cultivation need be given it. At present anything inferior to the third sort is not worth producing, because it cannot stand the shilling export duty. But under a more enlightened system of things, with a low duty such as I suggest, myriads of bushes would spring up on those low, sandy, and at present unprofitable wastes that skirt the sea-coast of the western province, around Negombo and Chilaw.

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The difference of duty would be more than made up by the diffusion of capital in planting, the employment of vast numbers of laborers, the purchase from Government of many thousand acres of now valueless flats, and all the attendant benefits arising out of the development of a new field of operation for the colonial industrial resources.[50] The cassia tree grows naturally to the height of 50 or 60 feet, with large, spreading, horizontal branches. The peelers take off the two barks together, and separating the rough outer one, which is of no value, they lay the inner bark to dry, which rolls up and becomes the *Cassia lignea* of commerce. It resembles cinnamon in taste, smell and appearance. The best is imported from China, either direct from Canton, or through Singapore, in small tubes or quills, sometimes the thickness of the ordinary pipes of cinnamon and of the same length; but usually they are shorter and thicker, and the bark itself coarser. It is of a tolerably smooth surface and brownish color, with some cast of red, but much less so than cinnamon. The exports from China are said to be about five million pounds annually; price about 32s. per cwt. In 1850, 6,509 piculs of cassia lignea (nearly one million pounds), valued at 87,850 dollars, were shipped from the single port of Canton. Cassia bark is of a less fibrous texture, and more brittle, and it is also distinguished from cinnamon by a want of pungency, and by being of a mucilaginous or gelatinous quality.

CASSIA BUDS are the dried flower buds (perianth and ovary) of the cassia tree, and are mostly brought from China. They bear some resemblance to a clove, but are smaller, and when fresh have a rich cinnamon flavor. They should be chosen round, fresh, and free from stalk and dirt. They are used chiefly in confectionery, and have the flavor and pungency of cassia. The exports from Canton in 1844 were 21,500 lbs.; in 1850, 44,140 lbs., valued at 7,400 dollars. The average quantity of cassia buds imported into the United Kingdom, in each of the thirteen years ending with 1842, was 40,231 lbs.; the average quantity entered for home consumption in these years was 6,610 lbs., and the average annual amount of duty received was L312.

Cassia bark yields a yellow volatile oil, called oil of cassia, the finer kind of which differs but little in its properties from that of cinnamon, for which it is generally substituted; it has a specific gravity of 1071. The best is manufactured in China, where the wood, bark, leaves and oil are all in request. The cassia oil is rated at 150 dollars per picul, and the trade in this article reaches about 250,000 dollars.

CANELLA ALBA, or wild cinnamon, is a valuable and ornamental tree, growing about fifteen feet high, which is cultivated in South America and the West Indies for its pungent bark, which is shipped to this country in bales or cases, in long quills and flat pieces, something like cinnamon. Large old cuttings root readily in the sand. It is grown chiefly in the Bahama Islands, from whence we derive our supplies.

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By the Caribs, the ancient natives of the West Indies, and the negroes, it was first employed as a condiment. In this country it is chiefly used as an aromatic stimulant and tonic, ranking between cinnamon and cloves. The bark possesses, however, no other quality than its hot spicy flavor and strong aromatic odor when exposed to the action of heat.

CASCARILLA BARK is obtained chiefly from the *Croton cascarilla*, a small shrub growing at St. Domingo, the Bahama Islands, and the Antilles. The chief portion comes from Eleuthera. In Hayti a pleasant kind of tea is made from the leaves. Other species of the family supply some of the bark of commerce.

From its strong and aromatic properties it has been found very efficacious in all febrile diseases, and vies with the Jesuits' bark; as a tonic it has very wholesome qualities, a pleasant and strong bitterness, and was for some time held in considerable repute among the faculty.

About twenty years ago, large shipments were made from the Bahamas. It was found, upon adulteration with hops, to reduce the cost of that article, and for the encouragement of the hop grower a prohibitory impost was laid upon it by the Home Government, consequently it became an unsaleable product.

The sea-side balsam, or sweet wood (*Croton Eleuteria*), from which some cascarilla bark is obtained, grows in the Bahama Islands and Jamaica, but almost all the bark imported comes from Nassau, New Providence. In 1840, 15,000 lbs. were imported for home consumption.

This bark produces the combined effect of an aromatic and of a moderately powerful tonic; but it does not possess any astringency. It has been employed as a substitute for cinchona. When burned it gives out a musky odor, and is often used in pastiles.

The value of this bark ranges, according to quality, from 17s. 6d. to 43 s. per cwt.

CLOVES.

The cloves of commerce are obtained from the flower buds of *Caryophyllus aromaticus (Eugenia caryophyllata*), which was originally a native of the Moluccas, but is now cultivated in several parts of the East and West Indies. They have the form of a nail, and when examined are seen to consist of the tubular calyx with a roundish projection, formed by the unopened petals. It is a very handsome tree, growing to the height of about twenty feet. The trunk is straight, and rises four or five feet before it throws out branches. The bark is smooth, thin, of a grey color, and the wood of the trunk too hard for ordinary cabinet work.

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The leaves are opposite, smooth, narrow, pointed, of a rupous color above, and green on the under side. They have a very aromatic odor when bruised between the fingers. The flowers produced in branched peduncles, at the extremity of the bough, are of a delicate peach color. The elongated calyx, forming the seed vessel, first changes to yellow, and, when ripe, red, which is from October to December, and in this state it is fit to gather. If left for a few weeks longer on the trees, they expand, and become what are termed “mother cloves,” fit only for seed or for candying. The ground under the tree is first swept clean, or else a mat or cloth is spread. The nearest clusters are taken off with the hand, and the more distant by the aid of crooked sticks. Great care should be taken not to injure the tree, as it would prevent future bearing.

The cloves are then prepared for shipment by smoking them on hurdles near a slow wood fire, to give them a brown color, after which they are further dried in the sun. They may then be cut off from the flower branches with the nails, and will be found to be purple colored within, and fit to be baled for the European market. In some places they are scalded in hot water before being smoked, but this is not common. The tree may be propagated either from layers or seed. Layers will root in five or six months if kept moist.

A strong dark loam, a gravelly, sandy, or clayey soil, but one not retentive of moisture, seems that best suited for its successful culture.

It does not thrive well near the sea, nor in the higher mountains, the spray of the sea and the cold being found injurious. The plants at first require the shade of other trees, such as the mango, coco-nut, &c. Although generally a hardy plant, it suffers from excessive drought. They should be planted about twenty feet apart. In its native country the tree begins to yield fruit in the sixth year, but a crop can seldom be looked for in other quarters under eight years. It is very long lived, sometimes attaining the age of 130 years.

There appears, according to Mr. Crawfurd, to be five varieties of the clove, *viz*.—the ordinary cultivated clove; a kind called the female clove by the natives, which has a pale stem; the kiri or loory clove; the royal clove, which is very scarce, and the wild clove. The three first are equally valuable as spices, the female clove being considered fittest for the distillation of essential oil. The wild clove, having scarcely any aromatic flavor, is valueless.

The produce which may be expected from the tree seems to be uncertain; it may, however, be averaged at five or six pounds. A clove tree, well weeded and taken care of, will produce from five to twenty pounds. On the other hand, a tree that is neglected will not give above two or three pounds. At intervals of from three to six years they usually produce one extraordinary crop, but then a year now and then intervenes, when they yield none at all; in others they will afford a double harvest.

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The clove tree was originally confined to the five principal Molucca islands, and chiefly to Machean. From these it was conveyed to Amboyna, a very short time only before the arrival of the Portuguese. By them the cultivation was strictly restricted to Amboyna, every effort being made to extirpate the plant elsewhere.

It has now, however, spread to Java, Singapore, and the Straits' Settlements, Ceylon, the Mauritius and Seychelles, Bourbon, Zanzibar, Cayenne, Dominica, Martinique, St. Kitts, St. Vincent, and Trinidad.

Cloves contain a volatile oil, associated with resinous, gummy, and astringent matter, which is yielded in larger proportion than by any other plant. Neuman obtained by distillation two ounces and two drachms from sixteen ounces of cloves. On an average cloves yield from 17 to 22 per cent. of oil, including the heavy and light oils. The oil is aromatic and acrid, and has been used as a condiment and a stimulant carminative. It is also extensively used by distillers and soap makers.

It is said that the clove does not thrive well on the soil of Java, the plantations of which trial had been made not having succeeded to the extent expected, although they were directed by skilled persons from Amboyna; the places they made choice of did not differ materially as to soil and climate from those of the Moluccas.

M. Teysman, Director of the Botanical Gardens at Batavia, seems to have bestowed much attention on the subject. The exports however from the island have been considerable. In 1830, there were 803 piculs shipped; in 1835, 4,566; in 1839, 2,334; in 1843, 2,027 piculs of 133 lbs.

M. Buee, who introduced the culture of the clove in the island of Dominica, about 1789, thus describes the results of his experience, which may be useful to other experimental cultivators. He obtained a few plants from Cayenne, and raised 1,600 trees from seed, which, in a year from the first sowing, were transplanted. The seeds were sown at about six inches apart from each other, in beds; over these beds small frames were erected about three feet from the ground, and plantain leaves were spread on the top, in order to shelter the young plants from the sun. The leaves were allowed gradually to decay, and at the end of nine months the young plants, which by that time were strong, were permitted to receive the benefit of the sun; but if not protected from it when very young, they were found to droop and die.

When transplanted, the trees were placed at sixteen feet apart from each other. They grew very luxuriantly, and at the end of fifteen months after their removal, attained the height of from three to four feet. The ground wherein they were planted had been a coffee plantation during forty years. The coffee trees had decayed, and an attempt had been made to replace them; but they refused to grow; whereas the clove plants flourished as if on congenial soil, and a crop was gathered on some of them when they were not more than six years old, which period is two or three years earlier than the usual time for gathering.

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The cloves sent from St. Vincent to England in 1800, were obtained from trees eight feet high, having a stem only two inches in diameter. Trial was made in that island of the relative growth of the plant on different soils; it grew sickly on land which was not manured, but on land which had received this preparation it flourished.

In Singapore, about ten years ago, there were then about 15,000 clove trees planted out, a few of which only had come in bearing. If these plantations had proved equally productive with those of the sister settlement of Pinang, it would have been able to export 60,000 lbs. of cloves, its own produce; but this expectation, it will be seen, has not been realised. In the season of 1841-42, there was 1000 piculs of cloves shipped from Pinang, but none were exported in the two previous years.

The quantity of land under cultivation with cloves there, in 1843, was 463 orlongs in Prince of Wales Island, and 517 in Province Wellesley. The number of trees planted out in the former island was 72,779; in the latter province 7,639. There were in the island 25,161 plants in nursery.

The trees in bearing were—In Prince of Wales Island, 28,739; not bearing, 44,040; produce in 1843, 87 piculs, 50 catties; gross value, 3,399 dollars; estimated produce of cloves for 1844, 469 piculs. In Province Wellesley—Trees in bearing, 1,073; not bearing, 6,566; produce in 1843, 1 picul, 13 catties; gross value 45 dollars.

The export of cloves from Pinang was, in 1849, 24,000 lbs.; in 1850, 52,400; in 1851, 27,866; in 1852, 45,087.

From tabular statements drawn up in 1844, by Mr. F.S. Brown, Chairman of the Pinang Chamber of Commerce, it appears that there were, in 1843, in that island and Province Wellesley adjoining, 96 clove plantations, containing 80,418 clove trees; besides many young trees in nurseries ready to be planted out. The produce of cloves there, in 1842, was 11,813 lbs., and this was a very short crop, it having that year proved a complete failure; the average crop for some years previous had been 46,666 lbs. Pinang only began to export this spice in 1832. Of the clove trees in Pinang there were then only 29,812 in bearing, leaving 75,767 in that settlement alone to come to maturity; estimated to yield about 300,000 lbs.

No success has attended repeated trials of cloves in Singapore. Until the trees reach the age of bearing, they grow and look extremely well; but any expectation of a crop that may have been raised by their hitherto fine condition, ends in disappointment, for just then the trees assume the appearance of sudden blight, as if lightning-stricken, and then die. 125 clove plants and 350 seedlings were sent to Singapore from Bencoolen, by Sir T. Raffles, in the close of 1819; but although every care was paid them—while the nutmegs which accompanied them throve amazingly well—little or no progress has been made with clove culture. Two or three hundred-weight were shipped in 1845, but since then hardly any mention is made of the spice.

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In a petition presented by the spice planters of Pinang and Province Wellesley, to the authorities at home, in 1844, praying that the duty on British Colonial nutmegs, mace, and cloves might be reduced to 1s. 9d., 1s. 3d., and 3d. respectively, on importation into England, in order to compete with foreign produce, it was stated that a few years hence Prince of Wales Island might be expected to produce 600,000 lbs. of nutmegs, 200,000 lbs. of mace, and 300,000 lbs. of cloves; whilst Singapore, if equally successful in the culture of the same, would yield yearly 137,000 lbs. of nutmegs, 45,000 lbs. of mace, and 60,000 lbs. of cloves. In short, the planters needed only encouragement to produce in the course of a few years a full supply of those valuable spices for the whole consumption of Great Britain.

Dr. Ruschenberger, who visited Zanzibar in 1835, thus speaks of the clove plantations there:—“As far as the eye could reach over a beautifully undulated land, nothing was to be seen but clove trees of different ages, varying in height from five to twenty feet. The form of the tree is conical, the branches grow at nearly right angles with the trunk, and they begin to shoot a few inches above the ground. The plantation contains nearly four thousand trees, and each tree yields on an average six pounds of cloves a year; they are carefully picked by hand, and then dried in the shade; we saw numbers of slaves standing on ladders gathering the spice, while others were at work clearing the ground of dead leaves. The whole is in the finest order, presenting a picture of industry and of admirable neatness and beauty. They were introduced into Zanzibar in 1818, from Mauritius, and are found to thrive so well that almost everybody in the island is now clearing away the cocoa nut to make way for them. The clove bears in five or six years from the seed; of course time enough has not yet elapsed for the value and quantity of Zanzibar cloves to be generally known; they are worth, however, in the Bombay market, about 30s. the Surat maund of 391/4 lbs.; the price for Molucca cloves in the Eastern market is from 28 to 30 dollars per picul of 133 lbs.; for those of Mauritius, 20 to 24 dollars per picul.”

The average annual consumption of cloves in the United Kingdom, in the four years ending 1841, was 49,000 lbs. The largest quantity of cloves imported during the past twenty-five years was 1,041,171 lbs., in 1847. The quantities imported and entered for home consumption in the last five years have been as follows:—

	Imports. lbs.	Home consumption. lbs.
1848	117,433	126,691
1849	274,713	133,713
1850	749,646	159,934
1851	253,439	138,132
1852	313,949	175,287

In 1848 we received 60,000 lbs. of cloves from British India.

THE NUTMEG.

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Myristica moschata, *M. officinalis*, or *aromatica*.—This tree is of a larger growth than the clove, attaining a height of thirty feet, and has its leaves broader in proportion to their length; the upper surface of these is of a bright green, the under of a greyish color. It is a dioecious plant, having male or barren pale yellow flowers upon one tree, and female or fertile flowers upon another. The fruit is drupaceous, and opens by two valves when ripe, displaying the beautiful reticulated scarlet arillus, which constitutes mace. Within this is a hard, dark brown, and glossy shell, covering the kernel, which is the nutmeg of the shops.

The kernels of *M. tomentosa* are also used as aromatics, under the name of wild or male nutmegs.

Lindley describes two other species, *M. fatua*, a native of Surinam, with greenish white flowers, and *M. sebifera* or *Virola sebifera*, a native of Guiana, with yellowish green flowers.

By expression, nutmegs are made to yield a concrete oil, called *Adeps Myristicae*, or sometimes erroneously oil of mace. A volatile oil is also procured by distillation. Nutmegs and mace are used medicinally as aromatic stimulants and condiments. In large doses they have a narcotic effect. The fleshy part of the fruit is used as a preserve.

Dr. Oxley has given such an admirable account of the nutmeg and its cultivation, as the result of 20 years experience in Singapore, that I shall draw largely from his valuable paper, which is contained in the second volume of “The Journal of the Indian Archipelago,” page 641.

The nutmeg tree, like many of its class, has a strong tendency to become monoecious, and planters in general are well pleased at this habit, thinking they secure a double advantage by having the male and female flowers on the same plant. This is, however, delusive, and being against the order of nature, the produce of such trees is invariably inferior, showing itself in the production of double nuts and other deformities. It is best, therefore, to have only female trees, with a due proportion of males.

The female flowers, which are merely composed of a tripid calyx and no corolla, when produced by a tree in full vigor are perfectly urceolate, slightly tinged with green at the base, and well filled by the ovary, whereas the female flowers of weakly trees are entirely yellow, imperfectly urceolate, and approach more to the staminiferous flowers of the male.

The shape of the fruit varies considerably, being spherical, oblong, and egg-shaped, but the nearer they approach sphericity of figure, the more highly are they prized.

There is also a great variety in the foliage of different trees, from elliptic, oblong and ovate, to almost purely lanceolate-shaped leaves. This difference seems to indicate in some measure the character of the produce; trees with large oblong leaves appearing to have the largest and most spherical fruit, and those with small lanceolate leaves being in general more prolific bearers, but of inferior quality.

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Whilst its congener the clove has been spread over Asia, Africa, and the West Indies, the nutmeg refuses to flourish out of the Malayan Archipelago, except as an exotic, all attempts to introduce it largely into other tropical countries having decidedly failed. The island of Ternate, which is in about the same latitude as Singapore, is said to have been the spot where it was truly indigenous, but no doubt the tree is to be found on most of the Moluccas. At present the place of its origin is unproductive of the spice, having been robbed of its rich heritage by the policy of the Dutch, who at an early period removed the plantations to the Banda isles for better surveillance, where they still remain and flourish. But although care was formerly taken to extirpate the tree on the Moluccas, the mace-feeding pigeons have frustrated the machinations of man, and spread it widely through the Archipelago of islands extending from the Moluccas to New Guinea. Its circle of growth extends westward as far as Pinang, or Prince of Wales Island, where, although an exotic, it has been cultivated as a mercantile speculation with success for many years. Westward of Pinang there are no plantations, looking at the subject in a mercantile point of view. The tree is to be found, indeed, in Ceylon, and the West Coast of India, but to grow it as a speculation out of its indigenous limits, is as likely to prove successful as the cultivation of apples and pears in Bengal.

In the Banda Isles, where the tree may be considered as indigenous, no further attention is paid to its cultivation than setting out the plants in parks, under the shade of large forest trees, with long horizontal branches, called “Canari” by the natives. There it attains a height of 50 feet and upwards, whereas from 20 to 30 feet may be taken as a fair average of the trees in the Straits’ Settlements; but notwitstanding our pigmy proportions (adds Dr. Oxley), it does not appear, from, all I could ever learn, that we are relatively behind the Banda trees, either in quantity or quality of produce, and I am strongly impressed with the idea that the island of Singapore can compete with the Banda group on perfectly even terms. Our climate is quite unexceptionable for the growth of the nutmeg, being neither exposed to droughts or high winds; and although we may lose by comparison of soils, we again gain by greater facilities of sending our products to market, by the facility of obtaining abundant supplies of manure, and any amount of free and cheap labor.

A nutmeg plantation, well laid out and brought up to perfection, is one of the most pleasing and agreeable properties that can be possessed. Yielding returns, more or less daily, throughout the year, there is increasing interest, besides the usual stimulus to all agriculturists of a crop time, when his produce increases to double and quadruple the ordinary routine.

Trees having arrived at fifteen years growth, there is no incertitude or fear of total failure of crop, only in relative amount of produce, and this, as will be seen, is greatly in the planter’s own power to command. It is against reason to suppose that a tree in flower and fruit will not expend itself if left to unaided nature: it must be supplied with suitable stimuli to make good the waste, therefore he who wants nuts must not be sparing of manure.

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The first requisite for the planter is choice of location. It is true that the nutmeg tree, aided by manure, will grow in almost any soil where water does not lodge, but it makes a vast difference in the degree of success, whether the soil be originally good, or poor and improved by art. The tree does not thrive in white or sandy soils, but prefers the deep red and friable soils formed by the decomposition of granite rocks and tinged with iron, and the deeper the tinge the better. I am therefore inclined to think, that iron in the soil is almost necessary for the full development of the plant. If under the before-mentioned soil there be a rubble of iron-stone at four or five feet from the surface (a very common formation in Singapore), forming a natural drainage, the planter has obtained all that he can desire in the ground, and needs only patience and perseverance to secure success. The form of the ground ought to be undulating, to permit the running off of all superfluous water, as there is no one thing more injurious to the plant than water lodging around its roots, although, in order to thrive well, it requires an atmosphere of the most humid sort, and rain almost daily. Besides the form of the ground, situation is highly desirable, particularly as regards exposure. A spot selected for a nutmeg plantation cannot be too well sheltered, as high winds are most destructive to the tree, independently of the loss occasioned by the blowing off of fruit and flower.

At present there is abundant choice of land in Singapore, the greater portion of the island being as yet uncultivated, and much answering to the above description. The land can be purchased from Government at the rate of from 10s. to 20s. per acre in perpetuity. I would advise the man who wishes to establish a plantation, to select the virgin forest, and of all things let him avoid deserted gambier plantations, the soil of which is completely exhausted, the Chinese taking good care never to leave a spot until they have taken all they can out of it. A cleared spot has a great attraction for the inexperienced, and it is not easy to convince a man that it is less expensive to attack the primitive forest, than to attempt to clear an old gambier plantation, overrun with lalang grass; but the cutting down and burning of large forest trees is far less expensive than the extirpation of the lalang, and as the Chinese leave all the stumps of the large trees in the ground, it is almost more difficult to remove them in this state than when you have the powerful lever of the trunk to aid you in tearing up the roots, setting aside the paramount advantage that, in the one case you possess a fresh and fertile soil, in the other an effete and barren one.

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Forest land, or “jungle,” as it is called in the East, can be cleared for about 25 to 30 dollars (L5 to L6) per acre, by contract, but the planter had better be careful to have every stump and root of tree removed, ere he ventures to commence planting, or the white ants, attracted by the dead wood, will crowd into the land, and having consumed the food thus prepared for them, will not be slow in attacking the young trees. Whilst the planter is thus clearing the ground, he may advantageously at the same time be establishing nurseries; for these the ground ought to be well trenched and mixed with a small quantity of thoroughly decomposed manure and burned earth, making up the earth afterwards into beds of about three feet wide, with paths between them for the convenience of weeding and cleaning the young plants. Of course if the planter can obtain really good plants, the produce of well-selected seed, it will be a great saving of time and expense to him, but unless the seed be carefully chosen, I would prefer beginning my own nurseries, and in the selection of seed would recommend the most perfectly ripe and spherical nuts. Oval long nuts are to be rejected, particularly any of a pale color at one end.

The planter having selected his seed, which ought to be put in the ground within twenty-four hours after being gathered, setting it about two inches deep in the beds already prepared, and at the distance of twelve to eighteen inches apart, the whole nursery to be well shaded both on top and sides, the earth kept moist and clear of weeds, and well smoked by burning wet grass or weeds in it once a week, to drive away a very small moth-like insect that is apt to infest young plants, laying its eggs on the leaf, when they become covered with yellow spots, and perish if not attended to speedily.

Washing the leaves with a decoction of the Tuba root is the best remedy I know of, but where only a few plants are affected, if the spots be numerous, I would prefer to pluck up the plant altogether, rather than run the risk of the insect becoming more numerous, to the total destruction of the nursery. The nuts germinate in from a month to six weeks, and even later, and for many months after germination the seed is attached to the young plant, and may be removed apparently as sound as when planted, to the astonishment of the unlearned, who are not aware of the great disproportion in size between the ovule and albumen, the former of which is alone necessary to form the plant. The plant may be kept in nursery with advantage for nearly two years. Should they grow rapidly, and the interspaces become too small for them, every second plant had better be removed to a fresh nursery; and set out at a distance of a couple of feet from each other. When transplanted, either in this way or for their ultimate position in the plantation, care should be taken to remove them with a good ball of earth, secured by the skin of the plantain, which prevents the ball of earth falling to pieces.

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The nurseries being established, the ground cleared and ready, the next proceeding is to lay out and dig holes about 26 or 30 feet apart, and as the quincunx order has so many advantages, it is the form I would recommend for adoption. The holes should be at least six feet in diameter, and about four feet deep, and when refilled the surface soil is to be used, and not that which is taken out of the hole. Each hole should be filled up about one foot higher than the surrounding ground, to allow for the settling of the soil and the sinking of the tree, which, planted at this height, will in a few years be found below the level. Over each hole thus filled up, a shed, made of Attap leaves or other shelter, closed on two sides, east and west, and proportioned to the size of the plant, is to be erected. It is not a bad plan to leave an open space in the centre of the top of each shed, about twelve inches wide, by which the young plant can obtain the benefit of the dew and gentle rains, which more than compensates for the few rays of sun that can only fall upon it whilst that body is vertical. After the sheds have been completed, each hole should have added to it a couple of baskets of well decomposed manure, and an equal quantity of burned earth, when all is ready for the reception of the plant, which, having been set out, if the weather be dry will require watering for ten days or a fortnight after, in fact until it takes the soil.

The planter having set out all his trees must not deem his labors completed, they are only commencing. To arrive thus far is simple and easy, but to patiently watch and tend the trees for ten years after, requires all the enthusiasm already mentioned. About three months after planting out, the young trees will receive great benefit if a small quantity of liquid fish manure be given them. In the first six years they ought to be trenched round three times, enlarging the circle each time, the trenches being dug close to the extremities of the roots, which generally correspond to the ends of the branches, and each new trench commencing where the old one terminated. They must of course greatly increase in size as the circle extends, requiring a proportionate quantity of manure, but the depth ought never to be less than two feet.

The object of trenching is to loosen the soil and permit the roots to spread, otherwise the tree spindles instead of becoming broad and umbrageous. Manure is beyond all other considerations the most important to the welfare of the estate; it is that which gives quantity and quality of produce, and without it a plantation cannot be carried on. The want of it must limit the cultivation in the Straits' Settlements, and will arrest many a planter, who, having got his plantation to look well up to the eighth year with very little manure, thinks he can go on in the same manner. The nutmeg tree likes well all sorts of manures, but that which is best suited for it seems to be well-rotted stable and cow-yard manure, mixed with vegetable matter, and when the tree is in bearing the outer covering of the nut itself is about one of the very best things to be thrown into the dung-pit. Dead animals buried not too near the roots, also blood, fish, and oil cakes are beneficial. Guano is of no use.

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But although manuring is the chief element in successful cultivation, there are many other matters for the planter to attend to during the period that the trees are growing. All obnoxious grasses must be carefully kept out of the plantation, at least from between the trees, and the harmless grasses rather encouraged, as they keep the surface cool. The trunk of the tree ought to be carefully washed with soap and water once a year to keep it clear of moss; this has been ridiculed as a work of supererogation, but let those who think so omit the operation.

Parasitical plants of the genus Loranthus are very apt to attach themselves to the branches, and if not removed do great injury.

The insect enemies of the tree are not very numerous, but it has a few, white ants among the number. They seldom attack a vigorous plant; it is upon the first symptoms of weakness or decay that they commence their operations. Their nests may be dislodged from the roots of the plant by a dose of solution of pig dung, to which they have a great aversion.

There are several species of insects which lay their eggs on the leaves, and unless carefully watched and removed, they commit great havoc amongst the trees. For this purpose it is necessary to wash the leaves with a decoction of Tuba root, and syringe them by means of a bamboo with lime and water, of the consistence of whitewash; this adheres to the leaves, and will remain even after several heavy showers.

Another nuisance is the nest of the large red ant; these collect and glue the leaves together, forming a cavity for the deposition of their *larvae*. The best mode of destroying them is to hang a portion of some animal substance, such as the entrails of a fowl, fish, &c., to the end of a pole, thrust through and protruding from the branches; the ants will run along the pole and collect in immense quantities around the bait, when, by a lighted faggot, they can be burned by thousands. This repeated once or twice a day for a week or so, will soon rid the tree of the invaders.

The number of men to be kept on an estate to preserve it in first-rate order after it has come into bearing, must depend of course upon the size of the plantation, but in general one man for every one hundred trees will be found sufficient, provided there be some four or five thousand trees. On a small scale the proportion must be greater.

The nutmeg planter is under the necessity of keeping up nurseries throughout the whole of his operations for the replacement of bad plants and redundant males. Of the latter ten per cent. seems to be about the best proportion to keep, but I would have completely dioecious trees. No person can boast to get a plantation completely filled up and in perfect order much sooner than fifteen years. Of the first batch planted, not more than one-half will turn out perfect females, for I do not take into account monoecious trees, which I have already condemned. The tree shows flower about the seventh year, but the longer it is before doing so, the better and stronger will it be. I cannot refrain from a smile when a sanguine planter informs me with exultation that he has obtained a nut from a tree only three or four years planted out; so much the worse for his chance of success, too great precocity being incompatible with strength and longevity.

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The best trees do not show flower before the ninth year, and one such is worth a score of the others. This will be evident when it is stated that I have seen several trees yield more than 10,000 nuts each in one year, whereas I do not believe that there is a plantation in the Straits' that averages 1,000 from every tree. This very great disparity of bearing shows plainly that the cultivation of the plant is not yet thoroughly understood, or greater uniformity would prevail, and I think it clearly enough points out that a higher degree of cultivation would meet its reward.

The tree has not been introduced into the Straits' sufficiently long to determine its longevity, but those introduced and planted in the beginning of the present century, as yet show no symptoms of decay. The experiment of grafting the trees, which at first view presents so many advantages, both in securing the finest quality of nut and the certainty of the sex, has still to be tried in this cultivation. Some three years ago (continues Dr. Oxley), I succeeded in grafting several plants by approach; these are not sufficiently old for me to decide whether it be desirable or not, for although the plants are looking well and growing, they as yet have thrown out their branches in a straggling irregular manner, having no leaders, and consequently they cannot extend their branches in the regular verticles necessary for the perfect formation of the tree, without which they must ever be small and stunted, and consequently incapable of yielding any quantity of produce. The grafts have succeeded so far as stock and scion becoming one, and in time a perpendicular shoot from the wood may appear. If after that it should increase in size and strength, so as to form a tree of full dimensions, the advantage gained would be worth any trouble, the quality of some nuts being so far above that of others, it would make a difference beyond present calculation; in short, 1,000 such picked trees at the present prices would yield something equivalent to L4,000 a year, for L4 per tree would be a low estimate for such plants. If this ever does occur, it will change the aspect of cultivation altogether, and I see no good reason why it should not, except that those possessing trees of the quality alluded to, would not very willingly permit others to graft from them, so it is only the already successful planter who can try the experiment properly.

An acre of land contains on an average 92 trees, and it is calculated an outlay of 300 dollars is required upon every acre to bring the tree to maturity; but as not more than one-half of the trees generally turn out females, and as many others are destroyed by accident and diseases to which this plant is very liable, it makes the cost of each tree, by the time it yields fruit, about eight dollars. The nutmeg tree begins to bear when about eight years old, but it gives no return for several years longer; and therefore to the expense of cultivation must be added the interest of the capital sunk. The plant being indigenous in the Moluccas, the expense of cultivation there is greatly less, and this consequently forms a strong ground of claim to the British planter for protective duties to their spices from the British Government.

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The planter having his tree arrived at the agreeable point of producing, has but slight trouble in preparing his produce for market. As the fruit is brought in by the gatherers, the mace is carefully removed, pressed together and flattened on a board, exposed to the sun for three or four days, it is then dry enough to be put by in the spice-house until required for exportation, when it is to be screwed into boxes, and becomes the mace of commerce. The average proportion of mace yielded in Singapore is one pound for every 433 nuts.

The nutmeg itself requires more care in its curing, it being necessary to have it well and carefully dried ere the outer black shell be broken. For this purpose the usual practice is to subject it for a couple of months to the smoke of slow fires kept up underneath, whilst the nuts are spread on a grating about eight or ten feet above. The model of a perfect drying-house is easily to be obtained. Care should be taken not to dry the nuts by too great a heat, as they shrivel and lose their full and marketable appearance. It is therefore desirable to keep the nuts, when first collected, for eight or ten days out of the drying-house, exposing them at first for an hour or so to the morning sun, and increasing the exposure daily until they shake in the shell. The nuts ought never to be cracked until required for exportation, or they will be attacked and destroyed by a small weasel-like insect, the larvae of which is deposited in the ovule, and, becoming the perfect insect, eats its way out, leaving the nut bored through and through, and worth less as a marketable commodity. Liming the nuts prevents this to a certain extent, but limed nuts are not those best liked in the English market, whereas they are preferred in that state in the United States. When the nuts are to be limed, it is simply necessary to have them well rubbed over between the hands with powdered lime. By the Dutch mode of preparation, they are steeped in a mixture of lime and water for several weeks. This no doubt will preserve them, but it must also have a prejudicial effect on the flavor of the spice.

After the nuts are thoroughly dried, which requires from six weeks to two months smoking, they cannot be too soon sent to market. But it is otherwise with the mace; that commodity, when fresh, not being in esteem in the London market, seeing that they desire it of a golden color, which it only assumes after a few months, whereas at first when fresh it is blood red; now red blades are looked upon with suspicion, and are highly injurious to the sale of the article.

This is one of those peculiar prejudices of John Bull, which somewhat impugns his wisdom; but it must be attended to, as John is very ready to pay for his caprice; therefore those who provide for him have no right to complain, although they may smile.

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The nutmeg tree was sent from Bencoolen to Singapore, the latter end of 1819, so that thirty-four years have elapsed since its first introduction. Sir Stamford Raffles shipped to the care of the resident commandant, Major Farquhar, 100 nutmeg plants, 25 larger ditto, and 1,000 nutmeg seeds, which were committed to the charge of Mr. Brooks, a European gardener, who was specially engaged by the East India Company to look after their embryo spice plantations here. Some of these plants were set out in rather a bad soil and locality, but several of them are at present, and have been for the last ten years, fine fruitful trees. 315 of the trees in the Government garden yielded, in 1848, 190,426 nuts, or at the average of 604 for each tree; but of these not over 50 were of the old stock, most having been planted since 1836; so that a planter may safely calculate on having a better average than is here set forth, provided he attends to his cultivation, and his trees are brought up to the age of fifteen years. If a plantation be attended to from the commencement after the manner I have endeavoured to explain, and the trees be in a good locality, the planter will undoubtedly obtain an average of 10 lbs. of spice from each tree from the fifteenth year; this, at an average price of 2s. 6d. per lb., is 25s. per annum. He can have about seventy such trees in an acre, so that there is scarcely any better or more remunerative cultivation when once established. But the race is a long one, the chances of life, and a high rate of interest in the country, make it one of no ordinary risk, and it is one that holds out no prospect of any return in less than ten years.

A person commencing and stopping short of the bearing point, either by death or want of funds, will suffer almost total loss, for the value of such a property brought into a market where there are no buyers must be purely nominal. Again, if the property has arrived at the paying point, almost any person of common honesty can take charge of and carry it on, for the trees after twelve years are remarkably hardy, and bear a deal of ill treatment and neglect; not that I would recommend any person to try the experiment. But it is some consolation for the proprietor to know that stupidity will not ruin him, and that even at the distance of thousands of miles he can give such directions, as, if attended to, will keep his estate in a flourishing and fruitful state.

The total number of nutmeg trees in Singapore in 1848 was 55,925, of which 14,914 only were in bearing. The produce of that year was 4,085,361 nutmegs, or 33,600 lbs. in weight. The greater number of the trees, it will be perceived, have not come into full bearing, but the produce is increasing rapidly, and in 1849 it amounted to fully 66,670 lbs.

Among the principal growers in that island are Dr. Oxley, Mr. C.R. Prinsep, and Mr. W. Montgomerie, who have each large plantations, with from 2,000 to 5,000 bearing trees on them. Others, as Sir. J. d'Almeida, Mr. Nicol, and one or two more, have planted extensively, but have not yet got their trees to the bearing point.

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A large supply of nutmeg and clove plants arrived at Pinang in 1802, from the Molucca Islands. There were 71,266 nutmeg and 55,264 clove plants; allowing one half of the former to have been male trees, there would only have been 35,633 useful nutmeg plants. It is believed that a mere fraction of these ever reached maturity, but they served to introduce the cultivation permanently. Plants were likewise sent to Ceylon and Cape Comorin. It does not appear that the climates of these two localities suit the nutmeg tree, as it requires rain, or at least a very damp climate throughout the year. The East India Company's spice plantations in Pinang were sold in 1824, and the trees were dispersed over the island.

The spice cultivators of the Straits' Settlements have for some time sought a further protective duty on nutmegs, and the extension of a similar protection to mace and cloves, the produce of these settlements; for singularly enough the present tariff affords no protection to mace, the growth of British possessions. From tabular statements, furnished by the Chamber of Commerce of Pinang, drawn up apparently with great care, it appears that in 1843 there were 3,046 acres cultivated with spice trees in Pinang and province Wellesley, containing 233,995 nutmegs, and 80,418 clove trees, besides 77,671 trees in nurseries ready to be planted out; and by a similar statement from Singapore, which is however not so complete, that 743 acres are cultivated, containing 43,544 nutmeg trees. The island of Pinang is estimated to contain 160 square miles, nearly the whole of which, with the exception perhaps of summits of the hills, is well adapted to spice growing. Province Wellesley is of much greater extent, and the soil of it has already been proved to be equally well fitted for that kind of cultivation; and the settlements of Malacca and Singapore are said to be admirably suited, in many places, for that species of produce, the latter of which has already several plantations fast approaching to maturity.

The cultivation is capable of great extension; encouragement is only required to be held out, and new plantations will be rapidly formed in these settlements. The same tables show that the produce in 1842 was, in Pinang and Province Wellesley, 18,560,281 nutmegs, 42,866 lbs. of mace, and 11,813 lbs. of cloves[51]; and in Singapore, 842,328 nutmegs, and 1,962 lbs. of mace. Thus making the produce from the two settlements 19,408,608 nutmegs in number (or in weight 147,034 lbs.), 44,822 lbs. of mace, and 11,813 lbs. of cloves. Now the consumption of these spices in Great Britain was, on an average of four years ending 1841, as follows:—Nutmegs, 121,000 lbs.; mace, 18,000 lbs.; cloves, 92,000 lbs. Showing, therefore, that the Straits' Settlements already produce more than sufficient of the two former to supply the home market.

In the course of four or five years more, Pinang alone will more than double the present quantity of nutmegs and mace produced in the Straits, and the produce of cloves will be more than tripled.

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I have been able, from several elaborate papers in my “Colonial Magazine,” to condense details, showing the progress of spice plantations in Prince of Wales Island and Province Wellesley. In the close of 1843 there were 64,902 nutmeg trees in bearing in the island; 39,209 male trees, 103,982 not bearing; making a total of 208,093 trees planted out, besides 52,510 plants in nursery. The quantity of ground under cultivation was 2,282 orlongs. The produce in 1842 was 15,116,591 good nuts, 1,461,229 inferior nuts, and 38,260 lbs. of mace. The gross value of the produce in 1843, reckoning the good nuts at five dollars per thousand, and the inferior at one dollar, was 76,944 dollars. The estimated number of nuts in 1843 was 12,458,762; in 1844, 25,429,000.

In Province Wellesley there were 247 orlongs under cultivation with the nutmeg, on which were 10,500 bearing trees, 8,095 male trees, and 7,307 not yet bearing, making in all 25,902 trees planted out. The produce was in 1842, 1,969,619 good nuts, 18,842 inferior ditto, and 4,500 lbs. of mace. The value of the produce of nutmegs was 9,867 dollars. The estimated number of nuts in 1843 was 1,980,000; in 1844, 2,958,000. There were in all 423 nutmeg plantations on the island and main land.

There were annually exported in the four years ending 1850, 48,000 lbs. of nutmegs from Pinang, and 57,400 lbs. of mace.

The French at an early period cultivated the nutmeg at the Mauritius, and from thence they carried it to Cayenne. In Sumatra it appears to have been grown successfully, and according to Sir S. Raffles, there was in 1819 a plantation at Bencoolen of 100,000 nutmeg trees, one-fourth of which were bearing. Attempts have been made in Trinidad and St. Vincent to carry out the culture, but for want of enterprise very little progress seems to have been made in the matter.

Under the new duties which came into operation this year, nutmegs, instead of standing at 1s. per pound all round, have been classified, and the so-called “wild” nutmegs of the Dutch islands are to pay only 5d per pound. This deprives the Straits’ produce of its last protection against that of the Banda plantations, where the tree grows spontaneously, while it gives the long Dutch nut a high protection. If an alteration in this suicidal measure is not speedily obtained, the Straits’ planters will be ruined. The Dutch have the power of inundating the market with the long aromatic nut. If the original plan of putting all British and all foreign nutmegs on the same footing had been adhered to, the Straits’ planters would not have complained, as they would have trusted to their superior skill and care to compensate for the grand advantage the Dutch have in their rich soils.

On observing this alteration of duty, Mr. Crawfurd and Mr. Gilman immediately prepared the following memorandum for the Chancellor of the Exchequer, which however failed to influence that Minister:—

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"MEMORANDUM ON THE DUTIES ON NUTMEGS.

"The duty proposed to be levied on nutmegs is 1s. per pound for cultivated, and 5d. per pound for those commonly called wild. The ground on which this distinction is founded, is said to be that the market value of the one is but half that of the other, and that the Customs can readily distinguish between them.Now it is admitted, on all sides, that there is but one species of culinary nutmeg, the *Myristica Moschata* of botanists, although at least a score of the same genus, all unfit for human food. The parent country of the aromatic nutmegs extends from the Molucca Islands to New Guinea, inclusive. In this they grow with facility and even in the Banda Islands, where there are parks of them, they hardly undergo any cultivation, and may truly be said, even there, to be a wild product. It is only when grown as exotics, as in the British settlements of Pinang and Singapore, that they require cultivation, and that a more careful and expensive one than any other produce of the soil.Aromatic nutmegs are sometimes large and sometimes small—sometimes round, sometimes oblong, and sometimes long, and this will be found the case whether cultivated or uncultivated. How, then, the Customs are able to distinguish them it is difficult to understand. In the ordinary Prices Current no mention whatever is made of the wild and cultivated, the lowest quality being quoted in the most recent at 2s. per pound, and the highest at 3s. 10d.,—the best of what are called wild fetching a higher price than the lower qualities of what are called cultivated.But suppose the distinction could be made with the most perfect certainty, to make it would be a palpable departure from the principle adopted with every other commodity, of charging a uniform rate of duty on quality. To give an example, the present price of black pepper is 3-5/8d. to 4d. per pound, while that of white pepper is 81/2d. to 1s. 2d. per pound, both paying the same duty of 6d.; yet nothing can be more easily distinguished than these two commodities, which, except as to curing, are the same article.Tea is a still more striking example. The duty is the same on all qualities, though prices range from 1l1/2d. to 3s. 6d. per pound. It was the very circumstance of the difficulty of distinguishing between the different kinds of tea, especially between Bohea and Congou, which, after an eighteen months trial, overthrew the system of rated duties of 1s. 6d., 2s., and 3s., adopted on the abolition of the East India Company's monopoly in 1833.Unless the duty on nutmegs is equalised there will be no end of trouble and disputes, and however expert the Customs may be, they will certainly be outwitted, and long-shaped and small nutmegs, although really cultivated, will be introduced at the lower duty, by unscrupulous traders, as

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wild ones.It may be added that duties of 12d. and 5d. do not, even if a departure from the principle of charging on quality were justifiable, represent the just proportional rates which ought to be levied upon what are supposed to be, respectively, cultivated and wild, as they are represented in the ordinary Price Current by the highest and lowest prices, which are 3s. 10d. and 2s. The just proportional duty ought to be on the lowest, not 5d., but 7d. The duty, as first proposed by the Chancellor of the Exchequer, of 1s. per pound on nutmegs, without distinction, was perfectly satisfactory to the planters, merchants, and the trade in general.It is a mistake to suppose that a duty of 1s. would exclude the so-called wild nutmegs. They would be imported in large quantities, as the cost is low. In quantity it was 17 Spanish dollars per picul, and there is no reason to suppose it would be more now. The finest picked cost say 34 Spanish dollars.

In Pinang and Singapore for cultivated the price is 65 to 70 dollars.

The planters for the most part do not sell on the spot, but consign here for sale on their own account.

London, May 23rd, 1853.

NUTMEGS IMPORTED AND EXPORTED TO AND FROM SINGAPORE.

	Imported. piculs.	Exported. piculs.	Growth of Singapore.	Value of the native growth. L
1841	2271/2	412	1841/2	3,323
1842	258	809	551	9,897
1843	1501/2	249	981/2	1,760
1844	52	282	230	4,131
1845	41	383	342	6,143
1846	79	331	252	4,526
1847	139	416	277	4,275

NUTMEGS EXPORTED FROM JAVA.

	Nutmegs. piculs.	Mace. piculs.
1830	1,304	177
1835	5,022	1,606
1839	5,027	1,581

1843	2,133	486

IMPORTS INTO THE UNITED KINGDOM.

NUTMEGS, WILD AND CULTIVATED.			MACE.		
	Imports.	Home consump.		Imports.	Consumption.
	lbs.	lbs.		lbs.	lbs.
1847	367,936	150,657	1847	60,265	18,821
1848	336,420	167,143	1848	47,572	19,712
1849	224,021	178,417	1849	45,978	20,605
1850	315,126	167,683	1850	77,337	21,997
1851	358,320	194,132	1851	77,863	21,695
1852	357,940	239,113	1852	61,697	21,480

MACE EXPORTED—ACTUAL GROWTH OF SINGAPORE.

	Quantity—piculs.	Value—L
1841	251/2	583
1842	72	1,616
1843	403/4	943
1844	161/2	359
1845	71	1,616
1846	8	179
1847	75	1,661

109 piculs of imported mace were also re-shipped in 1847.

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40,000 lbs. of mace were imported into the United Kingdom from India in 1848.

GINGER, GALANGALE, AND CARDAMOMS.

The rhizome of *Zingiber officinale* (*Amomum Zingiber*), constitutes the ginger of commerce, which is imported chiefly from the East and West Indies. It is also grown in China. In the young state the rhizomes are fleshy and slightly aromatic, and they are then used as preserves, or prepared in syrup; in a more advanced stage the aroma is fully developed, their texture is more woody, and they become fit for ordinary ginger. The inferior sorts, when dried after immersion in hot water, form black ginger. The best roots are scraped, washed, and simply dried in the sun with care, and then they receive the name of white ginger. The rhizome contains an acid resin and volatile oil, starch and gum. It is used medicinally as a tonic and carminative, in the form of powder, syrup, and tincture.

The root stocks of *Alpinia racemosa*, *A. Galanga*, and many other plants of the order, have the same aromatic and pungent properties as ginger.

The consumption of ginger is about 13,000 or 14,000 cwt. a year. Of 16,004 cwt. imported in 1840, 5,381 came from the British West Indies, 9,727 from the East India Company's possessions and Ceylon, and 896 cwt. from Western Africa.

The difference between the black and white ginger of the shops is ascribed by Dr. P. Browne and others to different methods of curing the rhizomes; but this is scarcely sufficient to account for them, and I cannot help suspecting the existence of some difference in the plants themselves. That this really exists is proved by the statements of Rumphius ("Herb. Amb.," lib. 8, cap. xix., p. 156), that there are two varieties of the plant, the white and the red. Moreover Dr. Wright ("Lond. Med. Journal," vol. viii.) says that two sorts are cultivated in Jamaica, *viz*., the white and the black; and, he adds, "black ginger has the most numerous and largest roots."

The rhizome, called in commerce ginger root, occurs in flattish-branched or lobed palmate pieces, called *races*, which do not exceed four inches in length. Several varieties, distinguished by their color and place of growth, are met with. The finest is that brought from Jamaica. A great part of that found in the shops has been washed in whiting and water, under the pretence of preserving it from insects.

The dark colored kinds are frequently bleached with chloride of lime. Barbados ginger is in shorter flatter races, of a darker color, and covered with a corrugated epidermis. African ginger is in smallish races, which have been partially scraped, and are pale colored. East India ginger is unscraped; its races are dark ash colored externally, and are larger than those of the African ginger. Tellichery ginger is in large plump races, with a remarkable reddish tint externally.

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Jamaica black ginger is not frequently found in the shops. The Malabar dark ginger is in unscraped short pieces, which have a horny appearance internally, and are of a dirty brown color both internally and externally.

Ginger is imported in bags weighing about a hundred-weight.

The Malabar ginger exported from Calicut is the produce of the district of Shernaad, situated in the south of Calicut; a place chiefly inhabited by Moplas, who look upon the ginger cultivation as a most valuable and profitable trade, which in fact it is. The soil of Shernaad is so very luxuriant, and so well suited for the cultivation of ginger, that it is reckoned the best, and in fact the only place in Malabar where ginger grows and thrives to perfection. Gravelly grounds are considered unfit; the same may be said of swampy ones, and whilst the former check the growth of the ginger, the latter tend in a great measure to rot the root; thus the only suitable kind of soil is that which, being red earth, is yet free from gravel, and the sod good and heavy. The cultivation generally commences about the middle of May, after the ground has undergone a thorough process of ploughing, harrowing, &c.

At the commencement of the monsoons, beds of ten or twelve feet long by three or four feet wide are formed, and in these beds small holes are dug at three-fourths to one foot apart, which are filled with manure. The roots, hitherto carefully buried under sheds, are dug out, the good ones picked from those which are affected by the moisture, or any other concomitant of a half-year’s exclusion from the atmosphere, and the process of clipping them into suitable sizes for planting performed by cutting the ginger into pieces of an inch and a half to two inches long. These are then buried in the holes, which have been previously manured, and the whole of the beds are then covered with a good thick layer of green leaves, which, whilst they serve as manure, also contribute to keep the beds from unnecessary dampness, which might otherwise be occasioned by the heavy falls of rain during the months of June and July. Rain is essentially requisite for the growth of the ginger; it is also however necessary, that the beds be constantly kept from inundation, which, if not carefully attended to, the crop is entirely ruined; great precaution is therefore taken in forming drains between the beds, and letting water out, thus preventing a superfluity. On account of the great tendency some kinds of leaves have to breed worms and insects, strict care is observed in the choosing of them, and none but the particular kinds used in manuring ginger are taken in, lest the wrong ones might fetch in worms, which, if once in the beds, no remedy can be resorted to successfully to destroy them; thus they in a very short time ruin the crop. Worms bred from the leaves laid on the soil, though highly destructive, are not so pernicious to ginger cultivation as those which proceed from the effect of the soil. The former kind, whilst they destroy the beds in which they once appear, do not spread themselves to the other beds, be they ever so close, but the latter kind must of *course* be found in almost all the beds, as they do not proceed from accidental causes, but from the nature of the soil. In cases like these, the whole crop is oftentimes ruined, and the cultivators are thereby subjected to heavy losses.

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Ginger is extensively diffused throughout the Indian isles, it being especially indigenous to the East, and of pretty general use among the natives, who neglect the finer spices. The great and smaller varieties are cultivated, and the sub-varieties distinguished by their brown or white colors. There is no production which has a greater diversity of names. This diversity proves, as usual, the wide diffusion of the plant in its wild state. The ginger of the Indian Archipelago is however inferior in quality to that of Malabar or Bengal. In the cultivation of ginger great improvement may be adopted and expense saved. The garden plough and small harrow should be used.

The present mode of preparing the land for this crop in the West Indies, is by first carefully hoeing off all bush and weeds from the piece you intend to plant; the workmen are then placed in a line, and dig forward the land to the full depth of the hoe, cutting the furrow not more than from five to six inches thick. The land is then allowed to pulverise for a short time; you then prepare it for receiving the plants by opening drills with the hoe, from ten to twelve inches apart, and the same in depth, chopping or breaking up any clods that may be in the land. Two or three women follow and drop the plants in the drills, say from nine to ten inches apart. The plants or sets are the small knots or fingers broken off the original root, as not worth the scraping. The plants are then covered in with a portion of the earth-bank formed in drilling. It requires great care and attention in keeping them clean from weeds until they attain sufficient age. It throws out a pedicle or foot stalk in the course of the second or third week, the leaves of which are of similar shape to that of the Guinea grass.

Ginger is a delicate plant, and very liable to rot, particularly if planted in too rich a soil, or where it may be subject to heavy rains. The general average of yield is from 1,500 to 2,000 lbs. per acre in plants, although I have known as much as 3,000 lbs. of ginger cured from an acre of land. The planting season generally commences in Jamaica in February and March, and the crop is got in in December and January, when the stalks begin to wither. The ginger is taken from the ground by means of the hoe, each laborer filling a good-sized basket, at the same time breaking off the small knots or knobs for future planting.

A good scraper of ginger will give you from 30 to 40 lbs. of ginger per day. It is then laid on barbacues (generally made of boards) to dry. It takes from six to ten days to be properly cured. The average yield in weight is about one-third of what is scraped. When intended for preserving, the roots must be taken up at the end of three or four months, while the fibres are tender and full of sap.

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The ginger grown in the West Indies is considered superior in quality to that of the East, doubtless because more care is paid to the culture and drying of the root, but it is of less importance to commerce. The quantities imported from these two quarters is however becoming more equal, and Africa is coming into the field as a producer, 1,545 casks and packages having arrived from the western coast in 1846. The annual average export of ginger from Barbados between the years 1740 and 1788, was 4,667 bags; between 1784 and 1786, 6,320 bags; in 1788, 5,562 cwt. were shipped; in 1792, 3,046 bags and barrels. In 1738, so widely was the culture of this root diffused in Jamaica, that 20,933 bags, of one cwt. each, and 8,864 lbs. in casks were shipped. The exports may now be taken on an average at 4,000 cwt.; but, like all the other staple products of the island, this has fallen off one-half since the emancipation of the negro population.

In the three years which preceded the abolition of slavery, 5,719,000 lbs. of ginger were shipped from Jamaica. In the three years ending with 1848, the quantity shipped had decreased 2,612,186 lbs., as will be seen by the following returns:—

GINGER SHIPPED.

	lbs.		lbs.
1830	1,748,800	1846	1,462,000
1831	1,614,640	1847	1,324,480
1832	2,355,560	1848	320,340
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	5,719,000		3,106,820

In 1843 there were shipped from Jamaica 3,719 casks and bags; in 1844, 3,692 casks and 1730 bags; in 1845, 3,506 casks, valued at L4 10s. each, and 1,129 bags, valued at L2 each, equal in all to L18,037. From the island of Hayti 8,769 lbs. of ginger were exported in 1835, and 15,509 lbs. in 1836. 39 packages of ginger were shipped from Barbados in 1851.

In Maranham and one or two other provinces of Brazil, ginger of an excellent quality is grown, and a good deal is exported. It was very early an article of culture in South America. According to Acosta, it was brought to America by one Francisco de Mendoza, from Malabar, and so rapidly did its cultivation spread, that as far back as 1547, 22,053 cwt. were shipped to Europe. Southey, in his “History of Brazil” (vol. i., p. 320), says, “Ginger had been brought from the island of St. Thomas, and throve so well that in the year 1573, 4,000 arrobas of 25 lbs. each were cured; it was better than what came from India, though the art of drying it was not so well understood. Great use was made of this root in preserves, but it was prohibited, as interfering with the Indian trade in that wretched species of policy which regards immediate revenue as its main object.”

Ginger was worth in the London market 25s. to 60s. the cwt. in bond; middling and fine qualities, 80s. to 160s. The duty is 5s. per cwt.

Amount of imports of ginger into the United Kingdom, with the quantities entered for home consumption:—

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	West India ginger.	Entered for home consumption.	East India ginger.	Entered for home consumption.
	cwts.	cwts.	cwts.	cwts.
1831	3,551	4,709	849	79
1832	5,947	6,795	2,508	213
1833	6,064	6,570	10,049	1,099
1834	9,913	9,918	10,004	1,638
1835	8,321	8,982	4,489	1,647
1836	10,226	6,304	13,589	3,524
1837	10,933	9,905	23,876	3,386
1838	13,366	9,944	25,649	1,431
1839	8,996	7,213	29,624	914
1840	5,381	7,935	9,719	1,568
1841	4,446	5,523	5,292	1,177
1842	4,671	5,068	3,680	1,956
1843	4,013	5,953	4,106	3,254
	casks, &c.	casks.	bags.	bags.
1844	4,619	3,128	5,101	6,964
1845	6,033	4,000	8,165	7,938

	Total ginger imported.	Retained for home consumption.
	cwts.	cwts.
1846	24,370	15,937
1846	20,010	15,163
1847	12,995	9,744
1848	13,748	10,454
1849	28,015	12,880
1850	33,953	16,543
1851	35,678	19,855
1852	20,297	18,691

GALANGALE ROOT is a good deal used in China, and forms an article of commerce, fetching in the London market 12s. to 16s. per cwt. in bond. It is the rhizoma of *Alpinia Galanga*. Its taste is peppery and aromatic. Externally the color of the root-stocks is reddish brown, internally pale reddish white.

1,280 cwt. of galangale root, valued at 2,880 dollars, was exported from Canton in 1850.

CARDAMOMS.

Cardamoms are the production of various species of plants of the same tribe as the ginger, and might be profitably cultivated with that aromatic root, as well as the Turmeric (*Curcuma longa*), which see.

Various species of *Alpiniae*, *Amomum*, *Elettaria*, *and Renealmia*, appear to furnish the cardamoms of the shops, which consist of the oval, trivalvular capsules containing the seeds. The bright yellow seeds are used in medicine as aromatic tonics and carminatives; and for curries, ketchups, soups, &c. Their active ingredient is a pungent volatile oil. The least dampness injures the finer sorts. About 688 cwts. of cardamoms, and 5,000 cwts. of bastard cardamoms are annually exported from Siam, “We imported about 300 tons in 1849. The price ranges from 1s. 6d. to 3s. the pound. The estimated value of the cardamoms and pepper shipped from Ceylon in the past few years was as follows:—1846, L208; 1847, L246; 1848, L205; 1849, L454; 1850, L960; 1851, L771; 1852, L590. The” following are some of the plants from which cardamoms are procured.

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1. *Amomum Cardamomum*, a Java plant, supplies the round cardamoms. It has pale brown flowers. The fruit varies in size from that of a black currant to a cherry.

2. A. angustifolium (Pereira), a plant having red blossoms; furnishes the large Madagascar cardamoms, and also supplies some of the seeds called “Grains of Paradise,” which are, however, larger than those imported under that name.

This species is found in Abyssinia, according to my friend Mr. Chas. Johnston, author of “Travels in Abyssinia,” who favored me with some specimens. The seeds are pale olive brown, devoid of the fiery peppery taste of the grains of paradise.

3. *A. maximum*, the great winged amomum, produces the Java cardamoma of the London market, and is also grown extensively in Ceylon, the Malay islands, Nepaul, Sumatra, and other islands of the Eastern Archipelago. There were exported from Ceylon in 1842, 5,364 lbs.; in 1843, 9,632 lbs.; 1844, 7,280 lbs.; and in 1845, 11,812 lbs. The pods are large and long, and dark colored, approaching to black, the taste nauseous and disagreeable, not the least resembling that of the Malabar cardamoms. It is propagated by cuttings of the rhizoma. The plants yield in three years, and afterwards give an annual crop. They are not used here, but sent to the continent.

4. *Alpinia Cardamomum*.—This is the source of the clustered cardamoms, and furnishes the best known sort. Its produce is in great request throughout India, fetching as much as L30 the candy of 600 Lbs. About 192 candies are grown annually in Travancore, and the usual crop in Malabar is reckoned at 100 candies annually. It flourishes on the mountainous parts of the Malabar coast, and among the western mountains of Wynaad. The bulbous plants, which grow three or four feet high, are produced in the recesses of the mountains by felling trees, and afterwards burning them, for wherever the ashes fall in the openings or fissures of the rocks, the plant naturally springs up. In the third year the plants come to perfection, bearing abundantly for a year or two, and then die. In Soonda Balagat, and other places where cardamoms are planted, they are much inferior to those grown in the wild state. It may be propagated by cuttings or divisions of the roots. Not more than one-hundredth part of the cardamoms raised in Malabar are used in the country. They are sent in large quantities to the ports on the Red Sea, and the Persian Gulf, up the Indus to Scinde, to Bengal and Bombay. The price of Malabar cardamons at Madras, in June, 1853, was about L3 the maund of 25 lbs. They fetch in the Bombay market L4 10s. the maund of 40 lbs. Cardamoms form a universal ingredient in curries, pillaus, &c. The seed capsules are gathered as they ripen, and when dried in the sun are fit for sale. They should be chosen full, plump, and difficult to be broken; of a bright yellow color, and piercing smell; with an acrid bitterish, though not very unpleasant taste, and particular care should be taken that they are properly dried.

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5. Amomum Grana-Paradisi, which is indigenous to the islands of Madagascar and Ceylon, yields an inferior sort of cardamoms, known by the names of grains of paradise, or Meleguetta pepper. These are worth in the English market only from 1s. 2d. to 1s. 4d. per pound, while the long and Malabar cardamoms fetch 2s. 8d. to 3s. 3d. the pound. This plant is a native of Guinea, and the western parts of Africa about Sierra Leone. We imported from thence in 1841, 7,911 pounds.

The taste of these Guinea grains is aromatic and vehemently hot or peppery. They are imported in casks from Africa, and are principally used in veterinary medicine, and to give an artificial strength to spirits, wine, beer, &c. The average quantity on which duty was paid in the six years ending with 1840, was 16,000 lbs. per annum. They are esteemed in Africa the most wholesome of spices, and generally used by the natives to season their food.

Dr. Pereira, from a careful examination and close inquiry, is of opinion that the *Amomum Grana-Paradisi* of Smith, and the *Amamum Melegueta* of Roscoe, are identical species.

In the second volume of the “Pharmaceutical Journal,” Dr. Pereira states that the term “grains of paradise,” or Melegueta, has been applied to the produce of no less than six scitamineous plants. At the present time, and in this country, the term is exclusively given to the hot acrid seeds imported into England from the coast of Guinea, and frequently called Guinea grains; and by the Africans Guinea pepper.

Elettaria Cardomomum, Don.—The fruit of this species constitutes the true, small, officinal Malabar cardamoms. It is an ovate oblong, obtusely triangular capsule, from three to ten lines long, rarely exceeding three lines in breadth, coriaceous, ribbed, greyish or brownish yellow. It contains many angular, blackish or reddish brown rugose seeds, which are white internally, have a pleasant aromatic odor, and a warm agreeable taste. 100 parts of the fruit yield 74 parts of seeds, and 26 parts of pericarpal coats.

This seems to be identical with *Amomum Cardamomum*.

Elettaria major, is a perennial, native of Ceylon, which grows in shady situations in a rich mixed soil. The dried capsules are known in commerce as wild or Ceylon cardamoms, and are of less value in the market than those of Malabar (*Elettaria Cardamomum*, Maton). It is chiefly grown about the Kandyan district; and in the eight years ending with 1813, the average export was nine and a-half candies per annum. The seeds in taste resemble our carraways, and are used for seasoning various dishes.

Ceylon cardamoms are now worth in the London market (Sept., 1853) 1s. to 1s. 3d. per lb.; Malabar ditto, 2s. 3d. to 3s.

PEPPER.

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The black pepper of commerce is obtained from the dried unripe fruit (drupes) of *Piper nigrum*, a climbing plant common in the East Indies, and of the simplest culture, being multiplied with facility by cuttings or suckers. The ripe fruit, when deprived of its outer fleshy covering by washing, forms the white pepper of the shops. The dried fruiting spikes of *P. longum*, a perennial shrub, native of Malabar and Bengal, constitute long pepper. The fruit of *Xylopia aromatica* is commonly called Ethiopian pepper, from being used as pepper in Africa. The seeds of some species of fennel-flower (*Nigella sativa* and *arvensis*), natives of the south of Europe, were formerly used instead of pepper, and are said to be still extensively employed in adulterating it. In Japan, the capsules of *Xanthoxylum piperitum*, or *Fagara Piperita*, are used as a substitute for pepper, and so is the fruit of *Tasmannia aromatica* in Van Diemen's Land. According to Dr. Roxburgh, *P. trioicum* is cultivated in the East, and yields an excellent pepper.

The pepper vine rises about two feet in the first year of its growth, and attains to nearly six feet in the second, at which time, if vigorous and healthy, the petals begin to form the corolla or blossom. All suckers and side shoots are to be carefully removed, and the vines should be thinned or pruned, if they become bushy at the top. Rank coarse weeds and parasitical plants should be uprooted. The vine would climb, if permitted, to the elevation of twenty feet, but is said to bear best when kept down to the height of ten or twelve feet. It produces two crops in the year. The fruit grows abundantly from all the branches, in long small clusters of from 20 to 50 grains; when ripe it is of a bright red color. After being gathered, it is spread on mats in the sun to dry, when it becomes black and shrivelled. The grains are separated from the stalks by hand rubbing. The roots and thickest parts of the stems, when cut into small pieces and dried, form a considerable article of commerce all over India, under the name of *Pippula moola*.

Almost all the plants of the family *Piperaceae* have a strong aromatic smell and a sharp burning taste. This small group of plants is confined to the hottest regions of the globe; being most abundant in tropical America and in the East Indian Archipelago, but more rare in the equinoctial regions of Africa. The common black pepper, *P. nigrum*, represents the usual property of the order, which is not confined to the fruit, but pervades, more or less, the whole plant. It is peculiar to the torrid zone of Asia, and appears to be indigenous to the coast of Malabar, where it has been found in a wild state. From this it extends between the meridians of longitude 96 deg. and 116 deg. S. and the parallels of latitude 5 deg. S. and 12 deg. N., beyond which no pepper is found. Within these limits are the islands of Sumatra and Borneo, with the Malay peninsula and part of Siam. Sumatra produces by far the greatest quantity of pepper. In 1842, the annual produce of this island was reckoned at 30,000,000 lbs., being more than the amount furnished by all the other pepper districts in the world.

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A little pepper is grown in the Mauritius and the West India Islands, and its cultivation is making some progress on the Western Coast of Africa, as we imported from thence 2,909 bags and casks in 1846, and about 110,000 lbs. in 1847.

Mr. J. Crawfurd, F.R.S., one of the best authorities on all that relates to the commerce and agriculture of the Eastern Archipelago, recently estimated the produce of pepper as follows:—

	lbs.
Sumatra (West Coast)	20,000,000
" (East Coast)	8,000,000
Islands in the Straits of Malacca	3,600,000
Malay Peninsula	3,733,333
Borneo	2,666,667
Siam	8,000,000
Malabar	4,060,000

Total	50,000,000
If we add to this	
Western Coast of Africa and B.W. Indies	53,000
Java	4,000,000
Mauritius and Ceylon	80,000

It gives	54,133,000
as the total produce of the world	

Black pepper constitutes a great and valuable article of export from the Indian Islands; which, as we have seen, afford by far the largest portion of What is consumed throughout the world. In the first intercourse of the Dutch and English with India, it constituted the most considerable and important staple of their commerce. The production of pepper is confined in a great measure to the western countries of the Eastern Archipelago, and among these to the islands in the centre and to the northern quarter, including the Peninsula. It is obtained in the ports on both sides of the coast of the latter, but particularly the north-eastern coast. The principal quarters (according to Mr. Crawfurd, my authority on this subject), are Patani, Tringanu, and Kalantin. In the Straits a large quantity is produced in the island of Singapore, and above all in Pinang, where the capital of Europeans and the skill and industry of the Chinese have been successfully applied to its culture. The western extremity of Sumatra, and the north-west coast of that island, are the most remarkable situations in it for the production of pepper, and here we have Acheen, Tikao, Bencoolen, Padang, and the country of the Lampungs. The production of the eastern extremity of Sumatra or Palembang is considerable, but held of inferior quality. In the fertile island of Java, the quantity of pepper grown is inconsiderable, nor is it remarkable for the goodness of its quality.

The province of Bantam has always furnished, and still continues to produce, the most pepper; but the culture of this creeper is fast giving place in Java to staples affording higher profits and requiring less care. The exports were, in the following years:—

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	piculs.		lbs.
1830	6,061	1843	3,737,732
1835	11,868	1848	461,680
1839	11,044	1851	95,037
1841	13,477	1852	135,690

The number of pepper vines in the district of Bencoolen, in the close of last year, 1852, was as follows:—1,571,894 young vines; 2,437,052 bearing ditto; total, 4,008,946.

Up to the end of September there had been delivered to the Government 1,145 piculs white pepper, and 1,128 piculs black pepper, while of the harvest of 1852 there were still probably to be received 330 piculs white, and 4,967 piculs black pepper.

The south, the west, and the north coasts of the great island of Borneo produce a large quantity of pepper; as early as 1721 it was a staple commodity of this island. Banjarmassin is the most productive place on the south coast, and the State of Borneo Proper on the north coast. The best pepper certainly does not grow in the richest soils, for the peppers of Java and Palembang are the worst of the Archipelago, and that of Pinang and the west coast of Sumatra are the best. Care in culture and curing improves the quality, as with other articles, and for this reason chiefly it is that the pepper of Pinang is more in esteem than that of any other portion of the Archipelago. From the ports and districts of Siam 3,500 to 4,000 tons are exported annually.

The duty at present levied on pepper in England is 6d. per lb., while the wholesale price for that of Pinang, Malabar, and Sumatra is about 4d. per lb. White pepper ranges from 9d. to 1s. 6d. per lb. The prime cost in Singapore is not more than 11/2d. per lb.

About 70,000 or 80,000 piculs of pepper are annually exported from Singapore, of which between 30,000 and 40,000 piculs have, until within the last two years, gone on to Great Britain. More than one-half of the pepper exported from Singapore is grown in the island by Chinese settlers.

The low selling price of the article in the English market, the high duty levied upon it, and the large freight paid for its carriage to Great Britain, now leave so small a price to the cultivator in Singapore, that the cultivation ceases to be remunerative, and is carried on at a loss; and has consequently within the last year or two begun to decrease rapidly, involving the Chinese growers, who are generally of the poorest class, and without capital, in great distress. A reduction in the duty on pepper has always been followed by a very large increase in the consumption of the article, as will appear from the following table, showing the importation and consumption in Great Britain during some of the first and last years of the different rates of duty:—

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Year	Quantity consumed	Duty s. d.	Singapore price s. d.		s. d.
1811	1,457,383	1 101/2	0 71/2	to	0 73/4
1814	941,569	1 101/2	0 11	"	1 1
1820	1,404,021	2 6	0 61/2	"	0 63/4
1824	1,447,030	2 6	0 43/4	"	0 51/2
1826	2,529,027	2 0	0 4	"	0 41/2
1836	2,749,491	1 0	0 0	"	0 0
1837	2,625,075	0 6	0 0	"	0 0
1845	3,210,415	0 6	0 21/4	"	0 43/4

In a memorial from the mercantile community of Singapore, sent home in 1848, it is asserted that a reduction in the duty of pepper being always attended by a large increase in the consumption, would not lead to any serious loss in the revenue, while it would confer a great boon on the poorer classes, to whom it has now become a necessary article of life. The reduction would also be of great advantage to British manufacturers, as well as to our Indian possessions, by giving rise to an increased demand or British goods and productions, and of the highest benefit to the agricultural settlers in the island of Singapore, by enabling them to procure for their labor an honest means of livelihood.

The pepper vines, which are allowed to climb poles or small trees, are tolerably productive at Singapore; and pepper planting is esteemed by the Chinese to be a profitable speculation, particularly if they are enabled to evade the payment of quit-rent. An acre of pepper vines will yield 1,161 lbs. of clean pepper. In Sumatra a full grown plant has been known to produce seven pounds; in Pinang the yield is much more. The average produce of one thousand vines is said, however, to be only about 450 lbs.

Colonel Low, in his “Dissertation on Pinang,” published at Singapore some years ago, gives an interesting account of the culture:—

“Pepper was, during many years, the staple product of Pinang soil, the average annual quantity having been nearly four millions of pounds; but previous to the year 1810, the above amount had decreased to about two-and-a-half millions of pounds, which was the result of the continental system.The price having fallen at length to three and three-and-a-half dollars the picul—with only a few occasional exceptions of rises—the cultivation of this spice was gradually abandoned, and the total product at this day does not exceed 2,000 piculs. The original cost, when pepper was at a high price, together with charges of transporting it to Europe, amounted to L36,357 for every five hundred tons, and the loss by wastage was estimated at L5,405. In 1818 there remained on the island 1,480,265 pepper vines in bearing, and the average value of exports of pepper from

Pinang, including that received from other places, was averaged at 106,870 Spanish dollars.

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As might have been foreseen, the fall of prices has so greatly diminished the cultivation of pepper to the eastward, that a reaction is likely to take place; and has in fact partly shown itself already. Some Chinese in Pinang and Province Wellesley seem to be preparing to renew the cultivation. There is abundant scope for the purpose on both sides of the harbour, and every facility is at hand for carrying it on.The pepper plant or vine requires a good soil, the richer the better, but the *red* soil of the higher hills is not congenial, the Chinese think, to it. The undulations skirting the bases of the hills, and the deep alluvial lands, where not saturated with water, or liable to be overflowed, are preferred.

> The Chinese have always been the chief cultivators, and when the speculation flourished they received advances from the merchants, which they paid back in produce at fixed rates.

When pepper was extensively cultivated on Prince of Wales Island, the European owner of the land had the forest cleared by contract, and the vines planted by contract, and when the vines came into bearing the plantation was farmed to the Chinese from year to year, on payment of a specific quantity of pepper. Any other plan would have ruined the capitalist, as the culture is almost entirely in their hands in the Straits' Settlements, and they will not work so well for others as when they are specially interested.The plants are set out at intervals, *every way*, of from seven to twelve feet, according to the degree of fertility of the soil, so that there are from 800 to 1,000 vines in one orlong of land; to each vine is allotted a prop of from ten to thirteen feet high, cut from the thorny tree called *dadap*, or where that is scarce, from the less durable *boonglai*; these props take root, thus affording both shade and support to the plant. The plant may be raised from seed pepper, but the plan is not approved of, cuttings being preferable, as they soonest come into bearing. The pits in which these cuttings are set should be a foot-and-a-half square, and two feet in depth; manure is not often applied, and then it is only some turf ashes. However unpicturesque a pepper plantation may be, still its neat and uniform appearance renders the landscape lively, and there can be little doubt that the island has suffered in its salubrity since the jungle usurped the extensive tracts formerly under pepper cultivation.When the vine has reached the height of three or four feet, it is bent down and laid in the earth, and about five of the strongest shoots which now spring up are retained and carefully trained up the prop, to which they are tied by means of ligatures of some creeping plants.One Chinese, after the plantation has been formed, can take care of two orlongs of land.

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The usual mode is this:—an advance is made by the capitalist to the laborer for building a house, and for agricultural implements; he then receives two dollars monthly to subsist on, until the end of the third year, when the estate or plantation is equally divided betwixt the contracting parties.The Chinese and even European cultivators used formerly to engage the Chinese who had just arrived from China; they paid off their passage-money, and then allowed them two dollars monthly, for provisions, for one year; with a suit of clothes, by which means the cost of the labor of one man averaged about three dollars monthly; but this plan is attended with risks.

The cost attendant on the cultivation of two orlongs of land, with pepper, for three years—the Chinese laborer receiving the usual hire of *five* Spanish dollars monthly—will be nearly as follows:—

Spanish dollars.
Price of land, clearing, and planting 40
Quit rent, at 75 cents per annum per orlong 9
Two thousand plants 4
" dadap props 6
Implements 6
House 10
Labor 200
Interest, loosely calculated at 30
—–
Total Spanish dollars 305

In a very good soil a pepper vine will yield about one-eighth of a pound of dry produce at the end of the first year; at the end of the second, about a quarter of a pound; and at the expiration of the third, probably one pound; at the end of the fourth, from three to three-and-a-half pounds; ditto fifth, from eight to ten pounds. After the fifth year up to the fifteenth, or even the twentieth year, about ten pounds of dry merchantable produce may be obtained from each vine, under favorable circumstances. The Chinese speculator used to rent out his half-share of a new plantation for five years, to his cultivating partner, after the expiration of the first three years, at the rate of thirty piculs per annum; the total produce of these five years giving about fifty-six piculs annually as an average.A pepper plantation never survives the thirtieth year, unless in extremely rich soil, and then it is unproductive; nor will the young vine thrive on an old worn out pepper land, a peculiarity which is applicable to the coffee tree. The chief crop lasts from August to February. Four pounds of dry produce, for ten of green, is considered a fair estimate. Great care is requisite in the management of the vine, and especially in training and tying it on the props. It is subject to be injured by the attacks of a small insect. The green pepper dries in two or three days, and if it is intended that it shall be black, it is pulled before it is quite ripe. To make white pepper, the berry is allowed to remain somewhat longer on the vine; it is, when plucked, immersed in boiling water, by means of which process and subsequent friction, before drying, the husk is separated.

> The exports of pepper from Pinang in the last four years have been—In 1849, 2,591,233 lbs.; in 1850, 6,397,733 lbs.; in 1851, 2,366,933 lbs.; in 1852, 2,112,133 lbs."

A small quantity of pepper seems to be annually exported from Ceylon, which I presume is the growth of that island; thus there were:—

54	cwts.	shipped in	1842
83	"	"	1843
102	"	"	1844

In the Customs' returns of Ceylon, it is classed with cardamoms, and 160 to 170 cwt. of the two were shipped in each of the years 1850 and 1851. Last year the quantity was smaller.

Pepper cultivation has been introduced into the Mauritius, and in 1839 more than 500,000 lbs. were imported from thence, but as the shipments have since decreased, I presume it has given place to the more profitable staple sugar. I have been able to glean no information as to the progress it has made in the West Indies. In Cayenne it has been successfully carried on for many years; and large shipments of pepper have been made thence to France.

BLACK PEPPER EXPORTED FROM SINGAPORE.

		Piculs.	Value in rupees.
1841	Total Exports	66,810	
"	Growth of Singapore	21,231	47,674
1842	Exports	74,228	
"	Growth of Singapore	32,277	72,473
1843	Exports	57,883	
"	Growth of Singapore	35,585	79,900
1844	Exports	67,148	
"	Growth of Singapore	42,995	386,152
1845	Exports	65,892	
"	Growth of Singapore	39,019	350,443
1846	Exports	56,709	

"	Growth of Singapore	35,712	-----
1847	Exports	60,994	
"	Growth of Singapore	36,565	328,397

Pliny, the naturalist, states that the price of pepper in the market of Rome in his time was, in English money, 9s. 4d. a pound, and thus we have the price of pepper at least 1,774 years ago. The pepper alluded to must have been the produce of Malabar, the nearest part of India to Europe that produced the article, and its prime cost could not have exceeded the present one, or about 2d. a pound. It would most probably have come to Europe by crossing the Indian and Arabian ocean, with the easterly monsoon, sailing up the Red Sea, crossing the desert, dropping down the Nile, and making its way along the Mediterranean by two-thirds of its whole length. This voyage, which in our times can be performed in a month, most probably then took eighteen. Transit and customs duties must have been paid over and over again, and there must have been plenty of extortion. All this will explain how pepper could not be sold in the Roman market under fifty-six times its prime cost. Immediately previous to the discovery of the route

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to India by the Cape of Good Hope, we find that the price of pepper in the markets of Europe had fallen to 6s a pound, or 3s. 4d. less than in the time of Pliny. What probably contributed to this fall, was the superior skill in navigation of the now converted Arabs, and the extension of their commerce to the islands of the Eastern Archipelago, which abounded in pepper. After the great discovery of Vasco de Gama, the price of pepper fell to about 1s. 3d. a pound, a fall of 8s. 1d. from that of the time of Pliny, and of 4s. 9d. from that of the Mahommedan Arabs, Turks, and Venetians.

In 1826, 14,000,000 lbs. of pepper were imported into the United Kingdom, of which about 5,500,000 were re-exported. In 1841, 15,000,000 lbs. were imported, of which 6,500,000 were re-shipped to other countries.

The home consumption, it will be seen, now averages about 3,250,000 lbs.:—

	Imports lbs.	Home consumption lbs.
1845	9,852,984	3,209,718
1846	5,906,586	3,299,955
1847	4,669,930	2,966,022
1848	8,125,545	3,185,337
1849	4,796,042	3,257,911
1850	8,028,319	3,170,883
1851	3,996,496	3,303,403
1852	6,641,699	3,524,501

The following return shows the number of bags of pepper imported into the United Kingdom, with the quantity retained for home consumption:—

	Imports.		Retained for home consumption.	
	Black. bags	White. bags	Black. bags.	White. bags.
1843	37,840	3,861	21,163	2,257
1844	60,705	2,123	23,525	2,122
1845	80,600	3,208	30,294	2,861
1847	37,194	1,236	28,768	2,654
1848	65,518	3,042	31,665	3,950
1849	43,651	2,616	32,246	3,859

CHILLIES AND CAYENNE PEPPER.

Chillies or capsicum are long roundish taper pods, divided into two or three cells, full of small whitish seeds. When this fruit is fresh, it has a penetrating acrid smell; to the taste it is extremely pungent, and produces a most painful burning in the mouth. They are occasionally imported dry, and form the basis of Cayenne pepper; put in vinegar when green or ripe, they are an acceptable present in Europe. In Bengal the natives make an extract from the chillies, which is about the consistence and color of treacle.

The consumption of chillies in India is immense, as both rich and poor daily use them, and it is the principal ingredient in all chutnies and curries; ground into a paste, between two stones, with a little mustard, oil, ginger, and salt, it forms the only seasoning which the millions of poor in that country can obtain to eat with their insipid rice. They are worth in the Bombay market about 40s. the candy of 600 lbs.

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Immense quantities of the capsicum are used by the native population of the West Indies, Africa, and Mexico; the consumption as a condiment being almost universal, and perhaps equal in quantity to salt. Ten barrels of these peppers were shipped from Montego Bay, Jamaica, in the first six months of 1851.

The wholesale price of chillies in the London market is from 15s. to 25s. the cwt., and there is a duty of 6d. per pound on them. Cayenne fetches 9d. to 2s. the pound.

Chilli is the Mexican name for all varieties of *Capsicum*. They are natives of the East and West Indies, and other hot climates. *C. annuum* is the species commonly noticed, but there seems to be numerous varieties, which by many are reckoned species. Thus, *C. frutescens* is a shrubby plant, which, along with *C. minimum*, supplies the variety called bird-pepper, it grows to a larger and more bushy size; *C. baccatum* has a globular fruit, and furnishes cherry or berry capsicum. They are all of the simplest culture, and may even be grown with very little care in England. Culture appears to increase the size, but to diminish the pungency of the fruit. In capsicums irritant properties prevail so as to obscure the narcotic action. Their acridity is owing to an oleaginous substance called capsicin. Cayenne pepper is used in medicine chiefly in the form of tincture, as a rubefacient and stimulant, especially in cases of ulcerated sore throat. It acts on the stomach as an aromatic condiment, and when preserved in acetic acid it forms chilli vinegar.

Red pepper may be considered one of the most useful vegetables in hygiene. As a stimulant and auxiliary in digestion it has been considered invaluable, especially in warm countries. A kind called the tobacco red pepper, is said to possess the most pungent properties of any of the species. It yields a small red pod, less than an inch in length, and longitudinal in shape, which is so exceedingly hot that a small quantity of it is sufficient to season a large dish of any food. Owing to its oleaginous character, it has been found impossible to preserve it by drying, but by pouring strong boiling vinegar on it a sauce or decoction can be made, which possesses in a concentrated form all the essential qualities of the vegetable. A single drop of this sauce will flavor a whole plate of soup or other food.

The “wort” or Cayenne pottage may be termed the national dish of the Abyssinians, as that, or its basis “dillock,” is invariably eaten with their ordinary diet, the thin crumpet-like bread of teff or wheat flour. Equal parts of salt and the red cayenne pods are well powdered and mixed together with a little pea or bean meal to make a paste. This is called “dillock,” and is made in quantities at a time, being preserved in a large gourd-shell, generally suspended from the roof. The “wort” is merely a little water added to this paste, which is then boiled over the fire, with the addition of a little fat meat and more meal to make a kind of porridge, to which sometimes is also added several warm seeds, such as the common cress or black mustard, both of which are indigenous in Abyssinia.—("Johnston’s Abyssinia.”)

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A great quantity of Agi or Guinea pepper is grown in Peru, the natives being very fond of this condiment. It is not uncommon for an American Indian to make a meal of twenty or thirty pods of capsicum, a little salt, and a piece of bread, washed down by two or three quarts of chica, the popular beverage.

PIMENTO.

The pimento, *Eugenia Pimento* (*Myrtus Pimenta*), is a native of Mexico, and the West Indies. It flourishes spontaneously and in great abundance on the north side of the island of Jamaica; its numerous white blossoms mixing with the dark green foliage, and with the slightest breeze diffusing around the most delicious fragrance, give a beauty and a charm to nature rarely equalled, and of which he who has not visited the shady arbors and perfumed groves of the tropics can have little conception. This lovely tree, the very leaf of which when bruised emits a fine aromatic odor, nearly as powerful as that of the spice itself, has been known to grow to the height of from 30 to 40 feet, exceedingly straight, and having for its base the spinous ridge of a rock, eight or ten feet above the surface of the hill or mountain. A single tree has frequently produced 150 lbs. of the raw, or 100 lbs. of the dried fruit.

The fruit has an aromatic odor, and its taste combines that of cinnamon, nutmeg, and cloves; hence its common name of allspice. The fruit of *Eugenia acris* is used for pimento.

The trunk is of a grey color, smooth and shining, and altogether destitute of bark. It is luxuriantly clothed with leaves of a deep green, somewhat like those of the bay tree, and these leaves are, in the months of July and August, beautifully contrasted and relieved by an exuberance of white flowers. The leaves yield by distillation a delicate odoriferous oil, which is said to be sometimes passed off for oil of cloves.

The berries are gathered before they are ripe, and spread on a terrace, exposed to the sun for about a week, during which time they lose their green color, and acquire that reddish brown tint which renders them marketable. Some planters kiln-dry them. Like many of the minor productions of the tropics, pimento is exceedingly uncertain, and perhaps a very plenteous crop occurs but once in five years.

In 1800 there were 12,759 bags and 610 casks of pimento imported from Jamaica; in 1824 there were 33,308 bags and 599 casks shipped from the island; in 1829 the quantity exported was 6,069,127 lbs.

In the year ending October 1843, the export of pimento from Jamaica was 29,322 bags and 156 casks; in the year ending October 1844, 12,055 bags and 88 casks; in the year ending October 1845, 233 casks, valued at 30s. each, and 59,494 bags, valued at 20s.

From 1st January to 1st August, 1851, 128,277 lbs. pimento were shipped from the port of Montego Bay, Jamaica.

There was a very considerable pimento plantation made in Tobago, some years ago, by a Mr. Franklin, but it was abandoned by his sons, that they might attend the more exclusively to sugar culture.

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Jamaica exported nearly two millions of pounds of pimento less, in the three years ending 1848, than she did in the three previous to the emancipation of the slaves. The number of pounds shipped annually, in these periods, is shown by the following figures:—

Year. lbs. 1830 5,560,620 1831 3,172,320 1832 4,024,800 1846 2,997,060 1847 2,800,140 1848 5,231,908

Pimento is imported into this country in bags of about 100 lbs. each. The imports have been:—

Year.	Imports.	Home consumption.
cwts.	cwts.	
1848	20,773	4,230
1849	24,994	3,419
1850	20,448	3,467
1851	14,840	3,935
1852	22,708	3,872

The following is a statement of the imports from the West Indies, and the consumption of the United Kingdom, in pounds:—

Year.	Imports.	Entries for home consumption.
lbs.	lbs.	
1831	1,801,355	305,739
1832	1,366,183	296,197
1833	4,770,255	330,890
1834	1,389,402	320,719
1835	2,536,353	343,942
1836	3,230,978	400,941
1837	2,026,128	383,401
1838	892,974	383,997
1839	1,071,511	309,078
1840	999,068	338,969
1841	797,757	297,201
1842	1,643,318	450,683
1843	2,028,658	378,096

The imports have been, in—

bags.	
1843	18,649
1844	2,408
1845	21,092
1847	9,649
1848	18,196
1849	14,108

Pimento is worth in the London market 6d. to 7d. per lb. The duty is 5s. per cwt.

VANILLA.

The fleshy, pod-like, odoriferous fruit of different species of *Epidendrum* constitute the substance called vanilla, which is used in confectionery for giving a delicious perfume to chocolate, liqueurs, &c. As an aromatic it is much sought after by confectioners, for flavoring ices and creams; and also by perfumers, liqueurists, and distillers. The best comes from the forests round the village of Zurtila, in the intendancy of Oaxaca, on the eastern slopes of the Cordillera of Anahuac, between the parallels of 19 deg. and 20 deg. N. All the vanilla which is used in Europe is imported from Mexico, Venezuela, and Vera Cruz.

It is a native of tropical America, and grows wild in Brazil, Peru, the banks of the Orinoco, and all places where heat, shade, and moisture prevail. There are many species indigenous to the Bahamas, Trinidad, Jamaica, Cuba, Dominica, Martinique and St. Vincent, which would produce considerable gain to the inhabitants if they would give themselves the trouble of cultivating or collecting its fruit.

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This parasitical plant has a trailing stem, not unlike the common ivy, but not so woody, by which it attaches itself to the trunks of trees, and sucks the moisture which their bark derives from the lichens and other cryptogamia, but without drawing nourishment from the tree itself, like the misletoe and loranthus. The Indians in Mexico propagate it by planting cuttings at the foot of trees selected for that purpose. It rises to the height of 18 or 20 feet; the flowers are of a greenish yellow, mixed with white. The plant is subcylindrical about eight or ten inches long, of a yellow color when gathered, but dark brown or black when imported into Europe. It is one-celled siliquose, and pulpy within, wrinkled on the outside, and full of a vast number of seeds like grains of sand, having when properly prepared, a peculiar and delicious fragrance. It should be gathered before it is fully ripe.

Different species of vanilla are natives of Guiana, and it is found in large quantities along the banks of its rivers, and in the wooded districts which intersperse the savannahs. The oily and balsamic substance which the minute seeds possess, may be found to have medicinal qualities. Its cultivation can be connected with no difficulties; it needs only to plant the slips among trees, and to keep them clear of weeds. It would prove therefore a great addition to a cocoa plantation. In 1825 the price was, in Germany, sixty-six dollars (equal to L9) per pound, and twenty-five to thirty dollars are paid for it in Martinique.

Humboldt states that the annual value of vanilla exported from the state of Vera Cruz was 40,000 dollars, L8,000 sterling. Some vanilla is exported from Maranham. The cultivation of vanilla, which was introduced into Java in the year 1847, is said to have made considerable progress, there being now no fewer than thirty plantations.

The fruit of this orchideous plant is entirely neglected in the province of Caracas, though abundant crops of it might be gathered on the humid coast between Porto Cabello and Ocumare, especially at Turiamo, where the pods attain the length of nearly a foot. The English and American merchants often seek to make purchases at the port of La Guayra, but with difficulty procure it in small quantities.

In the valleys that descend from the chain of coast towards the Caribbean sea, in the province of Truxillo, as well as in the mission of Guiana, near the cataracts of the Orinoco, a great quantity of the vanilla pods might be collected, the produce of which would be still more abundant, if, according to the practice of the Mexicans, the plant were disentangled from time to time from the other creepers, with which it is intertwined and stifled.

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When collected to prepare it for the market, about 12,000 of the pods are strung like a garland by their lower end, as near as possible to their foot-stalk; the whole are plunged for an instant into boiling water to blanch them; they are then hung up in the open air and exposed to the sun for a few hours. By some they are wrapped in woollen cloths to sweat. Next day they are lightly smeared with oil, by means of a feather or the fingers, and are surrounded with oiled cotton to prevent the valves from opening. As they become dry, on inverting their upper end they discharge a viscid liquor from it, and they are pressed several times with oiled fingers to promote its flow. The dried pods, like the berries of pepper, change color under the drying operation, grow brown, wrinkled, soft, and shrink to one-fourth of their original size. In this state they are touched a second time with oil, but very sparingly, because with too much oil they would lose some of their delicious perfume.

They are then packed for the market in small bundles of 50 or 100 in each, enclosed in lead foil, or tight metallic cases.

There are four local varieties, all differing in price and excellence; *viz*., the vanilla *fina*, the *zacate*, the *rezacate*, and the *vasura*.

One pod of vanilla is sufficient to perfume a pound and a half of cacao. It is with difficulty reduced to fine particles, but it may be sufficiently attenuated by cutting it into small bits, and grinding these along with sugar.

As it comes to us, vanilla is a capsular fruit, of the thickness of a swan's quill; straight, cylindrical, but somewhat flattened, truncated at the top, thinned off at the ends, glistening, wrinkled, furrowed lengthwise, flexible, from five to ten inches long, and of a reddish brown color. It contains a pulpy parenchyma, soft, unctuous, very brown, in which are embedded black, brilliant, very small seeds.

The kind most esteemed in France is called *leq* vanilla; it is about six inches long, from one-fourth to one-third of an inch broad, narrowed at the two ends and curved at the base; somewhat soft and viscid, of a dark reddish color, and of a most delicious flavor, like that of balsam of Peru. It is called vanilla *giorees*, when it is covered with efflorescences of benzcoin acid, after having been kept in a dry place, and in vessels not hermetically closed.

The second sort, called *vanilla simarona*, or bastard, is a little smaller than the preceding, of a less deep brown hue, drier, less aromatic, destitute of efflorescence. It is said to be the produce of the wild plant, and is brought from St. Domingo.

A third sort, which comes from Brazil, is the *vanillon*, or large vanilla of the French market; the *vanilla pamprona* or *bova* of the Spaniards. Its length is from five to six inches, its breadth from one-half to three-fourths of an inch. It is brown, soft, viscid, almost always open, of a strong smell, but less agreeable than the *leq*. It is sometimes a little spoiled by an incipient fermentation. It is cured with sugar, and enclosed in tin plate boxes, which contain from 20 to 60 pods[52]. The average annual import of vanilla into Havre, in the five years ending 1841, was about 16 boxes; in 1842 it was 30 packages.

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TONQUIN BEANS.—The seeds of the Tongo tree (*Dipterix odorata*), a native of Guiana, are the well-known tonquin beans used to give a pleasant flavor to snuff.

TURMERIC.

This article of commerce is furnished by the branches of the rhizome or root-stock of the *Curcuma longa*, and *C. rotunda*, plants which are natives of Eastern Asia, but have been grown in England and the West Indies. They thrive well in a rich light soil, and are readily increased by offsets from the roots.

In the East Indies, where it is known as Huldee, turmeric is much employed in dyeing yellow, principally silks, but the color is very fugitive. It is also used medicinally as an aromatic carminative, and as a condiment; it enters into the composition of curry sauce or powder, and many other articles of Indian cookery. It is cordial and stomachic, and considered by the native doctors of India an excellent application in powder for cleansing foul ulcers.

It is grown in, and exported chiefly from, Bengal and Malabar, Madras, Java, and China. The turmeric of Java is in high estimation in the European markets, ranking next to that of China, and being much superior to that of Bengal. The seeds of *Anethum Sowa*, from their carminative properties, form an ingredient in curry powder.

The price of turmeric in London is from 12s. to 20s. per cwt., according to quality. The entries for home consumption are about 4,000 to 5,000 cwts. annually. It is better shipped in casks or cases than in bags.

A kind of arrowroot is prepared from *C. angustifolia*, another species of this tribe of plants.

Amaranthus gangiticus, and another species, are much cultivated by the Hindoos for their stews and curries.

The quantity and value of the curry stuff imported into Ceylon, chiefly from India, has been in the last few years as follows:—

	Quantity.		
Years.	cwts.	packages.	Value.
1847			6,866
1848			9,981
1849	26,347	109	9,664
1850	24,396	300	7,267
1851	32,550		9,446

1852	9,039

What is comprised under the term “curry stuff,” I am not aware, but it appears to be a bulky article, for it was imported to the extent of 32,000 cwt. in 1852.

There are two varieties of turmeric usually sent into Europe from the East (whence all the turmeric imported into Europe is obtained), the “long” turmeric (*Curcuma longa*), and the “round,” or as it is better known the “Chinese turmeric.” The latter description is very rare, the former is the common article of commerce. According to one of my correspondents, Mr. Hepburn, chemist, of Falmouth, Jamaica, the common or long turmeric is indigenous to that island, growing luxuriantly in the mountainous districts, in rather damp soils, its locality being

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in the vicinity of rivers, water-courses and springs. In this respect it differs from ginger, which requires a rather dry soil for its culture. I am not aware that this plant possesses the property of impoverishing the soil like the ginger. From the general habits of the plant in its natural state, we may gather the following rules for our guidance in its culture. The plants should be laid down in rows of five or six inches distant from each other, in a soil moderately damp, of an aluminous or clayey nature, and free to a great extent of the more soluble alkalies, potash and soda, as these, by absorption, may destroy the coloring matter of the plant, and so diminish its value as a dye-stuff. Finally, in preparing the roots for exportation, they should be cleansed from all earthy particles, exposed for drying in the shade, and without any further preparation bagged for shipment.

The coloring matter of turmeric is of an orange yellow color exceedingly delicate and capable of change, either from the action of light or of alkalies, which turn it to a dark brown color. It is slightly soluble in water, and readily soluble in an alkaline solution, becoming dark brown. Alcohol extracts the coloring matter. The uses to which turmeric is applied are two: as an ingredient in the curry powder and paste, and as a dye for silk. It was some time ago used as a medicine; but though retained in the "Pharmacopoeias" of the present day, it is entirely discarded by the practitioner as a curative agent. The best Bengal and Malabar turmeric fetches a price nearly as high as that of ginger, and I see no reason why the West India planter could not send it into the British market quite as cheap as the East India trader. According to Dallas, 397 bags of turmeric were exported from Jamaica in 1797.

Turmeric is grown about the city of Patna and Behar. It is much cultivated about Calcutta and all parts of Bengal. One acre yields about 2,000 lbs. of the fresh root. It is also grown on the central table land of Afghanistan. The exports from Calcutta in 1841 were 11,000 Indian maunds, and 28,137 in 1842. The value of that exported from Madras in 1839 was 40,000 rupees, or L4,000; in 1840, L4,200. The quantity shipped from that Presidency in 1850 was 6,877 bags.

In the neighbourhood of Dacca about 200 lbs. of seed is sown to the beegah, measuring 80 cubits by 80, and the yield is from 640 to 800 lbs.

140 tons were imported into Liverpool in 1849, for dyeing and for curries; 414 tons in 1850; 11,554 bags and packages in 1851; and only 3,595 ditto in 1852. The price in January 1853 was, for Bengal, 10s. to 12s.; China, 12s. to 14s., and Malabar 9s. to 12s. the cwt. The imports into London were 18 tons in 1848, 191 in 1849, and 980 in 1850. The deliveries for consumption, 192 tons in 1848, 270 in 1849, and 870 tons in 1850.

In China turmeric is used with Prussian blue in coloring and facing tea.

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GINSENG

The produce of this plant, as an article of commerce, is confined to our transatlantic neighbours, who have the monopoly of the supply to China.

The root of *Panax quinquefolium*, the American ginseng, is much esteemed by the Chinese, for certain supposed beneficial effects upon the nerves, and for other presumed virtues; but our physicians have not discovered any proofs of its efficacy in Europe. The plant is an herbaceous perennial, growing upon the confines of Tartary and China, near the great wall. It is found wild, flourishing in moist situations, and attains the height of from two to three feet; it is also now produced largely in the northern, middle, and western States of the Union, particularly Virginia, Louisiana, and Pennsylvania, and a considerable trade is carried on with it to China. A variety of the plant was discovered, a few years ago, in the Himalaya mountains, and small quantities have been thence sent to Canton. It is also found growing in Canada. The root is about three or four inches in length, and one inch in thickness. It resembles a small carrot, but not so taper at the end, and is sometimes single, sometimes divided into two branches. The stem is striated, without branches, and of a red color near the root. The leaves, from four to six of which surround the stem where they form sheaths (bracteal), are simply pinnate. The flower stalk is long and green, the inflorescence a simple umbel. The fruit is a berry of a red color, and contains two seeds of the size of mustard seed. The officinal root differs in appearance, according to the country from which it is brought. In Korea and China it is white, corrugated when dry, and covered with a powder resembling starch. In Mandscharia and Dauria it is yellow, smooth and transparent, and when cut resembles amber. The taste of the root is bitter. Crude ginseng now sells in the Canton market at 70 to 80 dollars per picul of 133 lbs., and cured or clarified root at 130 to 140 dollars.

The stem of the plant, which is renewed every year, leaves, as it falls off, an impression upon the neck of the root, so that the number of these rings or marks indicates the age of the plant, and the value of the root increases accordingly. The Chinese government were formerly in the habit of sending out annually 30,000 Tartar soldiers to search for the plant, and each was obliged to bring home two ounces of the root gratis, and for all above that quantity he was paid its weight in silver. The Asiatic ginseng is said to be obtained from the root of *P. Schinseng* of Nees von Esenbeck, *P. Pseudo ginseng* of Wallich. This root might be procured in Prince Edward's Island and some of the other British North American colonies.

I have been able to trace, after some labor and research, the progressive exports of this curious article of trade from the United States.

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In 1790, 813 casks, of the value of 47,025 dollars, were exported; and in 1791, 29,208 lbs. From 1803 to 1807, the annual value of ginseng shipped was about 123,000 dollars, and from 1820 to 1830, it averaged 157,000 dollars.

The following figures show the value of the article in subsequent years:—1831, 115,921 dollars; year ending 30th September, 1835, 94,960 dollars; 1837, 212,899 lbs., valued at 108,548 dollars; 1840, 22,728 dollars; 1841, 437,245 dollars.

The quantity shipped in 1839, from Philadelphia alone, was 317,443 lbs. In 1841, 637,885 lbs. were exported from the United States.

The value of that exported in the years ending 30th June, was 1844, 95,008 in dollars, and in 1845, 117,146 dollars; 110,000 lbs. were collected at Toledo, Ohio, in 1845. The value of the exports in the following years, ending June 30th, were—1847, 64,466 dollars; 1849, 162,640; 1849, 182,966; 1850, 122,916 dollars.

CORIANDER, CARRAWAY, AND OTHER SEEDS.

The fruits of anise, carraway, coriander, &c., (erroneously called seeds,) are in demand for various purposes.

CARRAWAY SEED is imported to the extent of 500 tons annually from Germany and Holland, the price being about 33s. per cwt. It is also now much grown in Essex and Kent. In the years 1848 and 1849, 7,000 cwt. of this seed was imported, of which nearly the whole quantity was retained for home consumption.

CORIANDER SEED is chiefly used by distillers, to produce an aromatic oil. The quantity imported annually does not exceed 50 tons, and it is brought principally to the port of Hull. It is also cultivated in Suffolk, Essex and Kent.

Of MUSTARD SEED the aggregate quantity imported annually is about 2,000 tons for home consumption, and the flour is used as a well-known condiment to food, &c., and in medicine; the average price being about 9d. per pound.

ANISE.—The fruit of *Pimpinilla anisum*, under the name of aniseed, is principally imported from Alicant and Germany (the first is preferred), but some is also brought from the East Indies. It is an annual plant, largely cultivated in Spain, Malta, and various parts of Germany, and also in the island of Scio, Egypt, and parts of Asia. The imports are not large; 192 cwts. paid duty in 1833, and 315 cwts. in 1840. About 60 cwts. are annually received at Hull from Germany. It is used to flavor liqueurs, sweetmeats, and confectionery of various kinds. Oil of aniseed is obtained by distillation from the fruit, and 1,544 lbs. were imported in 1839. About two pounds of oil are obtained from one hundred-weight of seed.

STAR ANISE, *Illicum anisatum*, is a native of the countries extending from 231/2 deg. to 35 deg. of north latitude, or from Canton to Japan. The capsules constitute in India a rather important article of commerce, and are sold in all the bazaars. Large quantities are also used in Europe in the preparation of liqueurs. 695 piculs of star aniseed were exported from Canton in 1850, valued at 8,200 Spanish dollars. 81 piculs of oil of aniseed were exported from Canton in 1845, and 105 piculs in 1850, valued at 11,900 dollars. 3,000 piculs of aniseed are exported annually from Cambodia.

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PUTCHUK, OR COSTUS.

The substance called costus was highly prized by the ancients, and specimens may be met with at a few of the London drug-houses. It has been shown by Dr. Falconer to be the produce of a genus of the thistle tribe, to which he has given the name of *Aucklandia*. The root of *A. Costus* is supposed to be the *Costus Arabicus*, on the following grounds:—It corresponds with the descriptions given by the ancient authors, and is used at the present day for the same purposes in China, as costus was formerly applied to by the Greeks. The coincidence of the names—in Cashmere the root is called koot, and the Arabic synonym is said to be *koost*. It grows in immense abundance on the mountains which surround Cashmere. It is a gregarious herb, about six or seven feet high, with a perennial thick branched root, with an annual round smooth stem, large leaves and dark purple flowers. The roots are dug up in the months of September and October, when the plant begins to be torpid; they are chopped up into pieces, from two to six inches long, and are exported without further preparation. The quantity collected, according to Dr. Falconer, is very large, amounting to about two million pounds per annum. The cost of its collection and transport to a mercantile depot in Cashmere, is about 2s. 4d. the cwt. The commodity is laden on bullocks and exported to the Punjaub, whence the larger portion goes down to Bombay, where it is shipped for the Red Sea, the Persian Gulf, and China; a portion of it finds its way across the Sutlej and Jumna into Hindostan Proper, whence it is taken to Calcutta, and bought up there with avidity under the name of putchuk. The value is enhanced at Jugadree, on the Jumna, to about 16s. 9d. or 23s. 4d. per cwt. In the Chinese ports it fetches nearly double that price the cwt. The Chinese burn the roots as an incense in the temples of their gods, and they also attach great efficacy to it as an aphrodisiac. The imports into Canton in 1848 were 414 piculs; in 1850, 854 piculs; valued at 5,150 dollars. In Cashmere it is chiefly used for the protection of bales of shawls from insects. The exports from the port of Calcutta were, in 1840-41, 19,660 maunds; in 1841-42, 12,847; in 1847-48, 2,0501/4; in 1848-49, 2,1103/4;—worth about L1,500 annually.

Specimens of amboyna wood, the odoriferous sandal wood from Timor, clove wood, and other choice woods from the Moluccas and Prince of Wales Island, were sent home to the Great Exhibition in 1851.

LIGNUM ALOES, the eagle wood and Calambak of commerce, yielding an aromatic perfume, is furnished by the *Aquilaria malaccensis*, and *agallocha*, in Silhet, an ornamental evergreen shrub. A very high artificial value is placed on the better qualities of this product by the natives of the East; the best quality being worth about L14 the picul of 133 lbs.

This fragrant wood is probably the lign aloes of the Bible.

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Incense to the value of nearly one million and a quarter francs was exported from Alexandria in 1837.

Calambak or eagle wood, the true lignum aloes so highly esteemed in the East as a perfume or incense, is said to be produced by the *Aloexylum agallochum*, Lour. This remarkable wood contains a large quantity of an odoriferous oleo-resin; when heated it undergoes a sort of imperfect fusion, and exhales a fragrant and very agreeable odor. Its price in Sumatra is about L30 per cwt. Inferior specimens are obtained at Malacca. Eagle wood is also obtained from several other trees. The true eagle wood is however very scarce.

SECTION IV.

DYES AND COLORING STUFFS, AND TANNING SUBSTANCES.

Of the several classes of materials collected at the Industrial Exhibition in Hyde Park, in 1851, few possessed so much importance in the eyes of the textile and leather manufacturer and chemist as the different products used in the arts and manufactures for coloring and tanning purposes. These were in a great measure lost sight of by the public at large, being scattered about in small quantities in a great number of directions; and, from the minute samples shown, were in many instances overlooked altogether. Besides furnishing some novel and general statistical facts, which may prove interesting, I propose also in this section to draw attention more prominently to some of these products, which are at present little known or appreciated.

Coloring substances for staining and dyeing are obtained indifferently from the animal, mineral, and vegetable kingdoms, but it is of the last alone that I shall have to speak. The importance of a more careful consideration of this subject will be admitted, if we consider how much the prosperity and extent of our cotton, silk, woollen, and leather manufactures depends on a liberal and cheap supply of dyes and tannin, to give beauty and color to the fabrics, and substance and utility to the skins. Even oil colors, for painters' purposes, which do not come within the scope of my remarks, form an item in our yearly exports of the value of L250,000, and when we calculate the large amount of cotton, silk and wool worked up, most of which requires various coloring agents, gums, starches, and mordants;—that nearly 30,000 tons of hides are annually imported, exclusive of those obtained from our now slaughter-houses, besides goat, seal, and other skins—and that the exports of our various manufactures of cotton, linen, silk, wool and leather in 1852, setting aside our home consumption, amounted to nearly fifty millions sterling, we shall be able to form a better estimate of the importance of the various subjects we are about to notice.

Great Britain does not pay less than L600,000 annually for the dried carcasses of the tiny cochineal insect, while the produce of another small insect, that which produces the lac dye, is scarcely less valuable. Then there are the gall nuts used for dyeing and making black ink. Upwards of L3,000,000 is paid for barks of various kinds for tanners' purposes, about one million for other tanning substances and heavy dye woods, besides about L200,000 for various extracts of tannin, such as Gambier, Cutch, Divi-divi, and Kino. The aggregate value of the dye stuffs and gum it is difficult to estimate.

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The beautiful specimens of materials imported from China, India, New Zealand, the Continent, and other countries, and exhibited at the Crystal Palace, proves to us that we have yet much to learn from other nations in the art of fixing colors and obtaining brilliant dyes. The French are much our superiors in dyeing and the production of fast and beautiful colors. Their chemical researches and investigations are carried out more systematically and effectively than our own. Russia imports dyewoods and dye-stuffs to the value of five millions and a half of silver roubles annually.

It was well observed by the Jury Reporters at the Great Exhibition, that “a vast number of new coloring materials have been discovered or made available, and improved modes have been devised of economically applying those already in use; so that the dyer of the present time employs many substances of the very existence of which his practical predecessors were wholly ignorant. From the increased use of many of the vegetable colors, and from the improved modes of applying the coloring matters, a demand has naturally sprung up for various dye stuffs; and at the present time, many of the dyeing materials of distant countries are beginning to excite the attention of practical men; for though they have been acquainted with many of these substances, it is only recently that the progress of the art has rendered their use desirable or even practicable.”

It would be quite impossible, within the limits which I have assigned myself, to make even a bare enumeration of the various plants and trees from which coloring substances and dye stuffs can be obtained, I must, therefore, be content to specify only a few.

The roots of some species of Lithospermum afford a lac for dyeing and painting. Dried pomegranates are said to be used in Tunis for dyeing yellow; the rind is also a tanning substance.

Sir John Franklin tells us that the Crees extract some beautiful colors from several of their native vegetables. They dye a beautiful scarlet with the roots of two species of bed-straw, *Galium tinctorium* and *boreale*. They dye black, with an ink made of elder bark and a little bog-iron ore dried and powdered, and they have various modes of producing yellow. They employ the dried roots of the cowbane (*Cicuta virosa*), the bruised buds of the Dutch myrtle, and have discovered methods of dyeing with various lichens.

In the “Comptes Rendus,” xxxv., p. 558, there is an account by M.J. Persoz, of a green coloring matter from China, of great stability, from which it appears that the Chinese possess a coloring substance having the appearance of indigo, which communicates a beautiful and permanent sea green color to mordants of alumina and iron, and which is not a preparation of indigo, or any derivative of this dyeing principal. As furnished to M. Persoz by Mr. Forbes, the American consul at Canton, it was in thin plates of a blue color,

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resembling Japanese indigo, but of a finer grain, differing also from indigo in its composition and chemical properties. On infusing a very small quantity of it in water, this fluid soon acquired a deep blue color with a greenish tinge; upon boiling and immersing a piece of calico on which the mordants of iron and alumina had been printed, it was dyed a sea green color of greater or less intensity according to the strength of the mordant—the portions not coated remaining white.

A berry called *Makleua* grows on a large forest tree at Bankok, which is used most extensively by the Siamese as a vegetable black dye. It is merely bruised in water, when a fermentation takes place, and the article to be dyed is steeped in the liquid and then spread out in the sun to dry. The berry, when fresh, is of a fine green color, but after being gathered for two or three days it becomes quite black and shrivelled like pepper. It must be used fresh, and whilst its mixture with water produces fermentation. The bark of *Datisca cannabina* also dyes yellow. It contains a bitter principle, like quassia.

A coloring matter is prepared from the dried fruit of the *Rottlera tinctoria*, by the natives of the East, to dye orange, which is a brilliant and tolerably permanent dye. It is apparently of a resinous nature.

A small quantity of Alkanet root (*Anchusa tinctoria*), is imported from the Levant and the south of France, and is used to color gun stocks, furniture, &c., of a deep red mahogany and rosewood color. It is brought over in packages weighing about two cwt., the price being 40s. or 50s. per cwt.

Turmeric is now imported to the extent of upwards of 800 tons, a portion of this is used in dyeing. The culture and commerce has been already noticed in Section III.

The bark and roots of the berberry are used in the East to dye yellow; the color is best when boiled in ley. Some of the species of Symplocos, as *S. racemosa*, known as lodh about the Himalaya mountains, and *S. tinctoria*, a native of Carolina, are used for dyeing. The scarlet flowers of *Butea frondosa* (the Dhaktree), and *B. superba*, natives of the Indian jungles, yield a beautiful dye, and furnishing a species of kino (*Pulas kino*), are also used for tanning. *Althea rosea*, the parent of the many beautiful varieties of hollyhock, a native of China, yields a blue coloring matter equal to indigo. Indigo of an excellent quality has been obtained in the East from a twining plant, *Gymnema tingens* or *Asclepias tingens*.

The juice of the unripe fruit of *Rhamnus infectorius*, *catharticus* and *virigatius*, known as Turkey or French berries, is used for dyeing leather yellow. When mixed with lime and evaporated to dryness, it forms the color called sap-green. A great quantity of yellow berries are annually shipped from Constantinople; 115 tons were imported into Liverpool last year. The average annual imports into the United Kingdom are about 450 tons. They come from the Levant in hair bales weighing three and a quarter cwt., or in tierces of four to five cwt., and are used by calico printers for dyeing a yellow color. They are sometimes called Persian berries.

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It is a subject of surprise that the common betel-nut of the East has never been introduced for dyeing purposes. The roots of the awl tree of Malabar and other parts of India, *Morinda citrifolia*, and of *M. tinctoria*, found abundant in all the Asiatic islands, are extensively used as a dye stuff for giving a red color. It is usually grown as a prop and shade for the pepper vine and coffee tree. The coloring matter resides principally in the bark of the roots, which are long and slender, and the small pieces are the best, fetching 8s. to 10s. a maund. It is exported in large quantities from Malabar to Guzerat, and the northern parts of Hindostan, but seldom finds its way to Europe.

The wood and roots of another species, *M. umbellata*, known in the eastern islands as "Mangkudu," are used extensively for their red dye, in Celebes and Java. Specimens of all these, and of the Lopisip bark, bunchong bulu wood, and the gaju gum (from undescribed plants), have been introduced into England. They are said to furnish excellent dyes in the Asiatic islands. Native dyes from Arracan have also been imported, *viz*., thit-tel and the-dan yielding red dyes, ting-nget and reros, affording dark purple dyes; and thit-nan-weng, a chocolate dye. These would be worth enquiry, and particulars of the plants yielding them, the quantities available, and the prices might be procured. Dyes and colors from the following plants are obtained in India: several species of *Terminalia*, *Sinecarpus Anacardium*, *Myrica Sapide*, *Nelumbium speciosus*, *Butea frondosa*, and *Nyctanthes arboretristis*. The bunkita barring, obtained from an undescribed plant in Borneo, produces a dark purple or black dye. A species of ruellia, under the name of "Room," is employed in its raw state by the Khamptis and Lingphos to dye their clothes of a deep blue. It is described by the late Dr. Griffiths as "a valuable dye, and highly worthy of attention." It might, perhaps, be usefully employed as the ground for a black dye. In Nepaul they use the bark of *Photinia dubia* or *Mespilus Bengalensis* for dyeing scarlet. The bark of the black oak, *Quercus tinctoria* and its varieties, natives of North America, are used by dyers under the name of quercitron.

In the south of Europe, *Daphne Gnidium* is used to dye yellow. The root of reilbon, a sort of madder in Chili, dyes red. A purple tint or dye is obtained from the bark of an undescribed tree, known under the name of "*Grana ponciana*," growing about Quito; and Stevenson (Travels in South America) says, "if known in Europe, it would undoubtedly become an article of commerce." Another much more expensive species of coloring matter (red) is obtained in various parts of South America from the leaves of the *Bignonia Chica*, a climbing evergreen shrub, native of the Orinoco country, with large handsome panicles of flowers. The coloring substance is obtained by decoction, which deposits, when cool, a red matter; this is formed into cakes and dried. Dr. Ure thinks it might probably be turned to account in the arts of civilization. The order of plants to which it belongs, contains a vast number of species, all natives of tropical regions, and their value for the production of coloring substances may be worth investigation.

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It is met with in British Guiana, and the Indian tribes of that district prepare the pigment with which they stain their skin from it; it is called by them “Caraveru.” The coloring matter is used as a dye in the United States, and for artistical purposes would rival madder. Sir Robert Schomburgk thinks it might form an article of export if it were sufficiently known, as its preparation is extremely simple. The leaves are dried in the sun, and at the first exposure, after having been plucked from the vine which produces them, they show the abundant feculent substance which they contain.

LANA DYE.—A beautiful bluish-black color, known as “Caruto,” is procured in Demerara and Berbice from the juice of the fruit of the *Genipa Americana*, Linn.—a tree very common in the colony. The Indians use it for staining their faces and persons. The Lana dye was honorably mentioned by the jurors at the Great Exhibition in 1851. The bluish-black color obtained from it is remarkably permanent, a fact which has very long been known, though hardly any attempt appears to have been made to introduce it to the notice of European dyers. Another pigment is prepared by them from arnotto, mixed with turtle oil, or carap oil, obtained from the seeds of the *Carapa guianensis* (Aubl.). The wild plantain (*Urania guianensis*) and the cultivated plantain (*Musa paridisiaca*), the Mahoe (*Thespesia populnea*), and the pear seed of the Avocado (*Persea gratissima*), furnish dyes in various parts of the West Indies; specimens of many of these have been imported from British Guiana and Trinidad.

Russia produces good specimens of the wood of *Statice coriaria*, the leaves and bark of sumach, the bark of the wild pomegranate, yellow berries, *Madia sativa*, saffron, safflower and madder roots for dyeing purposes.

Avicenna tomentosa, a species of mangrove, is very common about the creeks of Antigua, Jamaica, and other West India islands, where it is used for dyeing and tanning.

In New Zealand, the natives produce a most brilliant blue-black dye from the bark of the Eno, which is in great abundance. Some of the borders of the native mats, of a most magnificent black, are dyed with this substance. It has been tried in New South Wales; but, as with other local dyes, although found well suited for flax, hemp, linen, or other vegetable productions, it could not be fixed on wools or animal matter. Dr. Holroyd, of Sydney, some time since, imported a ton of it for a friend near Bathurst. It is of great importance that chemical science should be applied to devise some means of fixing this valuable dye on wool. As the tree is so common, the bark could be had in any quantity at about L3 10s. a ton; and our tweed manufacturers are in great want of a black dye for their check and other cloths.

The principal heavy woods used for dyeing are fustic, logwood, Nicaragua wood, barwood, camwood, red Sanders wood, Brazil wood, and sappan wood. All the dyewoods are nearly L2 per ton higher than last year.

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Common Spanish fustic which in September, 1852, was only L3 10s. per ton, now fetches L6 10s. in the Liverpool market; and there is a great demand for all kinds of dyewoods. Tampico and Puerto Cabello fustic are now worth L6 10s. to L7 the ton, Cuba ditto, L9 10s. to L10.

Sappan wood is L4 higher than last year; barwood has risen cent per cent; logwoods are L2 per ton higher.

The following were the prices of the different dyewoods in the Liverpool market, on the 1st September, 1853, per ton:—

	L s. d.		L s. d.
FUSTIC, common Spanish	5 10 0	to	6 10 0
Tampico	6 10 0		7 0 0
Puerto Cabello	6 10 0		7 10 0
Cuba	8 0 0		9 10 0
LOGWOOD, Jamaica	5 0 0		5 5 0
St. Domingo	5 5 0		5 10 0
Campeachy, direct	7 12 6		8 0 0
Indirect and Tobasco	6 10 0		7 0 0
NICARAGUA. WOOD.			
Rio de la Hache, solid	9 0 0		11 10 0
" " small	6 0 0		6 10 0
Lima	12 0 0		14 10 0
BARWOOD, Angola } Gaboon }	7 0 0		-----
CAMWOOD	25 0 0		30 10 0
RED SANDERS WOOD	5 15 0		6 10 0
SAPPAN WOOD	10 0 0		15 0 0

RED SANDERS WOOD (*Pterocarpus santalinus*), which is hard and of a bright garnet red color, is employed to dye a lasting reddish brown on wool. It only yields its color to ether or alcohol. The tree, which is a lofty one, is common about Madras and other parts of India; it is also indigenous to Ceylon, Timor, and other Eastern islands. The exports of this wood from Madras in one year have been nearly 2,000 tons.

The imports of red Sanders wood from Calcutta and Bombay chiefly into London are to the extent of 700 or 800 tons a year, worth L6 to L9 per ton.

Of FUSTIC we import from 1,500 to 2,000 tons annually. We derive our supplies from Brazil, Tampico, Puerto Cabello, Cuba, and Jamaica. The best is obtained from Cuba; for while the common white fustic from Jamaica and the Spanish Main fetches only L5 10s. to L6 10s. the ton, that of Cuba realizes from L8 to L9 10s. the ton.

SAPPAN WOOD (*Caesalpinia Sappan*) is an article of considerable commerce in the East. It is the bukkum wood of Scinde, and is procured in Mergui, Bengal, the Tenasserim Provinces, Malabar and Ceylon. In 1842 as much 78,000 cwts. were shipped from Ceylon, but the export from thence has decreased. This island, however, ships dyewoods annually to the amount of L2,000. A large quantity is exported from Siam and the Philippine Islands; as much as 200,000 piculs annually from the former, and 23,000 piculs from Manila. 3,524 piculs were shipped from Singapore in 1851, and 4,074 piculs in 1852. The picul is about one cwt. and a quarter. Sappan wood yields a yellowish color, like that of Brazil wood (*C. brasiliensis*) but it does not afford of dye matter so much in quantity or so good in quality.

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It forms a large export from Ceylon: the shipments from thence were, in 1842, 77,694 cwt.; in 1843, 1,692; in 1844, 2,592; in 1845, 2,854. I have no detailed returns at hand, but in 1837, 23,695 piculs of sappan wood, and 2,266 piculs of roots of ditto were shipped, and in the first six months of 1843, 22,326 piculs were exported from Manila; a large portion of this comes to Europe, but some goes to China, the United States, Singapore, &c. 15,500 piculs were shipped from Manila in 1844, 5,250 ditto in 1845; and 1,210 tons in 1850. About 3,000 piculs of sappan wood and the same quantity of other dye-stuffs are annually imported into Shanghae. The price of straight sappan wood at Shanghae in July, last year, was thirty dollars per picul.

In Calcutta, in June last year, 4,000 piculs of the root of Manila sappan wood sold freely at about 7s. 6d. per factory maund, Siam ditto 6s.

75 tons were imported into Liverpool in 1849; and 120 tons in 1850, from Calcutta. The imports of sappan wood into the United Kingdom, in 1850, amounted to 3,670 tons, worth L8 to L12 the ton, and this continued the price in January 1853.

Camwood, red sanders wood, barwood, and other dye woods, are found in great quantities in many parts of Africa. The dyes of Africa are found to resist both acids and light, properties which no other dyes seem to possess in the same degree. About thirty miles east of Bassia Cove, in the republic of Liberia, is the commencement of a region of unknown extent, where scarcely any tree is seen except the camwood. This boundless forest of wealth, as yet untouched, is easily accessible from that settlement; roads can be opened to it with little expense, and the neighbouring kings would probably give their co-operation to a measure so vastly beneficial to themselves. It is impossible to ascertain the exact amount of export of these commodities to Europe and the United States, but it is very great, and employs a large amount of vessels. One Liverpool house imported 600 tons in a single year, worth L9,000.

In 1841 upwards of 3,000 tons of dye woods were imported into Liverpool from the western coast of Africa.

CAMWOOD (*Baphia nitida*) is used as a mordant and for producing the bright red color seen in English bandana handkerchiefs. The imports from Sierra Leone to Liverpool in 1849 were 216 tons, worth L20 to L25 per ton.

Gaboon barwood is another variety of this dyewood which is imported from the west coast of Africa, in straight flat pieces, from three to, five feet in length; the average annual import being about 2,000 tons, of the value of L4 a ton.

The imports of barwood into Liverpool were in—

Tons.

1835	2,000
1836	1,000
1837	1,150
1838	650
1839	350
1841	2,012
1850	1,710

Dyewoods imported in 1850. Re-exported.

Logwood 32,930

4,332
Fustic 9,808 1,771
Nicaragua 7,909 112
Barwood 1,896 1,229
Sappan 3,670 —
Green Ebony, and }
Cocuswood } 1,457 —
Red Sanders 656 —
Camwood 416 —
Brazil and Brazillito 309 —

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59,051 7,444

Thus we perceive the annual consumption of heavy dyewoods in this country, in dyeing cotton, linen, woollen and silk goods, &c., exceeds in weight 51,000 tons.

ARNOTTO.—The plants of this family are chiefly natives of the warmest parts of South America, the East and West Indies, and Africa. In America the seeds are called achote or roucou. From the port of Barcelona, in Venezuela, about 2,000 quintals are annually exported. The species grown for its dye is the *Bixa orellana*. It is used to impart a bright orange color to silk goods, and to afford a deeper shade to simple yellows. The dry hard paste is also found to be the best of all ingredients for giving a golden tint to cheese or butter. A convenient liquid preparation is now sold to dairymen. The Spanish Americans mix it with their chocolate, to which it gives a beautiful rich hue.

It is of two sorts, *viz*.:—

1. Flag or cake arnotto, which is by far the most important article in a commercial point of view, is furnished almost wholly by Cayenne. It is imported in square cakes, weighing two or three pounds each, wrapped in banana leaves, packed in casks.

2. Roll arnotto is principally brought from Brazil. The rolls are small, not exceeding two or three ounces in weight. It is hard, dry, and compact, brownish on the outside, and of a beautiful red color within.

The dye is usually prepared by macerating the pods in boiling water for a week or longer. When they begin to ferment, the seeds ought to be strongly stirred and bruised with wooden pestles to promote the separation of the red skins. This process is repeated several times, till the seeds are left white. The liquor passed through close cane sieves, pretty thick, of a deep red color, and a very bad smell, is received into coppers. In boiling, it throws up its coloring matter to the surface in the form of scum, which is taken off, saved in large pans, and afterwards boiled down to a due consistence, and then made up, when soft, into balls or cakes of two or three pounds weight.

The following description of the manufacture is from Dr. Ure:—

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“The pods of the tree being gathered, their seeds are taken out and bruised; they are then transferred to a vat, which is called the steeper, where they are mixed with as much water as covers them. Here the substance is left for several weeks or even months; it is now squeezed through sieves placed above the steeper, that the water containing the coloring matter in suspension may return into the vat. The residuum is preserved under the leaves of the pine-apple shrub, till it becomes hot by fermentation. It is again subjected to the same operation, and this treatment is continued till no more color remains.

“The substance thus extracted is passed through sieves, in order to separate the remainder of the seeds, and the color is allowed to subside. The precipitate is boiled in coppers till it be reduced to a consistent paste; it is then suffered to cool, and dried in the shade. Instead of this long and painful labor, which occasions diseases by the putrefaction induced and which affords a spoiled product, Leblond proposes simply to wash the seeds of arnotto till they be entirely deprived of their color, which lies wholly on their surface; to precipitate the color by means of vinegar or lemon juice, and to boil it up in the ordinary manner, or to drain it in bags as is practised with indigo.

“The experiments which Vauquelin made on the seeds of arnotto imported by Leblond, confirmed the efficacy of the process which he proposed; and the dyers ascertained that the arnotto obtained in this manner was worth at least four times more than that of commerce; that, moreover, it was more easily employed; that it required less solvents; that it gave less trouble in the copper, and furnished a purer color.”—("Dict. of Arts.”)

Our imports of arnotto for home consumption are from 200,000 to 300,000 lbs. per annum. The plant is grown in Dacca and other parts of India, and the eastern Archipelago. At the Hawaiian Islands, Tongataboo, Rio Janeiro, Peru and Zanzibar, the arnotto is an indigenous shrub which rises to the height of seven or eight feet, producing oblong heavy pods, somewhat resembling those of a chesnut. Within these there are generally thirty or forty irregularly-formed seeds, which are enveloped in a pulp of a bright red color, and a fragrant smell.

The imports of arnotto have been as follows:—

	lbs.	Retained for home consumption.
1834	252,981	—
1835	163,421	—
1839	303,489	224,794
1840	408,469	330,490
1847	270,000	296,821
1849	162,400	145,824

1850	301,504	231,280

The price of flag arnotto in the London market, in June 1853, was 1s. per lb.

We imported from France, in 1850, 1,924 cwt. of roll or flag arnotto, of the official value of L21,499; and in 1851, 1,253 cwt., worth L13,968.

Wood dye exported from Ceylon—

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Value	Quantity	
L	cwts.	
1848	1,359	—
1849	2,035	—
1850	1,766	5,206
1851	259	776
1852	770	2,396

CHAY-ROOT.—There is a plant called chay, the *Oldenlandia umbellata*, which is extensively cultivated as a dye plant in the East, especially on the coasts of Coromandel, Nellore, Masulipatam, Malabar, and other parts of India. The outer bark of the roots furnishes the coloring matter for the durable red for which the chintzes of India are famous. Chay-root forms a considerable article of export from Ceylon. The wild plant there is considered preferable; the roots, which are shorter, yielding one-fourth part more coloring matter, and the right to dig it is farmed out. It grows spontaneously on light, dry, sandy ground on the sea coast; the cultivated roots are slender, with a few lateral fibres, and from one to two feet long. The dye is said to have been tried in Europe, but not with very advantageous effect. Dr. Bancroft suspects it may be injured by the long voyage, but he adds that it cannot produce any effect which may not be more cheaply obtained from madder.

This red dye, similar to Munjeet, is used to a great extent in the southern parts of Hindostan by the native dyers.

It is not held in very good estimation in Europe but seems to deserve a better reputation than it at present possesses. Attention was drawn to it as a dye-stuff in 1798, by a special minute of the Board of Trade recommending its importation; but Dr. Bancroft, who made some experiments with a sample of damaged chay-root, considered it inferior to madder and hence discouraged its further importation.

The bark and root of various species of Morinda (*M. citrifolia* and *tinctoria*) are used in different parts of the East Indies, and considered a very valuable red dye. The colors dyed with it are for the most part exceedingly brilliant, and the coloring matter is far more permanent than many other red colors are, with improved management it would probably rival that of madder, and is, therefore, worthy more attention from dyers.

MANGROVE BARK (*Rhizophora mangle*), is used to dye a chocolate color in the East and West Indies. This was one of the colors introduced by Dr. Bancroft, and for the exclusive use of which he obtained an Act of Parliament. It is procured in plenty at Arracan, Malabar, and Singapore in the East.

SHUMAC or SUMACH, sometimes called young fustic, is the powder of the leaves, peduncles, and young branches of a small deciduous plant (*Rhus coriaria*), native of the South of Europe, but which is also grown in Syria and Palestine, for its powerful astringent properties, which renders it valuable for tanning light-colored leather, and it imparts a beautiful bright yellow dye to cottons, which is rendered permanent by proper mordants. It is principally imported from the Ionian Islands and the Morea. The species grown for the purpose in Spain, Portugal, and Italy is *R. Cotinus*, a shrub with pale purple flowers, whereas *R. coriaria* has greenish yellow blossoms. They may be propagated by cuttings of the roots and layers. *R. typhina*, and *R. glabia*, with their varieties, are North American species, which are also used for tanning purposes. In Montpellier and the South of France the twigs and leaves are known under the name of *redoul* or *roudo*. They are gathered every year, and the shoots are chipped or reduced to powder by a mill.

The imports into the United Kingdom were in 1846,10,256 tons; in 1847, 11,975 tons; in 1848, 9,617 tons; in 1849, 12,590 tons; in 1850, 12,929 tons, and in 1852, 9,758; which were all retained for consumption. In 1841, we received about 9,000 tons from the port of Leghorn. There were exported from Sicily in 1842, 123,305 tons, valued at L68,894. It is imported in packages of about a cwt., wrapped in cloth. America takes a large quantity of sumach. The imports into the port of Boston alone, were 19,070 bags in 1847; 34,524 in 1848; and 30,050 in 1849.

The prices in Liverpool, duty paid, in the close of this year, are per cwt.:—

	s. d.		s. d.	
Sicily, Messina	10 0	to	10 6	
" Palermo	12 0	"	13 0	
" Trieste	7 0	"	7 6	
" Verona	5 6	"	6 6	
" Tyrolese	8 0	"	9 0	

SAFFLOWER.—The dried flowers of *Carthamus tinctorius* yield a pink dye, which is used for silks and cottons, and the manufacture of rouge; the color, however, is very fugitive. It is an annual plant, cultivated in China, India, Egypt, America, Spain, and some of the warmer parts of Europe; and is indigenous to the whole of the Indian Archipelago. A large quantity is grown in and exported from Bali. The Chinese safflower is considered the best, and that from Bombay is least esteemed. The annual quantity exported from the district of Dacca averages about 150 tons. The shipments from Calcutta exceed 300 tons to various quarters. Our imports are on the decline, and are now only about 1,200 cwt. per annum. Safflower was shown in the Great Exhibition from Celebes, Assam, the vicinity of Calcutta, Dacca, the states of Rajpootana, and other places.

There are two species: *C. tinctorius*, which has small leaves and an orange flower; and *C. oxyacantha*, with larger leaves and a yellow flower, a native of Caucasus. The former is cultivated in Egypt, the Levant, &c., where it forms a considerable article of commerce. 6,633 cwts. of safflower were imported into the United Kingdom in 1835, of which about one-half was retained for home consumption. Of 5,352 cwts. imported in 1840, nearly the whole came from our possessions in the East. In 1847, about 405 tons were imported; in 1848, 506 tons; in 1849, 407 tons; in 1850, 522 tons. The price of safflower varies from L1 to L8 per cwt., according to quality. That from Bombay is least esteemed, fetching only 20s. to 30s.

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The annual quantity of safflower, according to Dr. Taylor, exported from the district of Dacca for eight years ending with 1839, amounted to 4,000 maunds, or about 149 tons. The exports through the Calcutta Custom House are occasionally large: in 1824-25 there were about 316 tons; 8,500 Indian maunds were shipped from Calcutta in each of the years 1841 and 1842.

The prices in the Liverpool market, in January 1853, were for Bengal, good and fine, L6 to L7 10s. per cwt.; middling, L4 to L4 10s.; inferior and ordinary, L2 10s. to L3.

GAMBOGE is extensively used as a pigment, from its bright yellow color. There are two kinds known in commerce, the Ceylon and the Siam. The former is procured from the *Hebradendron Cambogoides*, Graham; a tree which grows wild on the Malabar and Ceylon coasts, and affords the coarsest kind. The pipe gamboge of Siam is said to be obtained from the bruised leaves and young branches of *Stalagmites cambogoides*. The resinous sap is received into calabashes, and allowed to thicken, after which it is formed into rolls. Several other plants, as the *Mangostana Gambogia*, Gaertner, and the *Hypericum bacciferum* and *Cayanense*, yield similar yellow viscid exudation, hardly distinguishable from gamboge and used for the same purpose by painters. The *Garcinia elliptica*, Wallich, of Tavoy and Moulmein, affords gamboge, and approaches very closely in its characters to Graham’s *Hebradendron*. In like manner the Mysore tree bears an exceedingly close resemblance to that species. It is common in the forests of Wynaad in the western part of Mysore, and has been named by Dr. Christison *Hebradendron pictorium*. Another gamboge tree has recently been found inhabiting the western Burmese territories. Both these seem to furnish an equally fine pigment. As it can be obtained in unlimited quantity, it might be introduced into European trade, if the natives learn how to collect it in a state of purity, and make it up in homogenous masses in imitation of pipe gamboge, the finest Siam variety. It seems to possess more coloring matter, more resin and less gum than the ordinary gamboge of commerce. Gamboge owes its color to the fatty acid. The resin must be regarded as the chief constituent, and is most abundant in that imported from Ceylon, which contains about 76 per cent., and is therefore best adapted for painting. Gamboge also has its medicinal uses.

Various species of *Lecanora*, particularly *L. tartarea*, known as cudbear, are used in dyeing woollen yarn. The *Rocella tinctoria* and *fusiformis* furnish the orchil, or orchilla weed of commerce, which is sometimes sold as a moist pulp, but usually in the form of dry cakes, known under the name of *litmus*; it produces a fine purple color. Our imports, which have amounted to 6,000 or 7,000 cwts. annually, are derived chiefly from the Canary, Azores, and Cape Verd Islands. Rock

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orchilla was shown at the Exhibition, from the Berlingen Isles, from Angola, Madeira and the Cape de Verds. Orchilla weed is very plentiful about the shores of the islands of New Zealand, some being sent from thence to the Exhibition; but from a want of knowledge as to the time at which it should be gathered, and the mode of preparing it for the market, it has not yet become a saleable commodity there. The rich varieties of lichens on the rocks and plains of Australia have not been tested, as they ought to be, with Helot's lichen test. Various lichens, and *Rocella tinctoria*, from Tenasserim and other parts of India, have been introduced by the East India Company. In the Admiralty instructions given to Capt. Sir James C. Ross, on his Antarctic voyage, a few years ago, his attention was specially called to the search and enquiry for substitutes for the *Rocella*, which is now becoming scarce. A prize medal was awarded, in 1851, to an exhibitor from the Elbe for specimens of the weed, and an extract of red and violet orchil. Specimens of varieties of the lichens used in the manufacture of cudbear, orchil and litmus, and of the substance obtained, were also shown in the British department, which were awarded prize medals.

The beauty of the dyes given by common materials, in the Highlands of Scotland, to some of the cloths which were exhibited, should lead our botanists and chemists to examine, more closely than they have hitherto done, the dye-stuffs that might be extracted from British plants. Woad (*Isatis tinctoria*) and the dyers' yellow woad (*Reseda lutea*), are both well known. A piece of tweed, spun and woven in Ross-shire, was dyed brown and black, by such cheap and common dyes as moss and alder bark, and the colors were unexceptionable.

Sutherlandshire tweed and stockings, possessing a rich brown color, were produced with no more valuable dye than soot; in another piece, beautifully dyed, the yellow was obtained from stoney rag, brown from the crops of young heather, and purple from the same, but subjecting the yarn to a greater action of the dye than was necessary to produce brown. There is very little doubt but that beautiful and permanent dyes, from brown to a very rich purple, might be cheaply procured by scientific preparations of the common heather (*Genista tinctoria*). The inhabitants of Skye exhibited cloth with a peculiarly rich dye, obtained from the "crobal" moss. In the Spanish department, specimens of vegetable dyes from many cultivated and wild plants were furnished by the Agricultural Board of Saragossa, and of several of these it would be important to obtain descriptions and particulars.

Gums are of essential importance to the dyer, and the imports of these, therefore, are large, averaging about 8,000 tons.

INDIGO.

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The plants which afford this dye grow chiefly in the East and West Indies, in the middle regions of America, in Africa and Europe. They are all species of the genera *Indigofera*, *Isatis* and *Nerium*. *Indigofera tinctoria* or *coerulea*, furnishes the chief indigo of commerce, and affords in Bengal, Malabar, Madagascar, the Isle of France, and St. Domingo, an article of middling quality, but not in large quantity. The *Indigofera disperma*, a plant cultivated in the East Indies and America, grows higher than the preceding, is woody, and furnishes a superior dye-stuff. The Guatamela indigo comes from this species.

Indigofera Anil grows in the same countries, and also in the West Indies. The *Indigofera Argentea*, which flourishes in Africa, yields little indigo, but it is of an excellent quality. *I. pseudotinctoria*, cultivated in the East Indies, furnishes the best of all. *I. glauca* is the Egyptian and Arabian species. There are also the *cinerea*, *erecta* (a native of Guinea), *hirsuta*, *glabra*, with red flowers, species common to the East, and several others.

The *Wrightia tinctoria*, of the East Indies, an evergreen, with white blossoms, affords some indigo, as does the *Isatis tinctoria*, or, Woad, in Europe, and the *Polygonum tinctorium*, with red flowers, a native of China. *Baptisia tinctoria* furnishes a blue dye, and is the wild indigo of the United States.

SOURCES OF SUPPLY.—Indigo is at present grown for commercial purposes in Bengal, and the other provinces of that Presidency, from the 20th to the 30th deg. of north latitude; in the Province of Tinnevelly; in the Madras Presidency; in Java, in the largest of the Philippine islands, in Guatemala, Caraccas, Central America and Brazil. Bengal is, however, the chief mart for indigo, and the quantity produced in other places is comparatively inconsiderable. It is also still cultivated in some of the West India islands, especially St. Domingo, but not in large quantities. Indigo grows wild in several parts of Palestine, but attention seems not to have been given to its cultivation or collection. On most parts of the eastern and western coasts of Africa, it is indigenous; at Sierra Leone, Natal, and other places it is found abundant.

In our settlements of Honduras, Demerara, and various portions of the American continent, it would amply reward the labor of the cultivator; several inferior sorts of Indigofera being found there indigenous, and only requiring care and culture to improve them.

The quality of indigo depends upon the species of the plant, its ripeness, the soil and climate of its growth, and the mode of manufacture. The East India, and Brazilian indigo arrives here packed in chests, the Guatemala in ox-hides, called serons.

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The indigo imported from the western hemisphere was for some time considered superior in quality to that of the East. Its cultivation, however, has been neglected, and the Bengal indigo is preferred at present to any imported from South America, where it is now only cultivated by the Brazilians and Colombians. If proper attention were paid to the cultivation of the plant, and to the preparation of the dye, it is very likely part of that important trade would be brought back. It thrives best in a moist climate, and the interior of Guiana, chiefly newly-cleared land, would be well adapted for it.

The late Mr. Dunlop ("Travels in Central America") gives an interesting description, which, at the risk of repetition in some points, I shall give entire.

"Several vessels generally arrive at the Union from South America at the time of the periodical fairs, where nearly all the indigo (the only produce of any importance), is disposed of; formerly it reached 10,000 bales, but at present it does not at most exceed 3,000 bales of 150 lbs. each.

The indigo well known in Europe by the name of Guatemala indigo, was never cultivated in that province (in the same manner as not a grain of the Honduras cochineal is grown there), being entirely grown in the state of San Salvador, in the vicinity of San Miguel, San Vicenti, and the City of Salvador, with the exception of a small quantity of very superior quality grown in the state of Nicaragua, and a few bales in Costa Rica, which is all consumed in the State. Under the government of Spain, the produce of the state of San Salvador alone had reached 10,000 bales, and that of Nicaragua 2,000; the produce of San Salvador in 1820, two years before its independence, being 8,323 bales. But since 1822 the annual produce had gradually declined, and in 1846 it did not exceed 1,000 to 1,200 bales, nearly all the indigo estates being abandoned, partly, no doubt, from the great fall in the price of the article, but more on account of the impossibility of getting laborers to work steadily.

The plant cultivated in Central America for the manufacture of indigo, is the triennial plant, supposed to be a native of America; but there is also an indigenous perennial plant, abounding in many parts of Central America, which produces indigo of a very superior quality, but gives less than half the weight which is produced by the cultivated species. The ground for sowing the indigo seed is prepared in April,—a piece of good forest land near one of the towns being selected, a part is cut to make a rude fence, and the remainder burnt, which is easily accomplished, as everything is very dry at that season; and the ground is afterwards scratched with two sticks, fastened crosswise, to resemble somewhat the shape of a plough, and the seed scattered over it by hand. The rainy season always commences early in May, and the indigo is ready for cutting about the middle of July, taking about two and a half months to come to perfection. The growing crop somewhat resembles lucerne, and is in the best state for making indigo, when it becomes covered with a sort of greenish farina.

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The crop of the first year is small, and sometimes not worth manufacturing; that of the second year is the best, and the third is also very good, if it has been carefully weeded; but many indigo fields have lasted more than ten years without being re-sown, as the seed which falls naturally springs up again, and where the land is good yields nearly as large a crop as a new sown field. When the plant is ready for manufacturing, a number of men are collected, each of whom is either provided with, or brings his own mule or horse, if he has one. Two men always go together, cut the plant, then about the height of full-grown red clover, and take it to the vats, which are large tanks made of brick and lime, holding at least 1,000 gallons, and some as much as 10,000. Into these the plant is thrown till they are nearly full, when weights are put above it to prevent its floating; and the vats filled with water till it covers the mass of the indigo plant. After remaining from twelve to twenty-four hours, according to the state of the plant, weather, and other circumstances (the time required being determined by the color which the water assumes), the herb is taken out, and the water beaten with paddles in the very small vats, and by a wheel suspended above and turned by men or horses in the larger ones, till it changes from a green color, which it has acquired ere the removal of the herb, to a fine blue, when it is allowed to stand for some hours, till the coloring matter has settled to the bottom of the tank, a process which is generally hastened by throwing in an infusion of certain herbs to facilitate its settlement, or as the natives term it curdle (*cuajar*) the colored water. As soon as all the color has settled, the water is drawn off, and the blue, which is of the consistency of thick mud, is taken out of the vat and spread upon cotton, or coarse woollen cloth, and dried in the sun. The color in a great measure depends upon removing the herb exactly at the proper time, and upon properly beating the water, neither too long, or too short. Unless these processes are properly performed, the indigo will not be of first-rate quality; but some estates will never produce the best indigo, whatever care may be bestowed on the manufacture.

A *mansana*, of 100 yards square, which is nearly two British statute acres, produces generally about 100 to 120 lbs. of indigo, the carriage and cutting of the herb costing about twenty dollars, and the cleaning of the field and all other expenses connected with it, including the manufacture of the indigo, about as much more.

The indigo of Central America is not put into moulds when drying, as that of Bengal, but is allowed to remain in the rough shape in which it dries, and without further preparation is ready for baling and exportation.

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The bales are generally made up in 150 lbs. each, and the quality is classed by numbers, from 1 to 9; Nos. 1 to 3 being of the quality called *cobres* in Europe; Nos. 4 to 6 of that called *cortes*, and Nos. 7 to 9 of that called *flores*; Nos. 1 to 6 do not at present pay the expenses of manufacture, and are never intentionally made. No doubt, with a little more skill in the manufacture, the whole might, as in Bengal, be made of the quality called *flores*; but such improvements cannot be expected till a new race of people inhabit Central America. At present about one-half of the indigo produced is under No. 7, and as the cultivation is said not to pay at the present prices—and, indeed, hardly can be supposed to compete with Bengal, a country where labor is so much cheaper, and capital abundant—it is probable, that the cultivation will shortly be entirely abandoned, unless the price should again rise in Europe." In 1846, 21,933 lbs. of indigo were exported from Angostura.

The following particulars were contributed to my "Colonial Magazine," by the late Dr. Edward Binns, of Jamaica:—

The species generally cultivated is the *I. tinctoria*, which requires a rich moist soil and warm weather. The seed, which is at first sight not unlike coarse gunpowder, is sown three or four inches deep, in straight lines, twelve or fifteen inches apart. The shoots appear above ground in about a week; at the end of two months the plant flowers, when it is fit for cutting, which is done with a pruning knife. It must be mentioned that great care is requisite in weeding the indigo field when plants first shoot through the earth. In the State of St. Salvador, large vats made of mahogany, or other hard wood, are constructed for the reception of the plant, where it is allowed to undergo maceration and fermentation. In a short time the water becomes greenish, and emits a strong pungent smell, while carbonic acid gas is freely evolved. In about twenty-four hours it is run off into large flat vessels, and stirred about until a blue scum appears, when additional water is added, and the blue flakes sink to the bottom. The supernatant water has now acquired a yellowish tinge, when it is run off carefully, and the blue deposit or sediment put into bags to drain. It is subsequently dried in the shade, or sometimes in the sun, then placed in cotton bags and carried to the indigo fair, or forwarded to the city of Guatemala.The East Indian mode of manufacturing the indigo differs materially, and many suppose it preferable to the Salvador. It consists in *steaming* the fermented mass in large pipes enclosed in huge boilers. I am inclined to believe this to be the most economical, if not the best way of manufacturing indigo. From Guatemala alone, it is computed that from 6,000 to 8,000 serons of indigo are exported annually; while San Miguel, Chalatenaugo, Tejulta, Secatecolnea, St.

Vincent, Sensuntepepe, not only, it is said, produce a larger quantity, but the four last-mentioned places have the advantage as to quality. The *Belize Advertiser* stated, some time since, that the value of this dye from one State in 1830 produced 2,000,000 dollars, the minimum of an immense sum which has been most unjustly and unwisely wrested from the people of Jamaica, and the West India islands.Bridges ("Annals of Jamaica," p. 584, Append.), speaking of the vast returns of an indigo plantation, says, "The labour of a single negro would often bring to his owner L30 sterling per annum clear profit,—a sum which was at the time the laborer's highest price. It continued the *staple* of Jamaica till an intolerable tax oppressed it, while its price was lowered by the competition of other colonies.Its cultivation immediately declined throughout them all, but nowhere so rapidly as here. The financial error was quickly discovered,—a remedy was attempted by a bounty; but it came too late, the plantations were thrown up, and the planters, attracted by the temporary gain, abused the tardy boon, by introducing, as of their own growth, large quantities of foreign indigo." As Bridges may be said in this passage to be merely a commentator on Edwards, who has entered more largely upon the subject, I shall condense from the latter, statements connected with the manufacture and decay of this branch of industry, once the staple of Jamaica.Edwards ("West Indies," vol. ii., p. 275, 2nd edition) reckons three kinds of indigo—the wild, Guatemala, and French. The first is the hardest, and the dye extracted from it of the best quality as regards color and grain; but one or other of the two species is commonly preferred by the planter, as yielding a greater return. Of these the French surpasses the Guatemala in quantity, but yields to it in fineness of grain and beauty of color. The indigo thrives almost on any land, though the richest soils produce the most luxuriant plants, and the longest dry weather will not kill it. The cultivation and manufacture our author thus describes:—"The land being prepared, trenches, two or three inches in depth, are made by the hoe. These are ten or twelve inches asunder. The seeds are then strewed in the trenches by the hand, and slightly covered with mould. When the plants shoot, they are carefully weeded, and kept constantly clean, until they rise high enough to cover the ground. A bushel of seed is sufficient for four or five acres. The best season for planting is March; but if the land be good, it may be sown at any time, and in three months the plants attain maturity. In seasonable situations, they have four cuttings in the year. The subsequent growths from the plants ripen in six or eight weeks; but the produce diminishes after the second cutting, so that the seeds should be sown every second year. A species of grub, or worm, which infests the

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plant on the second year is avoided by changing the soil; or, in other words, by a rotation of crops. The produce per acre of the first cutting is about 60 lbs. It is nearly as much in North America; but when the thermometer falls to sixty, the returns are very uncertain, that degree of heat being too low for the necessary vegetation, maceration, and fermentation. The yieldings for the subsequent cuttings somewhat diminish; but in Jamaica and St. Domingo, if the land is new, about 300 lbs. per acre of the second quality may be expected annually from all the cuttings together; and four negroes are sufficient to carry on the cultivation of five acres, besides doing other occasional work, sufficient to reimburse the expenses of their maintenance and clothing."The process for obtaining the dye, according to the same author, was conducted through the means of two cisterns, the one elevated above the other, in the manner of steps. The higher, which was also the longer, was named the *sleeper*—its dimensions sixteen feet square and two and a half in depth. The second, into which the fluid was discharged, was called the *battery*; it was about twelve feet square, and four and a half in depth. These cisterns were of stone; but strong timber answered remarkably well. There was also a lime-vat, six feet square and four feet deep, the plug of which was at least eight inches from the bottom. This was for the purpose of permitting the lime to subside, before the lime-water was withdrawn. The plants then being ripe, or fit for cutting, were cut with reaping-hooks, or sickles, a few inches from the ground—six was the minimum—and placed by strata in the *sleeper*, until it was about three parts full. They were then pressed with boards, either loaded with weights or wedged down, so as to prevent the plants from floating loosely; and as much water was admitted as they would imbibe, until it covered the mass four or five inches deep. In this state it was allowed to ferment until the water had extracted the pulp. To know when this had been thoroughly effected, required extreme attention and great practical knowledge; for if the fluid were drawn off too soon, much of the pulp was left behind; and if the fermentation continued too long, the tender tops of the plants were decomposed, and the whole crop lost. When the tincture or extract was received in the battery, it was agitated or churned until the dye began to granulate, or float in little flakes upon the surface. This was accomplished at one period in Jamaica by paddles, worked by manual labor, and, in the French islands, by buckets or cylinders, worked by long poles; but subsequently—that is, at the time Edwards wrote—convenient apparatus was constructed, the levers of which were worked by a cog-wheel, kept in motion by a horse or mule. When the fluid had been churned for fifteen or twenty minutes, a small quantity was examined in a cup or plate, and if it appeared curdled or coagulated, strongly

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impregnated lime-water was gradually added, not only with a view to promote separation, but to prevent decomposition. Browne remarks ("Civil and Nat. Hist. of Jamaica," art. "Indigo"), the planters "must carefully distinguish the different stages of this part of the operation also, and attentively examine the appearance and color as the work advances,—for the grain passes gradually from a greenish to a fine purple, which is the proper color when the liquor is sufficiently worked,—too small a degree of agitation leaving the indigo green and coarse, while too vigorous an action brings it to be almost black." The liquor being then, as we shall suppose, properly worked, and granulation established, it was left undisturbed until the flakes settled at the bottom, when the liquor was drawn off, and the sediment (which is the indigo) placed in little bags to drain, after which it was carefully packed in small square boxes, and suffered to dry gradually in the shade.Such is the account, nearly word for word, which Edwards gives of the mode of manufacturing indigo. I shall now quote his remarks upon the outlay and gain upon the article *verbatim*.—"To what has been said above of the nature of the plant suiting itself to every soil, and producing four cuttings in the year, if we add the cheapness of the buildings, apparatus, and labor, and the great value of the commodity, there will seem but little cause for wonder at the splendid accounts which are transmitted down to us concerning the great opulence of the first indigo-planters. Allowing the produce of an acre to be 300 lbs., and the produce no more than 4s. per pound, the gross profit of only twenty acres will be L1,200, produced by the labor of only sixteen negroes, and on capital in land and buildings scarce deserving consideration." Yet, notwithstanding this statement, the author informs us afterwards that he knew, in the course of eighteen years' residence in the West Indies, upwards of twenty persons who tried to re-establish indigo manufactories, but failed. This appears strange, since it is plain that what has once been done can be done again, but especially in the manufacture of an article requiring a capital so very small in proportion to the profits as almost to tempt the most cautious and the most timid man to embark in it.I quote the following passage from the same author, for the purpose of showing the very loose manner in which statements are made on the authority of others, who are as incompetent to decide the merits of a question as the party himself chronicling their opinion. Speaking of the twenty unfortunate indigo-planters, our author thus writes:—- "Many of them were men of foresight, knowledge, and property. That they failed is certain; but of *the causes of their* FAILURE *I confess I can give no satisfactory account.* I was told that disappointment trod close upon their heels at every stop. At one time the fermentation was too long continued, at another

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the liquor was drawn off too soon; now the pulp was not duly granulated, and now it was worked too much. To these inconveniences, for which practice would doubtless have found a remedy, were added others of a much greater magnitude—the mortality of the negroes, from the vapour of fermented liquor (an alarming circumstance, that, I am informed, both by the French and English planters, constantly attends the process), the failure of the seasons, and the ravages of the worm. These, or some of these evils, drove them at length to other pursuits, where industry might find a surer recompense."—(p. 283.)The fallacy of much of this requires no comment, as it must strike even the most careless reader,—for if the so-called indigo-growers did not know the process of manufacturing the commodity, then it could not be surprising that they failed. Thus the cause of their failure required no comment, and no explanation. Were a ploughman taken from the field and placed at the helm of a ship, and the vessel in consequence wrecked, would any one be astonished but at the folly of those who placed him there? This was the case with the indigo-growers,—they attempted what they did not understand, and, consequently, lost their labor and their money. The mortality of the negroes employed, stated as another reason for abandoning the attempt, requires a somewhat more lengthy notice.I can briefly say, that I have learned that in the Central States of America, deaths among indigo-laborers are not more frequent than in other branches of tropical industry; and I never heard or have read that the *original* growers complained of the mortality attending the progress. The truth is, that this statement is not founded on fact. There is nothing whatever in the manufacture of indigo, either in the cultivation or the granulation, or even the maceration and fermentation of the plant, which is directly or indirectly, *per se*, injurious to human life. I have certainly never seen the indigo plant macerated on a large scale; but I have myself steeped much of it in water, and allowed it even to rot, and found nothing in the mass differing in any marked degree from decomposed vegetable matter. It seems to me that this idea of the manufacture of indigo being especially inimical to human life, is as unfounded as the belief, even by Humboldt, up to a very recent period, that none of the Cerealia would grow in tropical climates. In conversing with an old gentleman in Jamaica, some twelve years since, who had tried the manufacture of indigo, and with every prospect of success, but abandoned it, as he confessed, for the cultivation of the sugar cane, since it was then more profitable, he suggested the solution, that as the manufacture was light work, probably aged and debilitated, in place of youthful and vigorous slaves, were too frequently employed in the process—hence the mortality. This may be correct to a certain

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extent; but I am also inclined to think that another cause of mortality might be found in the mode and manner in which the negro was fed and clothed, and not because aged persons were exclusively engaged in the manufacture. I believe I may state, without fear of contradiction, that the real cause of the decline and consequent abandonment of the indigo plant was the monstrous duty levied upon it by the English government. Indeed, this has been already stated in the extract from Bridges; while the cause of the failure of the attempt to renew it, over and above the reasons we have given, was the greater temptation to embark capital in sugar plantations,—the West Indies enjoying a monopoly in this article, while they had competitors in the Southern States of America in the other. I have, therefore, no hesitation in saying, that, with a trifling capital, under prudent management, indigo might be cultivated to a very great extent, and with considerable profit, even now, in Jamaica. But the adventurer is not to expect to count his gains, as the original growers did, by thousands; he must be content with hundreds, if not fifties; for at the present day every branch of industry is laden with difficulties, encumbered by taxation, and obstructed by competition. There are two objections, however, which I have not removed,—I allude to “the failure of the seasons and the ravages of the worm.” Very little need be said to combat these. Seasons are mutable, and the same heaven that frowns this year on the labors of the husbandman, may smile the next; while a remedy for the “ravages of the worm” may be found in the mutation of the soil, the destruction of the grub, or the rotation of crops,—accessories to success which seem not to have entered into the vocabularies of the twenty pseudo indigo-growers, “many of them men of knowledge, foresight and property.”The following passage from Bryan Edwards will corroborate much that I have endeavored to enforce. It furnishes not only a solution which has been hinted at before, of the enigma why indigo ceased to be cultivated in Jamaica, but also *an incentive* to re-introduce the culture. He says (p. 444), “It is a remarkable and well-known circumstance, after the cultivation of indigo was suppressed by an exorbitant duty of near L20 the hundred-weight, Great Britain was compelled to pay her rivals and enemies L200,000 annually for this commodity, so essential to a great variety of her most important manufactures. At length, the duty being repealed, and a bounty some time after substituted in its place, the States of Georgia and South Carolina entered upon, and succeeding in the culture of this valuable plant, supplied at a far cheaper rate than the French and Spaniards (receiving too our manufactures in payment) not only the British consumption, but also enabled Great Britain to export a surplus at an advanced price to foreign markets.”—It is therefore plain that the manufacture of indigo was lost to

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Jamaica, not from any difficulty in growing the plant, or from any loss of life attending the process of manufacturing it, but from the ruinously heavy duty of L20 the hundred-weight—and that now, when no duty exists, it might be again cultivated with great advantage.

The cultivation of indigo has been repeatedly attempted in Cuba, but never with much success; although the shrub called the Xiquilite, from which it is extracted, grows wild in several districts of the island, but more especially towards the eastern extremity. The first *anileria*, or manufactory of indigo, was established in 1795, under the patronage of the *Ayuntamento* of the Havana, who made an advance of 3,500 dollars, without interest, to the party engaging in the speculation, in order to encourage the enterprise; but the undertaking proved unsuccessful, and the same fate has befallen every subsequent attempt to introduce this branch of industry. In 1827, the whole produce amounted only to 56 arrobas. In 1837 the imports of indigo greatly exceeded the exports; the former having amounted to 121,350 lbs., and the latter to 82,890 lbs. In 1833, 5,184 lbs. reached the United Kingdom from the Havana, and in 1843, 62,675 lbs.

In 1826 British Honduras exported 358,552 lbs.; in 1830, 2,650 serons; in 1844, 1,247 serons; and in 1845, 1,052 serons.

The indigo shrub is one of the most common bushes in Trinidad, where it grows wild on almost all the indifferent soils. In 1783, there were several plantations and manufactories of indigo established in Trinidad; these were subsequently abandoned, on account of a supposition that they were unhealthy. Prior to 1783, the colonists had a kind of simple process by which they extracted sufficient coloring matter to serve domestic consumption. This process is at present unknown, hence all the indigo used there is imported from Europe, although the plant from which it can be made vegetates in every direction.

In 1791 Hayti imported 930,016 lbs. of indigo, while in 1804 the export had dwindled to 35,400 lbs.

Indigo, as I have already stated, was once a most important crop in South Carolina, some attention has recently again been given to it by an individual or two in Louisiana, and the enterprise is said to promise success; enough might undoubtedly be raised in the United States to supply the home market. Some indigo produced at Baton Rouge was pronounced to have been equal to the best Caraccas, which sells at two dollars per pound; and the gentleman who cultivated it remarks, that one acre of ground there, well cultivated, will yield from 40 to 60 lbs.; that it requires only from July to October for cultivating it; that there is not connected with it one-third of the expense or time that is generally required for the cultivation of cotton.

I take the following from Smyth’s “Tour in the United States.”

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“This plant is somewhat like the fern when grown, and when young is hardly distinguishable from lucern grass, its leaves in general are pinnated, and terminated by a single lobe; the flowers consist of five leaves, and are of the papilonaceous kind, the uppermost petal being longer and rounder than the rest, and lightly furrowed on the side, the lower ones are short and end in a point; in the middle of the flower is formed the style, which afterwards becomes a pod containing the seeds.

“They cultivate three sorts of indigo in Carolina, which demand the same variety of soils. First, the French or Hispaniola indigo, which striking a long tap root will only flourish in a deep rich soil, and therefore, though an excellent sort, is not so much cultivated in the maritime parts of the State, which are generally sandy, but it is produced in great perfection one hundred miles backwards; it is neglected too on another account, for it hardly bears a winter so sharp as that of Carolina. The second sort, which is the false Guatemala, or true Bahamas, bears the winter better, is a more tall and vigorous plant, is raised in greater quantities from the same compass of ground, is content with the worst soil in the country, and is therefore more cultivated than the first soil, though inferior in the quality of its dye.

“The third sort is the wild indigo, which is indigenous here; this, as it is a native of the country, answers the purposes of the planter best of all, with regard to the hardiness of the plant, the easiness of the culture, and the quantity of the produce. Of the quality there is some dispute not yet settled amongst the planters themselves; nor can they distinctly tell when they are to attribute the faults of their indigo to the nature of the plant, to the seasons, which have much influence upon it, or to some defect in the manufacture.

“The time of planting the indigo is generally after the first rains succeeding the vernal equinox; the seed is sown in small straight trenches, about eighteen or twenty inches asunder; when it is at its height, it is generally eighteen inches tall. It is fit for cutting, if all things answer well, in the beginning of July.

“Towards the end of August a second cutting is obtained, and if they have a mild autumn, there is a third cutting at Michaelmas. The indigo land must be weeded every day, the plants cleansed from worms, and the plantation attended with the greatest care and diligence. About twenty-five hands may manage a plantation of fifty acres, and complete the manufacture of the drug, besides providing their own necessary subsistence and that of the planter’s family.

“Each acre yields, if the land be very good, 60 or 70 lbs. weight of indigo, at a medium the produce is 50 lbs. This however, is reckoned by many skilful planters but a very indifferent crop.

“When the plant is beginning to blossom it is fit for cutting, and when cut great care ought to be taken to bring it to the steeper without pressing or shaking it, as great part of the beauty of the indigo depends upon the fine farina, which adheres to the leaves of this plant. The apparatus for making indigo is inconsiderable and not expensive, for besides a pump, the whole consists only of vats and tubs of cypress wood, common and cheap in this country.

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“The indigo, when cut, is first laid in a vat, about twelve or fourteen feet long and four feet deep, to the height of about fourteen inches, to macerate and digest; then this vessel, which is called the *steeper*, is filled with water; the whole having laid from about twelve to sixteen hours, according to the weather, begins to ferment, swell, rise, and grow sensibly warm. At this time spars of wood are run across, to mark the highest point of its ascent; when it falls below this mark, they judge that the fermentation has attained its due pitch, and begins to abate; this directs the manager to open a cock, and let off the water into another vat, which is called the *beater*; the gross matter that remains in the first vat is carried off to manure the ground, for which purpose it is excellent, and new cuttings are put in, as long as the harvest of the weed continues. When the water, strongly impregnated with the particles of indigo, has run into the second vat or beater, they attend with a sort of bottomless buckets, with long handles, to work and agitate it, when it froths, ferments, and rises above the rim of the vessel that contains it. To allay this violent fermentation, oil is thrown in as the froth rises, which instantly sinks it. When this beating has continued for twenty, thirty, or thirty-five minutes, according to the state of the weather (for in cool weather it requires the longest continued beating), a small muddy grain begins to be formed; the salts and other particles of the plant united, dissolved, and before mixed with the water, are now re-united together, and begin to granulate. To discover these particles the better, and to find when the liquor is sufficiently beaten, they take up some of it from time to time on a plate, or in a glass; when it appears in a hopeful condition, they let loose some lime water from an adjacent vessel, gently stirring the whole, which wonderfully facilitates the operation; the indigo granulates more fully, the liquor assumes a purplish color, and the whole is troubled and muddy; it is now suffered to settle; then the clearer part is permitted to run off into another succession of vessels, from whence the water is conveyed away as fast as it clears on the top, until nothing remains but a thick mud, which is put into bags of coarse linen. These are hung up and left for some time until the moisture is entirely drained off.

“To finish the drying, this mud is turned out of the bags, and worked upon boards of some porous timber, with a wooden spatula; it is frequently exposed to the morning and evening sun, but for a short time only; and then it is put into boxes or frames, which is called the curing, exposed again to the sun in the same cautious manner, until, with great labor and attention the operation is finished, and the valuable drug fitted for the market. The greatest skill and care is required in every part of the process, or there may be great danger of ruining the whole;

the water must not be suffered to remain too short or too long a time, either in the steeper or beater; the beating itself must be nicely managed, so as not to exceed or fall short; and in the curing the exact medium between too much or too little drying is not easily attained. Nothing but experience can make the overseers skilful in these matters. There are two methods of trying the goodness of indigo; by fire and by water. If it swims it is good, if it sinks it is inferior, the heavier the worse; so if it wholly dissolves in water it is good. Another way of proving it, is by the fire ordeal; if it entirely burns away it is good, the adulterations remain untouched."

Indigo to the extent of 220,000 lbs. per annum is grown in Egypt. The leaves are there thrown into earthen vessels, which are buried in pits and filled with water; heat is applied, and the liquid is boiled away until the indigo becomes of a fit consistence, when it is pressed into shape and dried. Many Armenians have been invited from the East Indies to teach the fellahs the best mode of preparation, and, in consequence, nine indigo works have been established belonging to the government.

The indigo plant is found scattered like a weed abundantly over the face of the country in the district of Natal, Eastern Africa. It is said that there are no less than ten varieties of the plant commonly to be met with there. Mr. Blaine submitted, in 1848, to the Manchester Chamber of Commerce, a small specimen of this dye-stuff, which had been extracted by a rude process from a native plant, which was pronounced by good authority to be of superior quality, and worth 3s. 4d. per pound. Mr. W. Wilson, a settler at Natal, in a letter to the editor of the *Natal Witness*, thus speaks of the culture:—

"My attention was first forcibly drawn to the cultivation of indigo by some seed imported by Mr. Kinlock, from India. This seed, on trial, I found to grow luxuriantly; and after a few experiments I succeeded in manufacturing the dye. The success which thus attended my first attempts has encouraged me to try indigo planting on a more extensive scale. For this purpose I am allowing all the plants of this season to run to seed, and intend to plant equal quantities of Bengal and native indigo.While my attention was engaged in these preliminary experiments, I observed that the country abounded in a variety of species of indigo, and by a series of experiments found it rich and abundant, and have since learnt that it is known and in use among the natives, and called by them Umpekumbeto.This of course induced further inquiry, and on consulting different works I find that the Cape of Good Hope possesses more species of indigo than the whole world besides. Now I take it for granted that if Providence has placed these materials within our reach, it was evidently intended that we should, by the application of industry, appropriate

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them to our use. It becomes, then, a matter of necessity that indigo must thrive, this being its native soil and climate; and the experiments I have successfully made, go to support me in the opinion that the cultivation of indigo will bring an ample reward. Indeed it seems contrary to the laws of nature that it should be otherwise.

> I have obtained from the 140th part of an acre the proportion of 300 lbs. of indigo per acre. That the plant will cross successfully, I have also ascertained."

Cultivation in India.—During the nine years which preceded the opening of the trade with India in 1814, the annual average produce of indigo in Bengal, for exportation, was nearly 5,600,000 lbs. But since the ports were opened, the indigo produced for exportation has increased fully a third; the exports during the sixteen years ending with 1829-30, being above 7,400,000 lbs. a year.

The consumption in the United Kingdom has averaged, during the last ten years, about 2,500,000 lbs. a year.

In 1839-40 the export of indigo from Madras amounted to 1,333,808 lbs. A small quantity is also exported from the French settlement of Pondicherry. In 1837 the export from Manila amounted to about 250,000 lbs. The export from Batavia in 1841 amounted to 913,693 lbs., and the production in 1843 was double that amount. The annual exports of indigo, from all parts of Asia and the Indian Archipelago, were taken by M'Culloch, in 1840, to be 12,440,000 lbs. The imports are about 20,000 chests of Bengal, and 8,000 from Madras annually, of which 9,000 or 10,000 are used for home consumption, and the rest re-exported.

The total crop of indigo in the Bengal Presidency has ranged, for the last twenty years, at from 100,000 to 172,000 factory maunds; the highest crop was in 1845. The factory maund of indigo in India is about 78 lbs.

In the delta of the Ganges, where the best and largest quantity of indigo is produced, the plant lasts only for a single season, being destroyed by the periodical inundation; but in the dry central and western provinces, one or two *ratoon* crops are obtained.

The culture of indigo is very precarious, not only in so far as respects the growth of the plant from year to year, but also as regards the quantity and quality of the drug which the same amount of plant will afford in the same season.

The fixed capital required, as I have already shown, in the manufacture of indigo, consists simply of a few vats of common masonry for steeping the plant, and precipitating the coloring matter; a boiling and drying house, and a dwelling for the planter. Thus a factory of ten pair of vats, capable of producing, at an average, 12,500 lbs. of indigo, worth on the spot L2,500, will not cost above L1,500 sterling. The buildings and machinery necessary to produce an equal value in sugar and rum, would probably cost about L4,000.

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The indigo of Bengal is divided into two classes, called, in commercial language, Bengal and Oude; the first being the produce of the southern provinces of Bengal and Bahar, and the last that of the northern provinces, and of Benares. The first class is in point of quality much superior to the other. The inferiority of the Oude indigo is thought to be more the result of soil and climate, than of any difference in the skill with which the manufacture is conducted. The indigo of Madras, which is superior to that of Manila, is about equal to ordinary Bengal indigo. The produce of Java is superior to these.

Large quantities of indigo, of a very fine quality, are grown in Scinde. I have to acknowledge the receipt, from the Indian Government, of an interesting collection of documents on the culture and manufacture of indigo in Upper Scinde. The papers are chiefly from the pen of Mr. Wood, Deputy Collector of Sukkur, though there are several others, perhaps of much value, from various other of the revenue officers of Scinde.

Mr. Wood is of opinion that Scinde is much better suited than Bengal for the production of this dye-stuff—the alluvial soil on the banks of the Indus is equal in richness to that on those of the Ganges, and the climate seems equally well suited for the growth of the plant. But in two years out of three, the crops of the Bengal planter are injured by excessive inundations, while the work of gathering and manipulation is necessarily performed, during the rainy season, under the greatest imaginable disadvantages. In Scinde, on the other hand, the inundation of the river is produced almost solely from the melting of the snows in the Himalayas, and it is not liable to those excessive fluctuations in amount, or that suddenness in appearance peculiar to inundations chiefly arising from falls of rain. The Granges sometimes rises ten feet in four-and-twenty hours, and at some part of its course its depth is at times forty feet greater during a flood than in fair weather, while the Indus rarely rises above a foot a day, its extreme flood never exceeding fifteen feet, the limits and amount of the inundation being singularly uniform over a succession of years. Moreover, as rain hardly ever falls in Scinde, and when it does so only continues over a few days, and extends to the amount of three or four inches, no danger or inconvenience from this need be apprehended. Mr. Wood mentions that hemp may be grown in profusion on the indigo grounds, and that were the production of the dye once introduced, it would bring hundreds of thousands of acres now barren into cultivation, and secure the growth or manufacture of a vast variety of other commodities for which the country is eminently fitted. An experimental factory might, it is believed, be set up for from two to three thousand pounds, but this appears to be an amount of adventure from which the Government shrinks.

The districts of Kishnagar, Jessore, and Moorshedabad, in Bengal, ranging from 88 to 90 degs. E. latitude, and 221/2 to 24 degs. N. longitude, produce the finest indigo. That from the districts about Burdwan and Benares is of a coarser or harsher grain. Tirhoot, in latitude 26 degs., yields a tolerably good article. The portion of Bengal most propitious to the cultivation of indigo, lies between the river Hooghly and the main stream of the Ganges.

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In the East Indies, after having ploughed the ground in October, November, and the beginning of December, they sow the seed in the last half of March and the beginning of April, while the soil, being neither too hot nor too dry, is most propitious to its germination. A light mould answers best; and sunshine, with occasional light showers, are most favorable to its growth. Twelve pounds of seed are sufficient for sowing an acre of land. The plants grow rapidly, and will bear to be cut for the first time at the beginning of July; nay, in some districts so early as the middle of June. The indications of maturity are the bursting forth of the flower buds, and the expansion of the blossoms; at which period the plant abounds most in the dyeing principle. Another indication is taken from the leaves, which, if they break across when doubled flat, denote a state of maturity. But this character is somewhat fallacious, and depends upon the poverty or richness of the soil. When much rain falls, the plants grow too rapidly, and do not sufficiently elaborate the blue pigment. Bright sunshine is most advantageous to its production.

The first cropping of the plants is the best; after two months a second is made; after another interval a third, and even a fourth; but each of these is of diminished value.

Culture in India.—For the following excellent account of the modes of culture, and practice, &c., in Bengal, and other parts of India, I am indebted to Mr. G. W. Johnson, one of the correspondents of my “Colonial Magazine.” Mr. Johnson, besides his own Indian experience, has consulted all the best authorities, and the opinions of contributors to the leading periodicals of Calcutta on this important subject:—

When America became known to Europeans, its indigo became to them a principal object of cultivation, and against their skill the native Hindostanee had nothing to oppose, but the cheapness of his simple process of manufacture. The profit and extent of the trade soon induced Europeans to brave the perils of distance and climate to cultivate the plant in Hindostan; but these obstacles, added to the superior article manufactured by the French and Spaniards in the West Indies, would long have held its produce in India in subordination, if the anarchy and wars incident to the French Revolution, especially when they reached St. Domingo, had not almost annihilated the trade from the West, and consequently proportionally fostered that in the East. The indigo produce of St. Domingo was nearly as large as that of all the other West India islands together. From the time that the negroes revolted in that island, the cultivation of indigo has increased in Hindostan, until it has become one of its principal exports, and the quality of the article manufactured is not inferior to that of any other part of the world.The most general mode of obtaining the necessary supply of *weed*, as it is called

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by the planter, is as follows:—The land attached to the factory is parcelled out among the ryots or farmers, who contract to devote a certain portion of their farm to the cultivation of indigo, and to deliver it, for a fixed price per bundle, at the factory; a sum of money, usually equal to half the probable produce, has to be advanced to the ryot by the planter, to enable him to accomplish the cultivation, and to subsist upon until the crop is ready for cutting.If, as is generally the case, sufficient land is not attached to the factory to supply it with plant, the owner obtains what he requires by inducing the ryots in his vicinity to cultivate it upon a part of their land. Yet it is with them far from a favorite object of cultivation; and, indeed, if it were not for the money advanced to each ryot by the planter, to provide seed, &c., and which gives him a little ready money, bearing no interest, it is doubtful whether he would engage in the cultivation at all. Even this advance of money does not induce him to appropriate it to any but the worst part of his farm, nor to bestow upon it more than the smallest possible amount of labor. The reasons for this neglect are valid, for the grain crops are more profitable to the ryot, and indigo is one of the most precarious of India's vegetable products.In Bengal the usual terms of contract between the manufacturer and the ryot are, that the latter, receiving at the time a certain advance of money, perhaps one rupee (2s.) per biggah, with promise of a similar sum at a more advanced period of the season, undertakes to have a certain quantity of land suitably and seasonably prepared for sowing, to attend and receive seed whenever occasion requires, and to deliver the crop, when called upon, at the factory, at a specified price per bundle or 100 bundles. The particular conditions of these contracts vary generally in Bengal; they amount to advancing the ryot two rupees for every biggah of land, furnishing him with seed at about one-third its cost, on an engagement from him to return whatever his lands may produce (which, as has been said, is generally none at all), at the price charged, and receiving the plant from him at six, seven, eight, or sometimes nine bundles for a rupee—much oftener the former than the latter rates. A ryot cultivating alluvial lands, and having no seed, can hardly ever repay his advances; but it does not follow that he has been a loser, for he, perhaps, could not value his time, labor, and rent altogether at half the amount; and as long as this system is kept within moderate bounds, it answers much better than private cultivation to the manufacturer, and has many contingent advantages to the cultivator.In Tirhoot similar engagements are entered into with the ryots, who are there called *Assamees*. These engagements with Assamees are generally made in the month of September, on a written instrument

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called a *noviskaun*, by which they agree for a certain quantity of land, for five years, to be cultivated with indigo plant, and for which they are to be paid at the rate of six rupees per biggah, for every full field of plant measured by a luggie or measuring-rod. The luggie, it must be observed, varies in size throughout the district. In the southern and eastern divisions of Tirhoot and Sarun it is eight-and-a-half to ten feet long; and in the northern and western from twelve to fourteen feet. The Assamee receives, on the day of making his *bundobust*, or settlement, three rupees advance on each biggah he contracts for, another rupee per biggah when the crop is fit to weed, and the remaining two rupees at the ensuing settlement of accounts. Exclusive of the price of his maul or plant, the Assamee is entitled to receive two or three rupees per biggah (as may be agreed on) for gurkee, or lands that have failed, as a remuneration for his trouble, and to enable him to pay his rent. The foregoing are the principal stipulations of the noviskaun, but the Assamee further engages to give you such land as you may select, prepare it according to instructions from the factory, sow and weed as often as he is required, cut the plant and load the hackeries at his own cost, and in every other respect conform to the orders of the planter or his aumlah (managing man). The Assamee is not charged for seed, the cartage of his plants, or for the cost of drilling. I should mention that a penalty is attached to the non-fulfilment of the Assamees engagements, commonly called *hurjah*, *viz*., twelve rupees for every biggah short of his agreement, and this for every year that the noviskaun has to run. This is, however, seldom recoverable, for if you sue the Assamee in court and obtain a decree (a most expensive and dilatory process), he can in most instances easily evade it by a fictitious transfer of his property to other hands.The planter generally finds it his interest to get the Zemindar of the village in which he proposes cultivating, to join in the noviskaun, as a further security; or he engages with a jytedar, or head Assamee, having several others subordinate to him, and for whose conduct he is responsible. But a still better system is lately gaining ground in this district, I mean that of taking villages in ticka, or farm, by far the best and cheapest plan that has ever been resorted to for the cultivation of indigo.When the planter cultivates the ground himself, it is called in Tirhoot *Zerant* cultivation. *Zerants*, or *Neiz*, are taken on a pottah or lease for five years, at the average rent of three rupees per biggah. The heavy cost attending this cultivation has occasioned its decrease in most factories in Tirhoot and particularly since the fall in prices. About a third, I believe, was the proportion it formerly bore to the whole cultivation of the district, but of late

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such factories only have retained it as cannot procure sufficient good land under the Assamewar system; but now that the plan of taking villages in farm is becoming more and more prevalent here, it is very likely that Zerants will be entirely abandoned. From all the information I have been able to collect, the cost of a biggah of Zerant (ten feet luggie) may be estimated at sixteen rupees; that of Assamewar is generally twenty-five per cent. less, both exclusive of interest, agents' charges, and private expenses.It can only be the reluctance of the ryot to cultivate indigo that induces a manufacturer to grow it himself, for it has been found an expensive plan, profitable only when the dye is at its highest rate, and even then scarcely furnishing an adequate return. They not only could not cultivate so cheaply as the native laboring husbandman, but ordinarily had to engage extensive tracts of land, much of which was not suitable for their purpose, or, perhaps, for any other, and consequently, although the average rate of rent was even low on the whole, it constituted a very heavy charge on the portion from which they obtained their return.In Oude there are three systems of obtaining a supply of the plant, *viz*., *Kush Kurreea*, *Bighowty*, and *Nij*; but the latter is a mere trifle in proportion to the others, and is, therefore, not worth mentioning. On the *Bighowty* system, which prevails chiefly in the Meerut and Mooradabad districts, the planter advances for a biggah of *Jumowah* (irrigated sowings) nine rupees, and for a biggah of *Assaroo* (rain sowings) five rupees four annas. The next year's plant, or *khoonti*, becomes his on an additional payment of eight annas per biggah. He also supplies the seed at the rate of six seers per biggah, being almost double the quantity made use of in Bengal, but which is necessary to make up for the destruction of the plant the year following by the frost, white ants, hot winds, grass cutters, and, I may add, the village cattle, which are let loose to graze on the khoonte during the latter period, when not a blade of grass or vegetation is to be seen anywhere left.The Bighowty system is a sadly ruinous one, as, independently of the attempts to assimilate Assaroo, at five rupees four annas, with *Jumowah*, at nine rupees per biggah, which is very easily effected if the planter is not very vigilant, he is obliged to maintain an extensive and imposing establishment of servants, not only to enforce the sowings, weeding, and cutting, but also to look after his khoonte, and protect it from being destroyed by bullocks and grass cutters, or from being ploughed up clandestinely by the Zemindars themselves.

> The Kush Kurreea system again has its evils, as the planter never gets plant for the full amount of his advances, and hence often leads to his ruin.

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Soils.—Indigo delights in a fresh soil; new lands, of similar staple to others before cultivated, always surpass them in the amount and quality of their produce. Hence arises the superior productiveness of the lands annually overflowed by the Ganges, the earthy and saline deposits from which in effect renovate the soil. The further we recede from the influence of the inundation, the less adapted is the soil for the cultivation of indigo. The staple of the soil ought to be silicious, fertile, and deep. Mr. Ballard, writing on the indigo soils of Tirhoot, says that high “soomba,” or light soils, are generally preferred, being from their nature and level less exposed to the risk of rain or river inundation; but they are difficult to procure, and, moreover, require particular care in the preparation. Next in estimation is “doruss,” a nearly equal mixture of light earth and clay; a soil more retentive of moisture in a dry season than any other. “Muttyaur,” or heavy clay soils, are generally avoided, although in certain seasons, with mild showers of rain, they have been known to answer. The safest selection I should conceive to be an equal portion of soomba and doruss. In a country, however, interspersed with jheels and nullahs, it is difficult to form a cultivation without a considerable mixture of low lands, more or less, according to the situation of the Assamee’s fields. Great care should be taken, at all events, to guard against oosur lands, or such as abound with saltpetre; these can be most easily detected in the dry months. *Puchkatak*, that is, lands slightly touched with *oosur*, have been known to answer, as partaking more of the nature of *doruss* soil; but the crop is generally thin, although strong and branchy.There is another description of land that should be cautiously avoided. It goes by the name of *jaung*, and is a light soil, with a substratum of sand from six to twelve inches below the surface. The plant generally looks very fine in such fields till it gets a foot high, when the root touching the sand, and having no moisture to sustain it, either dies away altogether, or becomes so stunted and impoverished as to yield little or nothing in the cutting. Of the *daub* or *dearab* (alluvial) land, says Mr. Ballard, there is scarcely any in the district except what falls to the lot of my own factories, being situated on the banks of the Ganges and Great Gunduck. Of *bungur*, a stiff reddish clay soil, there is little in Tirhoot; it pervades the western provinces, and is best adapted for Assaroo sowings, which do not succeed in Tirhoot.*Preparation of the soil.*—The root of the indigo plant being fusiform, and extending to about a foot in length, requires the soil to be loosened thoroughly to that depth at least. Experience teaches that the fineness of the tilth to which the soil is reduced previously to the seed being committed to it, is one very influential

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operation for the obtaining a productive crop. Yet in some districts of Bengal, particularly about Furudpore, the sowing is performed without any previous ploughing. This is where the river, when receded, has left the soil and deposit so deep, that about October, or a little later, the seed being forcibly discharged from the sower's hand, buries itself, and requires no after covering by means of the rake or harrow.In Tirhoot they are indefatigable in this first step of the cultivation. Mr. Ballard says, that the preparation of indigo lands should commence in September, as soon as the cessation of the rains will permit; and as we do not rely on rain for our sowings (as is the custom in Bengal and elsewhere, and irrigation is never resorted to, from the heavy expense attending it), our principal aim is to preserve as much moisture in the fields as possible. They should receive, for this purpose, not less than eight ploughings, besides a thorough turning up with the spade, after the fourth ploughing, to clear the field from stubble, grass and weeds. It is absolutely indispensable to get all this done on our light soils, especially before the end of October, and have the land carefully harrowed down, so as to prevent the moisture escaping.Should there be heavy rains between the interval of preparing and sowing, it will be necessary to turn the fields up with either one or two ploughings, and harrow them down as before. If only a slight shower, running the harrow over them will be sufficient to break the crust formed on the surface, and which, if allowed to remain, would quickly exhaust the moisture. This, with the occasional use of the weeding-hook, is all that the lands will require till the time of sowing.—-("Transactions of the Agri.-Hort. Society of Calcutta," vol. ii., p. 22.)*Sowing*.—The time when the seed is committed to the soil varies in different parts of India, and, even in the same place, admits of being performed at two different seasons. The periods of sowing in Bengal are first immediately after the rains, from about the latter end of October. The rivers are then rapidly retiring within their beds, and as soon as the soft deposit of the year has drained itself into a consistency, though not solid enough to keep a man from sinking up to his knees in it, they begin to scatter the seed broadcast. This is continued until the ground has become too hard for the seed to bury itself; the plough is then used to loosen the crust, and the sowing continued to about the middle, or even the end of November, from which period the weather is considered too cold, until February. These autumnal sowings are called October sowings, from the month in which they generally commence. Much of the plant perishes during the months of December and January, and more again in the spring, unless there are early and moderate showers. The crop that remains is not so productive ordinarily in the vat, as that obtained from spring sowings, and some think the quality of the produce inferior. But there is no expense of cultivation, and the liabilities of the crop to failure are such a discouragement to cost and labor in rearing it, that the October sowing is followed by most planters who can obtain suitable land. The second period of sowing is the spring, with the first rains of March, or even the end of February. The land having been measured and placed under its slight course of tillage during the two or three preceding mouths, is sown broadcast as soon as the ground has been well moistened, or even in prospect of approaching rain. The quantity of seed used for this autumn sowing is generally more than what is considered requisite for spring sowing; six seers at the former and four at the latter season per biggah, in Bengal, is the quantity usually allowed.Some cultivators commence the autumn sowing as early as at the close of September, or as soon as the low lands are in a state to permit the operation after the inundation has subsided. This seed time may be said to continue until the end of December, and the crops from these sowings often yield an average produce, if the lands are not very low and wet. If they are, the sowing had better be delayed until January, or even February, for the crops from these latter sowings are usually the most productive, and the dye obtained from them the finest. The object for thus delaying the sowing is, that the young plants may have a more genial season for vegetation. Those who prefer sowing earlier, and yet are aware of the importance of saving the young plants as much as possible from the comparative low temperature of the season, sow some other crop with their indigo. Til, the country linseed, is good for this purpose in high lying soils. But I never knew an intermixture of crops that was not attended by inconveniences and injuries more than was compensated by the advantages gained.The success of sowings during March and April is very doubtful. It depends entirely upon the occurrence of rain, which in those months is proverbially uncertain. If the season should be sufficiently wet, the sowing may be performed in May; but a June sowing is very rarely remunerating. The rains setting in during the latter part of this month so promote the growth of weeds, that the young plants are choked and generally destroyed. The exceptions only occur in high lands, in unusually propitious seasons, and ought never to be relied upon except when the earlier sowings have failed. To protract the manufacturing season, some planters begin sowing upon low lying lands in the hot season, for the chance of a crop at the commencement of the rains; and they sow at the close of the rains with the hope of, as it were, stealing another in the next year. In the western provinces sowing necessarily occurs in the dry weather, usually in March and April, though occasionally either a little

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earlier or later.In Tirhoot the sowings commence about the latter end of February or the beginning of March, if by that time there is sufficient warmth in the atmosphere to ensure a healthy vegetation. Light soils are sown on one close ploughing; heavy soils on two, with from four to eight seers of seed, in proportion to the size of the biggah. After strewing the seed, the field should be harrowed down by two turns of the harrow, and then again by two turns more after the third day. In case of rain before the plant appears (which it ought to do on the sixth or seventh day), if a slight shower, the harrow should be used again; if very heavy, it were best to turn up the ground and re-sow. If rain fall after the appearance of the plant, and before it has got past four leaves, and attained sufficient strength to resist the hard crust before alluded to, immediate recourse must be had to drilling. In fact, the closest attention is required to watch the state of the young crop for a month at least after the sowings; if it yield the least, or assume a sickly appearance, drills are the only resource. These, if applied in time, in all March, for instance, or before the middle of April at latest, are generally successful, not only in restoring plants, but recovering such as may have become sickly from want or excess of moisture, or any other cause. In dry seasons they have been known to give a crop when broadcast sowings have failed. Each drill, with a good pair of bullocks, should do five biggahs a day. They are regulated to throw from three to four seers per biggah, but the quantity can be increased or diminished at pleasure. The natives do not employ them in their grain sowings, but commonly adopt a contrivance with their own plough for sowing in furrows, whenever their fields are deficient in moisture. The drill employed in Tirhoot resembles considerably the implement known by that name in England. It is found not only to effect a great saving of seed, ten seers being there sown broad-cost on a biggah of 57,600 feet square, and only seven seers by this drill; but also materially to improve the quality and regularity of the growth of the plant. Experience has demonstrated, that the more lateral room the plants have, the more abundant is their produce of leaves, in which the coloring matter chiefly resides. The seed employed should always be as new as possible, for though, if carefully preserved, it vegetates when one year old, and even when nearly two years old has produced a moderate crop, yet this has been under circumstances of an unusually favorable season and soil. The plants from old seed rarely attain a height of more than a foot before they wither and die. As frauds are very likely to be practised by giving old seed the glossiness and general appearance of new, great circumspection should be shown by the planter, who does not grow his own, in obtaining seed from known parties.Planters in the lower provinces are

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induced to use up-country seed, because, coming from a colder climate, it vegetates, and the plants ripen rapidly, so as to be harvested more certainly before the annual inundation, but they employ one-fourth more. Three seers per Bengal biggah are sufficient, if it is “Dassee” seed; but four is not too much if it is up-country seed. A Bengal biggah is only a third of the size of that of Tirhoot. If the weather is dry, the seed very often does not germinate until the occurrence of rain, and it has been known in a dry, light soil, to remain in the ground without injury for six weeks. If seasonable showers occur, the plants make their appearance in four days, or even less; and they must be watched, in order that they may be weeded on the earliest day that they are sufficiently established to allow the operation to be safely performed. In dry weather, it must not be done while they are very young, otherwise many of the seedlings will have their roots disturbed, and perish from the drought. However, not more than a fortnight should be allowed to pass, after the seedlings have appeared, before the weeds are carefully removed, and this clearing should be frequently repeated until the plants so overshadow the ground that they of themselves keep back the advance of the weeds. The first weeding is best performed immediately after a shower of rain.Irrigation is rarely adopted for the indigo crops in the lower provinces of Bengal, unless they happen to be grown in some situation very favorable to the operation, such as the bank of a river. It is much more attended to in the western provinces, and in Oude, the water being obtained from wells, which are dug in nearly every cultivated plot. In Oude, Mr. Ballard says that a biggah of land employs three persons to irrigate it, and occupies never less than six days. The ryot, or cultivator, requires for the work a pair of bullocks, which cost him at least 32s., a bucket made of a white bullock hide, at 2s., and a rope for 2s. more, both of which do not last him above a year. He never pays less than 8s. for the rent of a biggah of land near a well.In Bengal the plant requires three months to attain its highest state of perfection for manufacturing, but is often cut, from necessity, within half that time; for the approach of the river compels the premature removal of the crop, unless, indeed, its growth has been so retarded that it would not pay the expense of working. Most indigo factories have consequently to begin in June, or early in July, whenever they may have effected their spring sowings, and the labors of the season are commonly terminated by the middle or end of August.When the plants begin to flower is considered the best time for cutting them, and this is just what the botanist would have suggested, because then the proper sap of all plants is most abundant, and most rich in their several peculiar secretions. A vividly green, abundant and healthy foliage,

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downy at the back, is the surest intimation of the plants being rich in indigo. Plants that are ready for cutting in July and August, are usually the most productive.In the western provinces from sixteen to twenty maunds of plant is considered a good produce per biggah. In the upper provinces the produce of the best crop, which is sown directly the rains commence, is not more then ten maunds per biggah. The factory maund is equal to about seventy-eight pounds. One thousand maunds of plant are considered as producing quite an average quantity of indigo if this amounts to four maunds. Adopting another mode of estimate, Mr. Ballard says, that in Bengal an average crop may he considered to be from ten to twelve bundles, over an extensive cultivation, in a good season, from each Bengal biggah; the sheaf or bundle being measured by a six-feet cord or chain. Speaking of the produce in Tirhoot, the same gentleman says the “luggie,” or measuring rod, varies throughout the district. The common Tirhoot biggah, is, I believe, equal to two-and-a-half or three Bengal biggahs (about an English acre). Its produce varies according to the size of the luggie, the fertility of the soil, and accidents of season; eight to ten hackery loads, however, is generally considered a good average return. South and east of Tirhoot, one hundred maunds from six hundred biggahs, including “khoonti,” or a second cutting, is reckoned a successful result. In another part of the district, including Sarun, where the “luggie” is larger, the average produce is about one-third better. As we measure our plant on the ground (he adds), the bundle system is unknown here; but, I believe, forty-five or fifty Tirhoot hackery loads of plants (estimated to yield a maund of dry indigo), will be found equal to two hundred Bengal bundles.—("Trans. Agri. Hort. Soc., vol. ii. p. 23.”)In Oude the *jamowah*, or crop sown in May, yields on an average twenty maunds, or say thirteen bundles, per biggah (160 feet square). The “assaroo,” or rain sowings, producing a very inferior plant, the average return is not more than three maunds, or two bundles. The “khoonti,” or crop of the next year from the same plants, averages fifteen maunds, or ten bundles per biggah.In Central and Western India, the plants are allowed to produce the second and even the third year, according to some statements; but in Bengal the same stocks are rarely suffered to yield a second crop: being nearly all on lands that are under water in the height of the inundation, the stock is rotted in the ground. Mr. Ballard, speaking of the duration of the plant, says that, as for three years’ plant and “khoonti,” it is a mere chimera, like the many others with which the planters have hitherto deluded themselves, and which it only requires a little reflection to overthrow. A biggah may be cut here and there, on an extensive cultivation, but it can never

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be relied upon as forming a part of the cultivation.The uncertainty of the indigo crop has been already noticed, and is, indeed, as proverbial as that from the hop plant in England. In Bengal the crop is particularly subject to be destroyed by the annual inundation of the river, if it occurs earlier than usual. A storm of wind, accompanied by rain and hail, as completely ruins the crop as if devoured by the locust; neither from this latter scourge is the crop exempt.This proneness to injury extends throughout its growth. The seedlings are liable to be destroyed by an insect closely resembling the turnip-fly, as well as by the frog. Caterpillars feed upon the leaves of older plants, and the white ant destroys them by consuming their roots. To these destructive visitations are to be added the more than ordinary liability of the plant to injury, not merely from atmospheric commotions, but even from apparently less inimical visitations. Thus not only do storms of wind, heavy rains, and hail, destroy the indigo planter’s prospects, but even sunshine, if it pours out fervently after showers of rain, is apt, as it is properly termed, to *scorch* the plants; and if it occurs during the first month of their growth, is most injurious to their future advance. The reason of this effect appears to be the violent change from a state of imbibing to a rapid transpiration of moisture. No human invention or foresight can preserve the crop from the atmospheric visitations. To destroy and drive away the little coleopterous insects which attack the seedlings, it would be a successful method to spread dry grass, &c., over the surface intended to be cultivated, and to burn the litter immediately before the sowing. The heat and smoke produced has been found perfectly efficacious against the turnip-fly in England. To destroy the caterpillar, slacked lime dusted over the leaves, while the dew is upon them, is an effectual application. The white ants may be driven away or destroyed by frequent hoeings, which is the best preventive of the scorching, for hoeing preserves the soil in an equable and fitting state of moisture.The great supply of seed for Bengal cultivation is obtained from the western provinces, and forms an article of trade of no inconsiderable magnitude. The stubble in the low lands of Bengal is generally submerged before it has time to throw out fresh shoots, on which the blossom and subsequent seed-pod are formed. There are, however, some high tracts reserved for that purpose, and on these the plant is found well in flower in September, and the seed fit to gather in November or early in December.

Two methods are pursued to extract the indigo from the plant; the first effects it by fermentation of the fresh leaves and stems; the second, by maceration of the dried leaves; the latter process being most advantageous. They are thus described by Dr. Ure, in his “Dictionary of Arts and Manufactures:”—

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1. *From the recent leaves.*—In the indigo factories of Bengal, there are two large stone-built cisterns, the bottom of the first being nearly upon a level with the top of the second, in order to allow the liquid contents to be run out of the one into the other. The uppermost is called the fermenting vat, or the steeper; its area is twenty feet square, and its depth three feet; the lowermost, called the beater or beating vat, is as broad as the other, but one-third longer. The cuttings of the plant, as they come from the field, are stratified in the steeper, till this be filled within five or six inches of its brim. In order that the plant, during its fermentation, may not swell and rise out of the vat, beams of wood and twigs of bamboo are braced tight over the surface of the plants, after which water is pumped upon them till it stands within three or four inches of the edge of the vessel. An active fermentation speedily commences, which is completed within fourteen or fifteen hours; a little longer or shorter, according to the temperature of the air, the prevailing winds, the quality of the water, and the ripeness of the plants. Nine or ten hours after the immersion of the plant, the condition of the vat must be examined; frothy bubbles appear, which rise like little pyramids, are at first of a white colour, but soon become grey, blue, and then deep purple red. The fermentation is at this time violent, the fluid is in constant commotion, apparently boiling, innumerable bubbles mount to the surface, and a copper colored dense scum covers the whole. As long as the liquor is agitated, the fermentation must not be disturbed, but when it becomes more tranquil, the liquor is to be drawn off into the lower cistern. It is of the utmost consequence not to push the fermentation too far, because the quality of the whole indigo is deteriorated; but rather to cut it short, in which case there is, indeed, a loss of weight, but the article is better. The liquor possesses now a glistening yellow color, which, when the indigo precipitates, changes to green. The average temperature of the liquor is commonly 85 deg. Fahr.; its specific gravity at the surface is 1.0015; and at the bottom 1.003.As soon as the liquor has been run into the lower cistern, ten men are set to work to beat it with oars, or shovels four feet long, called *busquets*. Paddle wheels have also been employed for the same purpose. Meanwhile two other laborers clear away the compressing beams and bamboos from the surface of the upper vat, remove the exhausted plant, set it to dry for fuel, clean out the vessel, and stratify fresh plants in it. The fermented plant appears still green, but it has lost three-fourths of its bulk in the process, or from twelve to fourteen per cent. of its weight, chiefly water and extractive matter.The liquor in the lower vat must be strongly beaten for an hour and a half, when the

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indigo begins to agglomerate in flocks, and to precipitate. This is the moment for judging whether there has been any error committed in the fermentation, which must be corrected by the operation of beating. If the fermentation has been defective, much froth rises in the beating, which must be allayed with a little oil, and then a reddish tinge appears. If large round granulations are formed, the beating is continued, in order to see if they will grow smaller. If they become as small as fine sand, and if the water clears up, the indigo is allowed quietly to subside. Should the vat have been over-fermented, a thick fat-looking crust covers the liquor, which does not disappear by the introduction of a flask of oil. In such a case the beating must be moderated. Whenever the granulations become round, and begin to subside, and the liquor clears up, the beating must be discontinued. The froth or scum diffuses itself spontaneously into separate minute particles, that move about the surface of the liquor, which are marks of an excessive fermentation. On the other hand, a rightly fermented vat is easy to work; the froth, though abundant, vanishes whenever the granulations make their appearance. The color of the liquor, when drawn out of the steeper into the beater, is bright green; but as soon as the agglomerations of the indigo commence, it assumes the color of Madeira wine; and speedily afterwards, in the course of beating, a small round grain is formed, which, on separating, makes the water transparent, and falls down, when all the turbidity and froth vanish.The object of the beating is three-fold; first, it tends to disengage a great quantity of carbonic acid present in the liquor; secondly, to give the newly-developed indigo its requisite dose of oxygen by the most extensive exposure of its particles to the atmosphere; thirdly, to agglomerate the indigo in distinct flocks or granulations. In order to hasten the precipitation, lime water is occasionally added to the fermented liquor in the progress of beating, but it is not indispensable, and has been supposed capable of deteriorating the indigo. In the front of the beater a beam is fixed upright, in which three or more holes are pierced, a few inches in diameter. These are closed with plugs during the beating, but two or three hours after it, as the indigo subsides, the upper plug is withdrawn to run off the supernatant liquor, and then the lower plugs in succession. The state of this liquor being examined, affords an indication of the success of both the processes. When the whole liquor is run off, a laborer enters the vat, sweeps all the precipitate into one corner, and enters the thinner part into a spout which leads into a cistern, alongside of a boiler, twenty feet long, three feet wide, and three feet deep. When all this liquor is once collected, it is pumped through a bag, for retaining the impurities, into the boiler, and heated to ebullition. The froth soon subsides, and shows an oily looking

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film on the liquor. The indigo is by this process not only freed from the yellow extractive matter, but is enriched in the intensity of its color, and increased in weight. From the boiler the mixture is run, after two or three hours, into a general receiver called the *dripping vat*, or table, which, for a factory of twelve pairs of preparation vats, is twenty feet long, ten feet wide, and three feet deep, having a false bottom two feet under the top edge. This cistern stands in a basin of masonry (made water-tight with Chunam, hydraulic cement), the bottom of which slopes to one end, in order to facilitate the drainage. A thick woollen web is stretched along the bottom of the inner vessel, to act as a filter. As long as the liquor passes through turbid, it is pumped back into the receiver; whenever it runs clear, the receiver is covered with another piece of cloth to exclude the dust, and allowed to drain at its leisure. Next morning the drained magma is put into a strong bag, and squeezed in a press. The indigo is then carefully taken out of the bag, and cut with a brass wire into bits, about three inches cube, which are dried in an airy house, upon shelves of wicker work. During the drying a whitish efflorescence comes upon the pieces, which must be carefully removed with a brush. In some places, particularly on the coast of Coromandel, the dried indigo lumps are allowed to effloresce in a cask for some time, and when they become hard they are wiped and packed for exportation.2. *Indigo from dried leaves.*—The ripe plant being cropped, is to be dried in sunshine from nine o'clock in the morning till four in the afternoon, during two days, and threshed to separate the stems from the leaves, which are then stored up in magazines till a sufficient quantity he collected for manufacturing operations. The newly dried leaves must be free from spots, and friable between the fingers. When kept dry, the leaves undergo, in the course of four weeks, a material change, their beautiful green tint turning into a pale blue-grey, previous to which the leaves afford no indigo by maceration in water, but subsequently a large quantity. Afterwards the product becomes less considerable.The following process is pursued to extract indigo from the dried leaves:—They are infused in the steeping vat with six times their bulk of water, and allowed to macerate for two hours, with continual stirring, till all the floating leaves sink. The fine green liquor is then drawn off into the beater vat, for if it stood longer in the steeper, some of the indigo would settle among the leaves and be lost. Hot water, as employed by some manufacturers, is not necessary. The process with dry leaves possesses this advantage, that a provision of the plant may be made at the most suitable times, independently of the vicissitudes of the weather, and the indigo may be uniformly made; and, moreover, that the fermentation of the fresh leaves, often capricious in its course, is superseded by a much shorter period of simple maceration.

PRODUCTION OF INDIGO IN INDIA.

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maunds.

1840 120,000 1841 162,318 1842 79,000 1843 143,207 1844 127,862 1845 127,862 1846 101,328 1847 110,000 1848 126,565 1849 126,000

Average of the ten years 126,744 maunds.

The yield from the different districts in 1849, was nearly as follows:—

maunds.
Bengal 84,500
Tirhoot 24,500
Benares 9,500
Oude 6,500

125,000

In 1790 the general object of cultivation in Mauritius was indigo, of which from four to five crops a year were procured. One person sent to Europe 30,000 lbs., in 1789, of very superior quality.

CEYLON.—Indigo, though indigenous in Ceylon, is still imported from the adjoining continent, but its growth in this island would be subject to none of the vicissitudes of climate, that in the course of a single night have devastated the most extensive plantations in Bengal, and annihilated the hopes and calculations of the planter at a time when they had attained all the luxuriance of approaching maturity.

The district of Tangalle, in the southern province, is the best adapted to the culture and manufacture of indigo for various reasons, such as the abundance of the indigenous varieties of the plant, the similarity of the climate to that of the coast of Coromandel, where the best indigo is produced; facility of transport by water to either of the ports of export, Galle or Colombo, during the south-east, or to Trincomalee by the south-west monsoon; every necessary material is at hand for building a first rate indigo factory, including drying yards, leaf godowns (stores), steeping vats and presses, except roof and floor tiles—which may be obtained in any quantity from Colombo, during the south-west monsoon, at a moderate rate, compared with their cost at home.

In 1817 an offer was made to the Grovernment to introduce the cultivation of indigo, on condition of a free grant of the land required for the purpose and freedom from taxation for thirty years, after which the usual tax was to be levied; and in case the cultivation were abandoned, the land was to revert to the Crown. But whether from the disturbed state of the colony at the time or from incredulity on the part of the Government, as to the capability of the colony in this respect, the application was unheeded. A subsequent proposal, emanating from a Swedish gentleman of great ability, skill and enterprise, was defeated by his death, although a company was on the point of formation to carry out the scheme. It would not be difficult, says Mr. Barrett, to select 500,000 acres, the property of the Crown, which at a comparatively small expenditure might be brought into a proper state of cultivation for the reception of indigo seed; for very little would be required to be done beyond clearing the land of weeds, burning the grass, and then lightly ploughing and levelling the ground; and whenever manure

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might be requisite, the fecula of the leaf affords one of the richest that could be employed. Ceylon produces two other plants from which a very valuable blue dye may be obtained by a similar process to that of making indigo. The Singhalese head men of the Tangalle district have long been anxious for the establishment of an indigo plantation there, and would readily take shares in a company established for that purpose. Indigo would seem to have been exported by the Dutch from Ceylon so late as 1794. The wild varieties of indigo which grow on the sea-shore are used by the dobies (*washermen*).

Indigo grows in a wild state in Siam, and all the dye used in the country is manufactured from these plants. The extensive low grounds are admirably suited for the cultivation of this plant.

A large quantity is raised in Manila, but I have no full details of the cultivation in the Philippines. However, in the first six months of 1843, 1,039 piculs of indigo were shipped to Europe, and about 650 to other quarters—equal in all to about 226,000 lbs. in the half year. In the year 1847 the exports of indigo were 30,631 arrobas, equal to about 7,658 cwt.; in 1850 the total exports from Manila were 4,225 quintals.

JAVA.—The cultivation of indigo was introduced into Java in the time of the company. It was so much neglected during the administration of Governor Daendels, that the exportation ceased. It however revived subsequently, and in 1823 the exports were close upon 17,000 lbs. In 1826 it had risen to 46,000 lbs. In the single province of Westbaglen, about 60 square miles in extent, 86 indigo factories were established in the course of seven or eight years. In 1839, the exports of this dye-stuff from Java were 588,764 kilogrammes, valued at 71/2 million francs.

It has been found by experience that a good soil is essentially necessary for the plant, and the indigo transplanted from elevated grounds to the rice fields succeeds better and yields more coloring matter than when raised direct on the spot from the seed. The residencies of Cheribon, Baglen and Madura, are those in which the crop succeeds best. From being so exhausting a crop, and finding it prejudicial to their rice grounds, they are gradually abandoning indigo culture in Java, and about two-thirds of the indigo plantations have within the, last year or two been replaced with sugar.

The value of the Java indigo is set down at 250 rupees (L25) per maund. If this be the average price, and it cannot be manufactured lower, Bengal has little to fear from Javanese competition. The product of indigo rose from 276 maunds in 1825, to 28,000 in 1842, and the quantity sold by the Dutch Trading Company in the last-named year was 10,500 chests, of about the same dimensions as those usually exported from Calcutta.

Some further statistics of the culture in Java are shown in the following returns of the quantity exported:—

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lbs.	
1830	22,063
1835	535,753
1839	595,818
1841	913,693
1843	1,890,429
1851	769,580
1852	838,288

The produce in 1848 was 1,151,368 lbs.

	1840.	1841.
Residencies in which this culture is introduced	9	10
Number of factories	728	728
Families occupied with this culture	197,085	192,159
Extent of fields where the cutting has been made in *bahas* of 71 decametres	40,844	38,829
Quantity of *bahus* planted before the gathering	317	538
Quantity of indigo crop in pounds	2,032,097	1,663,427
" average pounds per *bahu*	493/4	43

The extent of fields destined for the crop of 1842 was 37,970 bahus, and the amount of the crop was calculated by approximation at 1,862,000.

The gradual increase of the export in the eighteen years ending 1842, is shown as follows:—

Maunds.	
1825	76
1826	126
1827	109
1828	310
1829	600
1830	480
1831	563
1832	2,213
1833	2,861
1834	3,310
1835	7,023
1836	5,365

1837	10,822
1838	9,788
1839	15,680
1840	27,946
1841	24,044
1842	28,000

Total imports of indigo into the United Kingdom, and quantity retained for home consumption:—

	Imports.	Home consumption.
	cwts.	cwts.
1848	59,127	9,032
1849	81,449	12,270
1850	70,482	16,374
1851	89,994	27,947
1852	83,565	16,381

IMPORTS OF INDIGO.

	East Indies.	Mexico and the ports of South America.
	lbs.	lbs.
1831	6,996,062	------
1832	6,196,080	66,363
1833	6,315,529	125,264
1834	3,595,697	64,638
1835	3,861,853	88,306
1836	7,218,991	198,003
1837	5,706,896	365,091
1838	6,578,352	142,739
1839	4,651,542	363,148
1840	6,940,192	124,766
1841	7,451,653	247,031
1842	8,931,112	155,003
1843	6,319,294	130,836

Entered for home consumption about two millions and a half pounds annually. (” Parl. Returns No. 656, September 1843, and 426, September 1844.”)

The consumption of indigo in Europe and North America in round numbers, estimated from authentic sources, is thus set down by Mr. Macculloch in 1849:—

chests.
In Great Britain for home consumption 9,820
" France total for ditto 10,400
" American ports from London and Liverpool 2,500
" " Calcutta 700
" " Holland, &c 400
Other European countries export from London and Liverpool. 21,530
" " Holland 4,270
" " Calcutta 120
" " France 300

50,040

MADDER.

This substance, which is so extensively used in dyeing red, is the product of the long slender roots of the *Rubia tinctorum*, a plant of which there are several varieties. Our principal supplies of this important article of commerce are obtained from Holland, Belgium, France, Turkey, Spain, and the Balearic Isles, the Italian States, India, and Ceylon.

The plant is generally raised from seed, and requires three years to come to maturity. It is, however, often pulled in eighteen months without injury to the quality; the quantity only is smaller. A rich soil is necessary for its successful cultivation, and when the soil is impregnated with alkaline matter, the root acquires a red color; in other cases it is yellow. The latter is preferred in England, from the long habit of using Dutch madder, which is of this color, but in France the red sells at two francs per cwt. higher, being used for the Turkey-red dye. Madder does not deteriorate by keeping, provided it be kept dry. It contains three volatile coloring matters, madder purple, orange, and red. The latter is in the form of crystals, having a fine orange red color, and called Alizaine. This is the substance which yields the Turkey-red dye. The chay root is employed in the East Indies as a substitute for madder, and so is the root of *Morinda citrifolia*, under the name of Sooranjee.

Turkey madder roots realise about 30s. per cwt. About 1,100 tons are annually shipped from Naples, worth about L30 per ton.

Madder has become an article of great request, on account of the fine scarlet color produced from its roots, and is so essential to dyers and calico printers that without it they cannot carry on their manufactures. It is cultivated extensively in Holland, from whence it is imported in large quantities into both England and France, though it is cultivated to some extent in both countries. It has also been raised as a soiling crop, but the coloring matter is of so penetrating and subtile a character, that the flesh, milk, and even the bones of animals fed upon it are said to be tinged to a considerable degree with it. The soils best adapted, and which should be selected for its cultivation, are dry, fertile, and deep sandy

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loams; the roots are long and fibrous, and descend to a depth of from two to three feet. It may be propagated by seed, which, by some, is thought the best method, but the more usual mode is by the division of, and transplanting, the roots. The ground should be thoroughly and deeply pulverised, clean, and well-manured for the preceding crop, that the manure may be thoroughly rotted and incorporated with the soil: in April or May the suckers will be fit for taking from the older plantations—those of two or three years producing the best. The sets should have roots four or five inches long. Mark out rows two feet apart, with a line, and set the plant with a dibble, one foot apart in the rows. The roots should be dipped in a puddle of fine rich earth and water, beaten to the consistence of cream, previous to planting; let the crown of the plant be clearly over ground, and secure the earth well around the root, to keep out drought. The plantation requires nothing more but to be kept perfectly clean and well-hoed during the summer months; and after the top decays in the autumn, to be earthed up by the plough for the winter, each year, till the plants are three years old, when they are of the proper size and age for lifting, which must be done by trenching the land two feet deep—several hands accompanying the digger to pick out the roots, which must be thoroughly cleaned and dried on a kiln till they are so brittle as to break across, when they are fit to be packed in bags, and sold to the dye-stuff manufacturers who grind and reduce them to powder for use. The produce is variable; usually from eight to twenty cwt. per acre, but as much as 3,000 to 6,000 lbs. is frequently obtained. The forage amounts to about 15,000 lbs. the first year, and 7,500 lbs. the second year. In a new and good soil manure may be dispensed with for the first crop. Some cultivators interline and grow other crops between the rows, but the best cultivators state that such a practice is objectionable. The breadth of land under this crop in England is much reduced, in consequence of the reduction in price from the competition of the Dutch growers.

Madder is extensively grown on the central table land of Afghanistan, forming one of the leading products of Beloochistan.; and, according to Mr. Pottinger, it sells in the Kelat Bazaar at about 10 lbs. for 2s. The cultivation there pursued is as follows:—The ground is repeatedly ploughed, and laid out finally in small trenches, in which the seed is sown, covered slightly with earth, and then the whole is flooded. Whilst thus irrigated, the trenches are filled with a mixture of rich manure and earth. The plants appear in about ten days, and attain a height of three or four feet during the first summer. They are cut down in September and used as fodder for cattle. Subsequently, and until spring arrives, the ground is manured and repeatedly flooded. During the second year's growth, the plants which are intended to produce seed are set apart, but the stems of the remainder are cut every four or six weeks, in order to increase the size and goodness of the roots.

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Madder is said to repay a nett profit of 200 dollars to the acre, when properly managed. It produced on the farm of a gentleman, who has devoted some attention to this product in Ohio, at the rate of 2,000 lbs. per acre, and it may be made to produce 3,000 lbs., which is a greater yield than the average crops of Germany and Holland. Nine acres were planted by another person in the United States, in 1839, which he harvested in 1842. The labor required is said to be from 80 to 100 days work per acre.

In the third year the stems are pruned as in the two preceding, and in September the roots are dug up. The roots are fusiform and thin, without any ramifications, and usually from three to five feet long. As soon as raised, they are immediately cut into small pieces and dried, and are then merchantable.

Mr. Joseph Swift, an enterprising American farmer, of Erie county, Ohio, who occupies about 400 acres of choice land, mostly alluvial, in the valley of the Vermilion river, seven miles from Lake Erie, has detailed his practice in the “New Genesee Farmer” (an agricultural periodical), for March, 1843. His directions must be understood as intended for those who wish to cultivate only a few acres, and cannot afford much outlay of capital. Those who desire to engage in the business on an extensive scale, would need to adopt a somewhat different practice:—

Soil and preparation.—” The soil should be a deep, rich, sandy loam, free from weeds, roots, stones, &c., containing a good portion of vegetable earth. Alluvial “bottom” land is the most suitable, but it must not be wet. If old upland is used, it should receive a heavy coating of vegetable earth, from decayed wood and leaves. The land should be ploughed very deep in the fall, and early in the spring apply about one hundred loads of well-rotted manure per acre, spread evenly, and ploughed in deeply; then harrow till quite fine and free from lumps. Next plough the land into beds four feet wide, leaving alleys between three feet wide, then harrow the beds with a fine light harrow, or rake them by hand, so as to leave them smooth and even with the alleys; they are then ready for planting.*Preparing sets and planting.*—Madder sets or seed roots are best selected when the crop is dug in the fall. The horizontal uppermost roots (with eyes) are the kind to be used; these should be separated from the bottom roots, and buried in sand in a cellar or pit. If not done in the fall, the sets may be dug early in the spring, before they begin to sprout. They should be cut or broken into pieces, containing from two to five eyes each; *i.e.*, three to four inches long. The time for planting is as early in the spring as the ground can be got in good order, and severe frosts are over, which in this climate (America) is usually about the middle of April. With the beds prepared as directed, stretch a line lengthwise the bed, and with the corner of

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a hoe make a drill two inches deep along each edge and down the middle, so as to give three rows to each bed, about two feet apart. Into these drills drop the sets, ten inches apart, covering them two inches deep. Eight or ten bushels of sets are requisite for an acre.*After culture.*—As soon as the madder plants can be seen, the ground should be carefully hoed, so as to destroy the weeds and not injure the plants; and the hoeing and weeding must be repeated as often as weeds make their appearance. If any of the sets have failed to grow, the vacancies should be filled by talking up parts of the strongest roots and transplanting them; this is best done in June. As soon as the madder plants are ten or twelve inches high, the tops are to be bent down on the surface of the ground, and all except the tip end covered with earth, shovelled from the middle of the alleys. Bend the shoots outward and inward in every direction, so as in time to fill all the vacant space on the beds, and about one foot on each side. After the first time covering, repeat the weeding when necessary, and run a single horse plough through the alleys several times to keep the earth clean and mellow. As soon as the plants again become ten or twelve inches high, bend down and cover them as before, repeating the operation as often as necessary, which is commonly three times the first season. The last time may be as late as September, or later if no frosts occur. By covering the tops in this manner, they change to roots, and the design is to fill the ground as full of roots as possible. When the vacant spaces are all full, there is but little chance for weeds to grow; but all that appear must be pulled out.*The second year.*—-Keep the beds free from weeds; plough the alleys and cover the tops, as before directed, two or three times during the season. The alleys will now form deep and narrow ditches, and if it becomes difficult to obtain good earth for covering the tops, that operation may be omitted after the second time this season. Care should be taken, when covering the tops, to keep the edges of the beds as high as the middle; otherwise the water from heavy showers will run off, and the crop suffer from drought.*The third year.*—Very little labor or attention is required. They will now cover the whole ground. If any weeds are seen, they must be pulled out; otherwise their roots will cause trouble when harvesting the madder. The crop is sometimes dug the third year; and if the soil and cultivation have been good, and the seasons warm and favorable, the madder will be of a good quality; but generally it is much better in quality, and more in quantity, when left until the fourth year.*Digging and harvesting.*—This should be done between the 20th of August and the 20th of September. Take a sharp shovel or shovels, and cut off and remove the tops with

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half an inch of the surface of the earth; then take a plough of the largest size, with a sharp coulter and a double team, and plough a furrow outward, beam-deep, around the edge of the bed; stir the earth with forks, and carefully pick out all the roots, removing the earth from the bottom of the furrow; then plough another furrow beam-deep, as before, and pick over and remove the earth in the same manner; thus proceeding until the whole is completed.*Washing and drying.*—As soon as possible after digging, take the roots to some running stream to be washed. If there is no running stream convenient, it can be done at a pump. Take large round sieves, two-and-a-half or three feet in diameter, with the wire about as fine as wheat sieves; or if these cannot be had, get from a hardware store sufficient screen wire of the right fineness, and make frames or boxes, two-and-a-half feet long and the width of the, wire, on the bottom of which nail the wire. In these sieves or boxes, put half a bushel of roots at a time, and stir them about in the water, pulling the branches apart so as to wash them clean; then, having a platform at hand, lay them onto dry. (To make the platform, take two or three common boards, so as to be about four feet in width, and nail deals across the under side). On these spread the roots about two inches thick for drying in the sun. Carry the platforms to a convenient place, not far from the house, and place them side by side, in rows east and west, and with their ends north and south, leaving room to walk between the rows. Elevate the south ends of the platforms about eighteen inches, and the north ends about six inches from the ground, putting poles or sticks to support them—this will greatly facilitate drying. After the second or third day's drying, the madder must be protected from the dews at night, and from rain, by placing the platforms one upon another to a convenient height, and covering the uppermost one with board. Spread them out again in the morning, or as soon as danger is over. Five or six days of ordinarily fine weather will dry the madder sufficiently, when it may be put away till it is convenient to kiln-dry and grind it.*Kiln-drying,*—The size and mode of constructing the kiln may be varied to suit circumstances. The following is a very cheap plan, and sufficient to dry one ton of roots at a time. Place four strong posts in the ground, twelve feet apart one way, and eighteen the other; the front two fourteen feet high, and the other eighteen; put girts across the bottom, middle, and top, and nail boards perpendicularly on the outside as for a common barn. The boards must be well seasoned, and all cracks or holes should be plastered or otherwise stopped up. Make a shed-roof of common boards. In the inside put upright standards about five feet apart, with cross-pieces to support the scaffolding. The first cross-pieces to be four feet from the floor;

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the next two feet higher, and so on to the top. On these cross-pieces lay small poles, about six feet long and two inches thick, four or fire inches apart. On these scaffolds the madder is to be spread nine inches thick. A floor is laid at the bottom to keep all dry and clean. When the kiln is filled, take six or eight small kettles or hand-furnaces, and place them four or five feet apart on the floor (first securing it from fire with bricks or stones), and make fires in them with charcoal, being careful not to make any of the fires so large as to scorch the madder over them. A person must be in constant attendance to watch and replenish the fires. The heat will ascend through the whole, and in ten or twelve hours it will all be sufficiently dried, which is known by its becoming brittle like pipe stems.*Breaking and grinding.*—Immediately after being dried, the madder must be taken to the barn and threshed with flails, or broken by machinery (a mill might easily be constructed for this purpose), so that it will feed in a common grist-mill. If it is not broken and ground immediately, it will gather dampness so as to prevent its grinding freely. Any common grist-mill can grind madder properly. When ground finely it is fit for use, and may be packed in barrels like flour for market.*Amount and value of product, &c.*—Mr. Swift measured off a part of his ground, and carefully weighed the product when dried, which he found to be over two thousand pounds per acre, notwithstanding the seasons were mostly dry and unfavorable. With his present knowledge of the business, he is confident that he can obtain at least three thousand pounds per acre, which is said to be more than is often obtained in Germany. The whole amount of labor he estimates at from eighty to one hundred days' work per acre. The value of the crop, at the usual wholesale price (about fifteen cents per pound), from three to four hundred dollars. In foreign countries it is customary to make several qualities of the madder, which is done by sorting the roots; but as only one quality is required for the western market, Mr. Swift makes but one, and that is found superior to most of the imported, and finds a ready sale.

Madder is produced in Middle Egypt to some extent, for the consumption of the country, principally for dyeing the *tarbouche* or skull caps which are universally worn. Its culture was introduced in 1825. In 1833, 300 acres in Upper Egypt, and 500 in the Delta and the Kelyout, were devoted to madder roots.

New South Wales is eminently suited to the culture of this valuable root, and as the profits upon its cultivation are very large, I would strongly recommend it to the attention of agriculturists there. The article produces to France an annual sum of one million sterling; the price of the finest quality in the English market being L60 per ton. Its yield varies from L40 to L50 per acre, and the expenses upon its proper

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culture should not exceed one-half that amount. The colonists would find it to their interest to turn their attention to such articles as this, for which there is an extensive demand at home, instead of confining themselves exclusively to the commoner and bulkier products, which they export at a much less profit, and which when once the market is fully supplied, may fall to a price at which they cannot afford to sell.

The following is a calculation of the expenses generally supposed to attend a crop according to the mode of cultivation practised in Vaucluse:—

Rent per hectare (21/2 English acres), 3 years, at L s. d.
165 francs 19 17 6
Manure, 440 francs L17 12 6
Carriage of ditto, 132 francs 3 5 10
--------- 22 18 4

L42 15 10

These expenses may almost be dispensed with in our colonies, as the soil at Vaucluse has long been exhausted.

Two and a-half acres require 170 lbs. seed, at 21/2d. per pound,
which, with the labor afterwards bestowed, including the
cost of spade trenching, will be 30 0 0

L72 15 10

The average produce per hectare is 77 cwt., which, at L1 4s. 2d. per cwt. (the price on the spot), is L93. The price is now much lower, but still it is clear a most profitable return would be derived from the first crop, and a proportionably larger one afterwards.

A considerable portion of the madder roots, instead of being ground and exported in that form, as heretofore, is now exposed, after being invested with dilute sulphuric acid, to a boiling heat by means of steam, by which the coloring matter is considerably altered and improved in quality for some dyeing processes, while the quantity rendered soluble in water is greatly increased. The madder so prepared is known as “garancine,” and forms an important branch of manufacture in the south of France, which was well illustrated at the Great Exhibition in 1851, by a collection of specimens supplied by the Chamber of Commerce of Avignon. The spent madder, after being used in dyeing, is now also converted by Mr. H. Steiner, of Accrington, into a garancine (termed *garanceuse* by the French) by steaming it with sulphuric acid in the same manner as the fresh madder, and thus a considerable quantity of coloring matter is recovered and made available which was formerly thrown away in the spent madder. Both varieties of garancine give a more scarlety red than the unprepared madder, and also good chocolate and black, without soiling the white ground, but are not so well fitted, particularly the garancine of spent madder, for dyeing purples, lilacs, and pinks. The value of the garancine imported from France in 1848 was L59,554, and of that imported in 1851 L93,818. This preparation of ground madder is imported into Liverpool to the extent of from 500 to 600 tons annually from Marseilles, for the use of calico printers in the manufacturing districts. The price is L7 to L8 the ton.

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This important root is already cultivated to a considerable extent in Russia but not nearly in sufficient quantity to meet the local demand; so that large quantities are imported from Holland and elsewhere, every year.

The quantity of madder, madder-root, and garaneine annually imported into the United Kingdom is exceedingly large, over 15,000 tons, as is shown by a reference to the following figures:—

	Madder.	Madder roots.	Garancine.	Total.
	cwts.	cwts.	cwts.	cwts.
1848	81,261	139,463	5,955	276,679
1849	92,736	161,986	4,969	259,691
1850	100,248	161,613	5,845	267,706
1851	92,925	202,091	9,382	304,398
1852	84,385	179,813	——	——

We imported from France, duty free, the following:—

	Madder.	Official value.	Madder-root.	
	cwts.	L	cwts.	L
1848	54,084	122,851	25,068	70,749
1849	57,108	131,059	23,459	81,274
1850	54,559	123,628	13,693	55,263
1851	65,577	151,502	34,017	167,721

The price in the Liverpool market, in June 1853, for Bombay madder-roots was L1 18s. to L2 14s. the cwt.

INDIAN MADDER.—*Rubia cordifolia*, or *Munjestha*, a variety with white flowers, a native of Siberia, is cultivated largely in the East, particularly about Assam, Nepaul, Bombay, Scinde, Quitta, China, &c., for its dye-stuff, and is known as Munjeet. A small quantity is exported from China and India; about 338 Indian maunds were shipped from Calcutta in 1840, and 2,328 in 1841. It fetches in the London and Liverpool markets from 20s. to 25s. and 30s. per cwt., duty free; 405 tons were imported into Liverpool from Bombay and Calcutta, in 1849, and 525 tons in 1850, but none was imported in 1851 and 1852.

It was remarked by the Jury in 1851, at the Great Exhibition, that this is a valuable dye-stuff, and hitherto not so well appreciated as it deserves, for some of the colors dyed with it are quite as permanent as those dyed with madder, and even more brilliant. Its use however is gradually increasing, and it is unquestionably well worthy the attention of dyers.

LOGWOOD.—The logwood of commerce is the red heart wood, or duramen, of a fine lofty growing tree (*Haematroxylon Campechianum*), growing in Campeachy and the bay of Honduras, and which is also now common in the woods of Jamaica and St. Domingo. It is principally imported as a dye wood, cut into short lengths. We chip, grind, and pack it into casks and bags, ready for the dyers, hatters, and printers' use, who esteem it as affording the most durable deep red and black dyes. It is sometimes used in medicine as an astringent. That grown in Jamaica is least valued that of Honduras, Tobasco, and St. Domingo, fetches a somewhat higher price; but that imported from Campeachy direct, is the most esteemed. The annual imports into Liverpool are about 1,300 tons from Honduras, 100 from Tobasco, and 1,800 from Campeachy.

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It thrives best in a damp tenacious soil, with a small proportion of sand. It is imported in logs, which are afterwards chipped, and is of great commercial importance from its valuable dyeing properties. Old wood is preferred; it is so hard as almost to be indestructible by the atmosphere. The albumen is of a yellowish color, and is not imported. The bark and wood are slightly astringent. The imports of logwood into the United Kingdom, were 23,192 tons in 1848, 23,996 tons in 1849, and 34,090 tons in 1850, of which 3,484 tons were re-exported in 1848, and 2,307 tons in 1849. The imports in the past two years of 1852 and 1853, have averaged 20,000 tons, of which about 3,000 tons were re-exported. It is increasing in use, for in 1837, the quantity retained for home use was only 14,6771/2 tons. The price varies according to quality from L4 to L7 per ton.

We received from Honduras 5,401 tons in 1844; and 55,824 tons in 1845. From Montego Bay, Jamaica, 398 tons were shipped between January and July 1851.

FUSTIC.—This is the common name of a species of dye wood in extensive use, which is obtained from *Maclura tinctoria*, or *Broussonitia tinctoria*, Kunth, a large and handsome evergreen tree, growing in South America and the West Indies. The wood is extensively used as an ingredient in the dyeing of yellow, and is largely imported for that purpose. The quantity entered for home consumption in the United Kingdom was 1,731 tons in 1847, 1,653 in 1848, and 1,842 tons in 1849.

Ninety-one tons were shipped from Montego Bay, Jamaica, in the first six months of 1851.

QUERCITRON.——This bark furnishes a yellow dye, of which about 3,500 tons are annually imported in hogsheads of from half a ton to a ton. 296 tons were imported into Liverpool from Philadelphia in 1849, and 514 tons in 1850.

BRAZIL WOOD.—This very ponderous wood is obtained in Brazil from the *Caesalpina Braziliensis*, which yields a red or crimson dye, when united with alum or tartar, and is used by silk dyers. It is imported principally from Pernambuco, 1,200 quintals having been shipped to London in 1835, but about 500 tons, worth about L4 a ton, were imported from Costa Rica in 1845.

The tree is large, crooked, and knotty, and the bark is thick, and equals the third or fourth of its diameter.

The imports may be stated at about 600 tons annually, the average price being L50 per ton.

Brazil wood is found in the greatest abundance and of the best quality, in the Province of Pernambuco, but being a government monopoly it has been cut down in so improvident a manner, that it is now seldom seen within several leagues of the coast.

Among the Cuba dye woods is Copey *(Clusia rosea*, Linn).

Braziletto, obtained from *C. Crista*, is one of the cheapest and least esteemed of the red dye woods, imported from Jamaica and other West India islands to the extent of 150 tons per annum, fetching L6 to L8 per ton. 2,361 tons of Nicaragua wood were imported in 1848, 2,701 tons in 1849, and 6,130 tons in 1850.

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Spain exhibited various vegetable dyes obtained from cultivated and wild plants furnished by the Agricultural Board of Saragossa.

LICHENS.

The chief lichens employed in the manufacture of orchil and cudbear are the following: —

Angola weed (*Ramalina furfuracea*).

Mauritius weed (*Rocella fusiformis*), which comes also from Madagascar, Lima, and Valparaiso, and then bears the distinctive commercial name of the port of shipment.

Cape weed (*Rocella tinctoria*), from the Cape de Verd Islands.

Canary Moss (*Parmelia perlata*).

Tartareous Moss (*Parmelia tartarea*).

Pustulatus Moss (*Umbilicaria pustulata*).

Velvet Moss (*Gyrophora murina*).

The last three are imported from Sweden.

Of these lichens, the first, which is the richest in coloring matter, grows as a parasite upon trees; all the remainder upon rocks.

Rocella corallina, *Variolaris lactea* and *dealbata*, have been also resorted to.

About 130 tons of cudbear are imported annually from Sweden.

These lichens are found on rocks, on the sea coast. The modes, of treating them for the manufacture of the different dyes is the same in principle, though varying slightly in detail. They are carefully cleaned and ground into a pulp with water, an ammoniacal liquor is from time to time added, and the mass constantly stirred in order to expose it as much as possible to the air. Peculiar substances existing in these plants are, during this process, so changed by the combined action of the atmosphere, water, and ammonia, as to generate the coloring matter, which, when perfect, is pressed out, and gypsum, chalk, or other substances, are then added, so as to give it the desired consistency; these are then prepared for the market under the forms of cudbear or litmus.

HENNA (*Lawsonia inermis*), is an important dye-stuff, and the distilled water of the flowers is used as a perfume. The Mahomedan women in India use the shoots for dyeing their nails red, and the same practice prevails in Arabia. In these countries the manes and tails of the horses are stained red in the same manner. The *Genista tomentosa* yields red petals used in dyeing, and containing much tannic acid.

ORCHILLA WEED.—The fine purple color which the orchilla weed yields, is in use as an agent for coloring, staining, and dyeing. About 30,000 lbs. is obtained annually in the island of Teneriffe. 460 arrobas (or 115 cwt.) of orchilla were exported from the Canary Isles in 1833. In 1839, 6,494 cwts. paid duty, and 4,175 cwts. in 1840. The average imports of the three years ending with 1842, was 6,050 cwt. A little comes in from Barbary and the islands of the Archipelago.

Dr. W.L. Lindley, in a very interesting paper, read before the Botanical Society of London, in December, 1852, on the dyeing properties of the lichens, stated—

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The subject of the *colorific* and *coloring* principles of the lichen has, within the last few years, attracted a due share of that attention which, has been increasingly devoted to organic chemistry. Since 1830, Heeren, Kane, Schunck, Rochleder and Heldt, Knop, Stenhouse, Laurent and Gerhardt, have published valuable papers on these principles; but, here again, we have to regret the great discrepancy in the various results obtained, and there is therefore, here also, imperatively demanded re-investigation and correction before *any* of the results already published can he implicitly relied upon, and before we can have safe data from which to generalise. I have no doubt that a great proportion of the obscurity overhanging this subject depends on the circumstance that many of the chemists, who have devoted attention to the color-educts and products of the lichens, were not themselves botanists, and have therefore probably, in some cases at least, analysed species under erroneous names, and also because their investigations have comprehended a much too limited number of species.Their utility in the arts, and especially in dyeing—including the collection of a series of the commercial dye lichens, *i.e.*, those used by the manufacturers of London, &c., in the making of orchil, cudbear, litmus, and other lichen dyes. While investigating the dyeing properties of the lichens, I made experiments, with a view to test their colorific power, on as many species as I could obtain in sufficient quantity, to render it at all useful to operate on—that number, however, being very limited (between forty and fifty).Dr. Lindley adds, many parties may be able to aid his investigations, by furnishing information on their economic uses, and on their special applications in dyeing and other arts—(particularly on their employment, as dye agents, by the natives of Britain and other countries)—with specimens of the lichens so used, and their common names—specimens of fabrics dyed therewith—-notes of the processes employed for the elimination of the dyes, &c. Parties resident in, or travelling through our western Highlands and Islands, the northern Highlands, Ireland, Wales, Norway, Iceland, and similar countries, are most likely to be able to afford this description of information—many native lichens being still used by the peasantry of these countries to dye their homespun yarn, &c.He proceeded to treat—1. The vast importance of this humble tribe of plants in the grand economy of nature, as the pioneers and founders of *all* vegetation. 2. Their importance to man and the lower animals, as furnishing various articles of food. 3. Their importance in medicine, and especially in its past history, at home and abroad. 4. Their importance in the useful and fine arts, and especially in the art of dyeing. 5. Their affinities and analogies to other cryptogamic families, and to the Phanerogamia. 6. Their value as an element of the picturesque in nature; and, 7. Their typical significance.

He then adverted more especially to the subject of his communication, under the ten following heads:—

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I. The colors of the Thallus and apothecia of Lichens—their causes, and the circumstances which modify and alter them.

II. History of the application of their coloring matters to the art of dyeing.

III. Chemical nature and general properties of these coloring matters.

IV. Tests and processes for estimating qualitatively, and quantitatively the colorific powers of individual species—with their practical applications.

V. Processes of manufacture of the Lichen-dyes, on the large and small scale in different countries—with the principles on which they are founded.

VI. Nomenclature of the dye-Lichens, and of the Lichen-dyes.

VII. Botanical and commercial sources of the same.

VIII. Special applications of the Lichen-dyes in the arts.

IX. Commercial value of the dye-Lichens, and their products.

X. Geographical distribution of the dye-Lichens—with the effect of climate; situation, &c., on their colorific materials.

Of the four first sections of his paper, the following is a very short summary or synopsis:—

Under the first head, the author spoke of chlorophylle and various organic and inorganic substances, which enter into the formation of the colors of the thallus and apothecia of lichens, and of the modifications of these colors depending on various degrees of—1. Exposure to air and light. 2. Temperature. 3. Moisture, &c. 4. Atmospheric vicissitudes. 5. Season of the year. 6. Nature of the Gonidic reproduction (*i.e.*, gemmation). 7. Nature of habitat. 8. Organic decomposition. 9. Coalescence of parts, monstrosities, &c.Under the second section, he traced historically the manufacture of Lichen-dyes, and the native use of Lichens as dye agents, among different nations, from the times of Theophrastus, Dioscorides, and Pliny, down to the present day, sketching briefly the ancient end modern history of orchil, cudbear, and litmus, and specifying the native use of lichen-dyes in different, countries of Europe, Asia, and America. He alluded more particularly to their application to the dyeing of yarns, &c., by the Scotch Highlanders, under the name of "*Crottles*." "The process of the manufacture of the various crottles, generally consisted in macerating the powdered lichen for two or three weeks, in stale urine, exposing the mass freely to the air by repeated stirring, and adding lime, salt, alum, or argillaceous and other substances, either to heighten the color or impart consistence. To such an extent did this custom at one time prevail, that, in several of our northern counties each farm and cottage had its tank or barrel of putrefying urine, a homely but perfectly efficient mode of generating the necessary amount of ammonia. In the county of Aberdeen, in particular, every homestead

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had its reservoir of “Graith,"[53] and the “Lit-pig,"[54] which stood by every fireside, was as familiar an article of furniture in the cots of the peasantry, as the “cuttie-stool,” or the “meal girnel.” So lately as 1841 (and I presume the practice continues to the present day), Mr. Edmonston stated that, of four or five native dyes, used by the Shetlanders to color cloth and yarns, two at least were furnished by lichens, *viz*., a *brown dye* from *Parmelia saxatilis*, under the name of “Scrottyie,” and a *red* one from *Lecanora tartarea*, under that of “Korkalett.” It is very probable, however, that steam and free trade have gradually dispelled this good old custom, even in the remoter corners of our island; machinery-made articles being now readily supplied, at a rate so extraordinarily cheap, as to render it absolutely expensive (as to time, if not also as to money) to prepare colors, even by a process so simple and inexpensive as that just mentioned.”Under the third head, he examined, in a general way, the chemistry of the colorific and coloring matters of the lichens and the results to which it has led, avoiding as much as possible the technicalities inseparable from such a subject, and giving a short *vise* of the researches of Heeren, Kane, Rochleder, and Heldt, Stenhouse, Schunck, Laurent, and Gerhardt, and others. “Our untaught senses should undoubtedly lead us to expect the lichens, whose thallus exhibits the brightest tints, to yield the finest dyes, and these, too, of a color similar to that of the thallus, but experience teaches us that the beautiful reddish or purplish coloring-matters are producible in the greatest abundance by the very species from which we should least expect to derive any, *viz*., in those most devoid of external color. This, though at first sight very remarkable, is easily explicable, when we remember that, in most of the so-called dye-lichens, colorific principles exist in a colorless form, and only become converted into colored substances under a peculiar combination of circumstances.“Some lichens contain coloring matters, ready formed, and these exhibit themselves in the tint of the thallus of the plants, *e.g.* chrysophanic [or parietinic] acid in *Parmelia parietina*, and vulpinic acid in *Evernia vulpina*. In other species we find principles, which, while in the plant, and unacted on by chemical re-agents, are colorless, but which, when the lichens are exposed to the combined influence of atmospheric air, water, and ammonia, yield colored substances. This series of colored products is usually comprehended more for convenience sake than on account of chemical identity, under the generic term orceine.”The whole subject of the chemistry of these bodies is at present in a most unsatisfactory condition, demanding fresh investigation and research, in illustration of which, the author exhibited tables of the colorific and coloring principles, so far as they are at present known, showing their chemical formulae and the authority therefor, and various relative information. “It is highly probable that when the chemistry of the lichens has been more fully studied, and the whole subject of their color-educts and products better understood, we shall begin to reduce the present confused mass of complex substances, and find the same principles more extensively diffused through different lichen species.” Dr. L. entered somewhat minutely on the chemical reactions of the better known colorific and coloring principles, and their derivatives, so far at least as these throw any light on the production and transmutation of the red or purple colors extracted from what may be termed *par excellence*, the *dye-lichens*. After a few remarks on the chemical constitution of orchil and litmus, as given by Kane, Gelis, Pereira, and others, he discussed the subject of decolorisation of weak infusions of orchil and litmus by exclusion of atmospheric air, and by various deoxidising agents, and the different theories as to the causation of this phenomenon. “I have repeatedly had occasion to notice that, when weak infusions of these substances are excluded for some time from atmospheric air, in a bottle, with a tightly fitting cork, they gradually lose color, but rapidly regain it on re-exposure. It is curious that both orchil and litmus are what are called transient or false colors, *i.e.*, they slowly lose their bloom and tint by long exposure to the atmosphere; the coloring matter, therefore, appears to be decolorised both by exposure to, and exclusion from the air, phenomena apparently of very opposite characters. The cause of the latter phenomenon has never, so far as I am aware, been quite satisfactorily explained; but it has been variously supposed to be due:—

1. To the mere negation of oxygen.

2. To the development, in the liquids, of various substances, capable of exerting a decolorising influence on the coloring matter.

3. To deoxidation of the coloring matter by substances, which have a great tendency to become oxidised or peroxised; *e.g.* hydrogen, in the case of decolorisation by sulphuretted hydrogen, nascent hydrogen, and the protoxides of iron and tin, &c.4. To the fixation of an additional amount of hydrogen in a new colorless body, formed by the union of the sulphuretted hydrogen or other substances with the coloring matter of the liquid. This view is chiefly supported by Kane, who says, “that precisely as the coloring matters combine with water, to form different shades of red-colored bodies—with ammonia to produce a series of bodies, which are blue and purple—so they combined with sulphuretted hydrogen to form colorless compounds in solution, which, if solid, very probably would be white.” He supposes, in a word, that for every colored substance existing

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in orchil and litmus, there is a corresponding white one, producible by the action of sulphuretted hydrogen, &c.; and, in proof of this theory, he mentions having obtained from Azolitmine and Betaorceine colorless bodies, to which he gave the respective names of Leuco-litmine and Leuco-orceine.The author then gave a short summary of Dr. Westring's experiments on the dyeing powers of the Swedish lichens, which he found might be conveniently divided into four classes, according to the degree of heat employed in their maceration, *viz*.:—

1. Lichens, whose coloring matter was easily extractable by *cold* water alone.

2. Those which required for the elimination of their coloring matter, maceration in *tepid* water (*i.e.* below 258 degs. Swedish thermometer).

3. Those which required maceration in *warm* water (*i.e.*between 50 and 60 degs. Swedish thermometer).

4. Those requiring *boiling* water alone, or with the aid of solvents.

"It must be admitted that our knowledge of the true nature of the colorofic and coloring principles of the lichens is, as yet, very imperfect and confused, and one great cause of the dubity and obscurity overhanging the subject, is the fact that different analysts have arrived at most opposite results, even in the examination of the same species. For instance, in *Rocella tinctoria*, which has, of all the dye-Lichens, been most frequently selected for analytical investigation, on account of its important product orchil, the discrepancies between the results obtained are very striking. In it Heeren discovered his *Erythrine*; Kane his *Erythriline*; Schunk his *Erythric acid*; and Stenhouse three different substances in as many varieties of the plant; all of these bodies differing more or less from each other in composition and properties (at least, if we are to assume, as correct, the descriptions given of them by their respective discoverers")."I have already hinted that there is no ratio between the external and internal color or structure of a lichen, and the kind or amount of coloring matter it will be found to yield. It is exceedingly natural to suppose that such a ratio should exist; but, proceeding for some time on this supposition, I was frequently disappointed in my results—the most showy and brilliantly colored lichens often furnishing the dullest and most worthless colors. For instance, the bright yellow thallus of *Parmelia parietina*, and the beautiful scarlet apothecia of *Scyphophorus cocciferus*, instead of producing a rich yellow in the one case, and a deep crimson in the other, yielded, respectively, only dirty greenish-yellow and brownish colors. As a general rule I should almost be inclined to say that the finer the color of the thallus of any given lichen, the more

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is that lichen to be suspected of poverty in valuable coloring matters; and that, on the other hand, the palest pulverulent or crustaceous species, especially such as are saxicolous, may be expected to yield the most beautiful and valuable pigments (*e.g.* the Rocellas and Lecanoras). In such circumstances it is necessary to have some test, of easy applicability, of the kind and amount of colorific properties of any lichen, and this fortunately is readily attainable."The fourth section of the paper was devoted to the consideration of the various tests of colorific power, which have been recommended by different authors. "Of these, the greater number proceed on the principle of developing the coloring matter by some alkali, in conjunction with the decomposing action of atmospheric oxygen and water; others are founded on the reaction between colorific principles of certain of the dye lichens and some of our ordinary chemical re-agents." The author noticed in particular—1. Helot's test, } 2. Westring's tests, }qualitative. 3. Stenhouse's test, } 4. " quantitative.Helot's test consists in digesting the dried and powdered lichen or a few hours, at a temperature of 130 degs., in a weak solution of ammonia, sufficiently strong, however, to be tolerably pungent. One that is fit for the dyer will yield a rich violet red liquor.Dr. Westring recommended simply macerating three or four drachms of the lichen in cool spring water, assisting, perhaps, the solvent action of the water by minute quantities of common salt, nitre, quicklime, sulphate of copper or iron, or similar re-agents. If these means failed, after a sufficient length of time had been allowed for the development of color, he digested a fresh portion of the pulverised lichen in water, containing small quantities of sal-ammoniac and quicklime [in the proportion of 25 parts of water, 1-10th lime, and 1-20th sal-ammoniac for every part of lichen], for a period varying from eight to fourteen days, and by this process, he says, he never failed to develop all the color which the plant was capable of yielding.Dr. Stenhouse, of London, one of our latest and best authorities on the chemistry of the lichens, adds to an alcoholic infusion of the lichen, a solution of common bleaching powder (chloride of lime), whereby, if it contain certain colorific principles capable of developing, under the joint action of air, water, and ammonia, red coloring matters, a fugitive but distinct *blood-red color* will be exhibited. The amount of this colorific matter may be estimated quantitatively by noting the quantity of the chloride of lime solution required to destroy this blood-red color in different cases: or the same result may be obtained by macerating for a short period in milk of lime—filtering—precipitating the filtered liquor by acetic or muriatic acid—collecting

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this precipitate on a weighed filter—drying at ordinary temperatures and again weighing.The author entered into a full analysis of these tests and processes—pointing out their respective advantages and disadvantages—and showing their practical value and applications. He stated that he had made use of these, and various other tests, in upwards of 300 experiments, and the one which he employed to the greatest extent, because most uniformly applicable, was Helot's ammonia test. The following combination is that most favorable for the development of the coloring matter of the lichens—viz., the presence1. Of *water* as a solvent menstruum. 2. Of atmospheric *oxygen*. 3. Of *ammonia*, in the state of vapor or in solution, and 4. Of a moderate degree of *heat*;And according as the proportion of these combining elements varies, so do the kind and amount of color educed by them. This combination is the foundation of all the processes for the manufacture of the lichen dyes throughout the world, however different these may appear to be in detail or results.I believe it may come to be a matter of great commercial importance to discover, at home or abroad, some cheap and easily-procurable substitute for the *Roccellas*, which are gradually becoming scarce, and consequently valuable in European commerce, having sometimes fetched, in times of scarcity, no less than L1,000 per ton. No plants can be so easily collected and preserved as lichens—requiring merely to be cleaned, dried, pulverised, and packed; and if their bulk be an objection to transport, their whole colorific matter may be collected in the way I have already mentioned. Ascending to the verge of eternal snows, and descending to the ocean level—with a geographical diffusion that is co-extensive with the surface of our earth, it is difficult to say where lichens shall not be found. There are myriads of small rocky islets in the boundless ocean, and there are thousands of miles of barren rocky coast and sterile mountain range in every part of the world, which, though at present unfit to bear any of the higher members of the vegetable kingdom, are yet carpeted and adorned with a rich covering of lichens, and of those very species too, which I have already spoken of as prolific in colorific materials. I sincerely believe, therefore, that a more general attention to the very simple tests just enumerated, would ultimately result in a greatly extended use of the lichens as dye agents. What renders it very probable that efforts in this direction are likely to meet with success is the great similarity of species found all over the world. It has been repeatedly noticed that the European species, which, of course, are best known, differ little from those of North America. Dr. Robert Brown remarked the same fact with regard to New Holland species, and Humboldt also recognised

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the similarity in natives of the South American Andes. Of a large collection made by Professor Royle, in the Himalayas, Don pronounced almost every one to be identical with European species. From examining the raw vegetable products, sent by different countries to the Great Exhibition of 1851, I am satisfied that, even now, there are many fields open for the establishment of an export trade in *Roccellas* and other so-called orchella weeds." I there saw specimens of good dye lichens from almost every part of the world, including our own young colonies; and as a single instance of their probable value, I may introduce here the copy of a note appended to a specimen of orchella weed from the island of Socotra, contained in the Indian collection of that exhibition, "*abundant*, but *unknown* as an article of use or commerce. Also abundant on the hills around (Aden) and *might* be made an article of trade." Roccellas from this source are estimated as worth L190 to L380 per ton. I believe that a similar statement might be made with regard to the countless islands of the broad Atlantic and Pacific, which may, at some future period, perhaps not far distant, be found to be rich depots of orchella weeds, just as some of them are, at present, rich fields of guano, and may, as such, become new nuclei of British commerce and enterprise. Even at home, in the immediate vicinity of Edinburgh, or, to restrict our limits still more narrowly, within the compass of Arthur's Seat, there are not a few very good dye-lichens, which require merely to be scraped with an old knife or similar instrument, from the rocks to which they adhere, and subjected to the ammonia process already mentioned. Of twelve specimens thus collected at random one morning, I found no less than three yielded beautiful purple-red colors, apparently as fine as orchil or cudbear, while the others furnished rich and dark tints of brownish-red, brown and olive-green.

> Dr. Lindley's communication was illustrated with specimens of coloring matters yielded by various lichens collected in the neighbourhood of Edinburgh, &c.

BARKS FOR TANNING.

Let us now take a brief review of the sources from whence tanning materials may be obtained, which will also enable us to form a fair estimate of the prospect of future supplies. Only one medal was awarded, at the Great Exhibition, for tanning substances, *viz*., to Messrs. Curtis, Brothers (United Kingdom, No. 126), but honorable mention was made of the following competitors:—One from Tunis, one from Van Diemen's Land, one from New Zealand, one from Belgium, one from the Cape of Good Hope, one from Canada, and one from the United Kingdom.

The substance from which pure tannin is most frequently obtained for chemical purposes is nutgalls, for tannin constitutes above 40 per cent, of their weight. It may be procured also from several other sources, such as oak, horse chestnut, sumach, and cinchona barks, catechu, kino, &c.

The basis of the skins of animals is composed of a substance to which the name of gelatine is given. One of the properties of this substance is, that when combined with tannin, it forms the compound of tannate of gelatine, or leather, a substance which is so useful to mankind. From time immemorial, the substance employed to furnish the tannin to the hides of animals, in order to convert them into leather, has been oak bark. But as the purpose for which oaks are grown is their timber, and not their bark, the supply of oak bark cannot be calculated upon, and this is, perhaps, one of the causes why tanning as an art is in such a backward state.

The consumption of tannin required in the leather manufacture may be estimated from the fact that more than 672,000 cwts. of raw hides were imported in 1851, besides the hides of the cattle, &c., consumed in the United Kingdom. On the Continent and in the United States the consumption of bark for this purpose is also considerable.

The imports of bark for the use of tanners and dyers has amounted yearly to the very large quantity of 380,674 cwt., besides what we obtain at home. Oak bark contains usually the largest proportion of tannin, and according to Davy's experiments eight-and-a-half pounds of oak bark are equivalent for tanning purposes to two-and-a-quarter of galls, three of sumach, seven-and-a-half of Leicester willow, eleven of Spanish chesnut, eighteen of elm, and twenty-one of common willow bark. Tannin obtained from these sources, however, differs materially in some of its characters. The tannin of nutgalls, which is that generally employed for chemical purposes, is sometimes called gallo-tannic acid, to distinguish it from other species.

Notwithstanding the number of different substances which have from time to time been introduced for the use of tanners, it is, nevertheless, pretty generally acknowledged that there is nothing superior, or even equal, to good oak bark, and that all attempts to hurry the process beyond a certain point by the use of concentrated solutions of tan, &c., are for the most part failures, as the manufacture of good leather, to a great extent, depends on the process being conducted in a slow and gradual, but—at the same time—-thorough and complete matter.

Oak bark is, however, by no means the only astringent bark well suited to the use of the tanner, and in various parts of the world other similar substances are used with very great success. All these tanning materials, though they may not be considered by the English tanner equal to the best oak bark, are, nevertheless, of great value to him; they may be employed in conjunction with oak bark, or even as a substitute in times of scarcity, or when the price of oak bark is high; in fact the very existence of such substances tends to keep down and equalise the price of bark, and to prevent it from undergoing those great fluctuations in value which would necessarily occur were it the only tanning material available to our manufacture—("Prof. Solly in Jury Reports of Great Exhibition.")

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There are a vast number of bark and other substances useful for tanning purposes, which are found in the tropics, that are comparatively unknown or little regarded in Europe; but which might be readily obtained in large quantities and at a trifling cost. The bark of many species of *Acacia* furnishes the tanning principle in a great degree, particularly that of *A. arabica*, which, under the name of Babul wood, is largely used about Scinde, Biliary, Gruzerat, and other parts of India; where it is regarded as a powerful tonic. The fruit of *A. vera*, termed Egyptian and Senegal “bablah,” has been employed in tanning and dyeing. Numerous species of this tribe are found abundant in New South Wales and the Cape Colony, and these, particularly the wattle bark of Australia, are in common use for tanning, from their astringent properties. The bark and rind of the fruit of the pomegranate (*Pumica Granata*) have similar properties.

The bark of *Avicenna tomentosa* is in great use in the Brazils for tanning. So are the curved pods of *Caesalpinia Coriari*, in the East and West Indies, under the name of Divi-divi. *Coriaria myrtifolia* is not only used in tanning leather, but also for staining black. It is worth L9 to L10 per ton. *Pterocarpus marsupium* furnishes about Tellicherry the concrete exudation called kino, a powerful astringent used for tanning.

The plants of the mangrove tribe, *Rhizophora Mangle*, and other allied species, have frequently an astringent bark, which is in many cases used for tanning and dyeing black. This tree is very common in most tropical countries, where it forms dense thickets on the muddy banks of rivers and the sea shores. The bark of *Bauhinia variegata*, is made use of in Scinde and other parts of Asia. The bitter astringent bark and the galls of several of the Tamarisk tribe are also well suited for the purpose.

Mesembryanthemum nodiflorum, one of the numerous indigenous species of the Cape, is used in making morocco leather.

The extract procured from the bark of the *Butea*, that of the *Buchanania latifolia*, the *Scyzgium* (*Calyptranthes*), *Jambolana*, &c., are likely to be of consequence to the tanners, and could be produced in India in large quantities. Specimens of these, and of the bark of the Saul tree, of *Nychanthes arbortrista, Terminalia angustifolia*, and of the gaub fruit (*Diospyros glutinosa*), were shown by the East India Company. The bark of the hemlock tree is extensively employed for tanning in New Brunswick.

The bark of yellow hercules (*Xanthoxylum ochroxylon*), and the pods of *Acacia tortuosa* are used for tanning in the West Indies.

In the instructions given by the Admiralty to Sir James Boss, when proceeding on his Antarctic Expedition, his attention was particularly called to the astringent substances adapted for tanning, and to the various extracts of barks, &c., imported into England from our Australian settlements, and which are employed by the tanner. Little sterling information has as yet been obtained as to the qualities of the astringent gums, barks, and dyes, yielded in such abundance by the trees of those colonies, and the proportion of tannin they contained.

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In 1846, 563 tons of bark for tanning were exported from Port Phillip.

A large quantity of tannin is extracted from various species of Eucalyptus, the gigantic gum trees in Australia and Van Diemen's Land (of which quarter all the species are natives), and sent to the English market; it is said to be twice as powerful in its operations as oak bark. Some of these trees attain a height of 200 feet. Their bark separates remarkably into layers. A sort of kino gum, an astringent resinous-like substance, is also extracted from *E. resinifera*, the brown gum-tree of New Holland, which is sold in the medicine bazaars of India. It exudes in the form of red juice from incisions in the bark. A single tree will often yield 60 gallons. In Brazil they use the bark of *Luhea panicata*, an evergreen climber, for tanning leather; and in Peru the bark of some species of *Weinmaunia* serve the same purpose. Among other powerful astringents I may notice the root of a species of Sea Lavender (*Statice Caroliniana*), *Myrica cerifera*, and *Heuchera Americana*, all natives of North America. Also the petals of *Hibiscus Rosa-sinensis*, a native of Asia.

The sea-side grape (*Coccolaba uvifera*) yields an astringent substance, known as Jamaica kino.

The bark of the *Cassia auriculata*, and the milky juice of the *Asclepias gigantea*, are used for tanning in India.

The red astringent gum obtained from *Butea frondosa*, a middling size tree, common in Bengal and the mountainous parts of India, is used by the natives for tanning. English tanners, however, object to its use on account of the color which it communicates to the leather.

The barks of the *Mora excelsa*, Benth; Courida (*Avicenna nutida*), cashew (*Anicardium occidentale*), guava and hog-plum (*Spondius lutea*, Linn.), have all been successfully used for tanning in Demerara and the West India Islands, where they are very abundant. Specimens were sent from British Guiana.

The root of the Palmetto palm (*Chaemaerops Palmetto*) is stated to be valuable for the purposes of tanning. The leaves of *Nerium Oleander* contain tannic acid. The bark of a species of Malphigia is much used by the Brazilians.

The panke (*Gunnera scabra*) is a fine plant, growing in Chili, on the sandstone cliffs, which somewhat resembles the rhubarb on a gigantic scale. The inhabitants eat the stalks, which are subacid, tan leather with the roots, and also prepare a black dye from them. The leaf is nearly circular, but deeply indented on its margin. Mr. Darwin measured one which was nearly eight feet in diameter, and therefore no less than twenty-four in circumference. The stalk is rather more than a yard high, and each plant sends out four or five of these enormous leaves, presenting together a very noble appearance.

The barks replete with the tanning principle should be stripped with hatchets and bills from the trunk and branches of trees in spring, when their sap flows most freely. The average quantity of oak bark obtained from our forests is estimated at 150,000 tons annually, of which Ireland and Scotland furnish but a very small quantity.

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The following table, given by Dr. Ure, shows the quantity of extractive matter and tannin yielded by different substances:—

	In 480 parts by Davy.	In 100 parts by Cadet.
Sicilian sumach	78	—
Malaga ditto	79	—
Souchong tea	48	—
Green tea	41	—
Bombay catechu	261	—
Bengal ditto	231	—
Nutgalls	127	46
Bark of pomegranate	—	32
" Virginian sumach	—	10
" Carolina ditto	—	5

Catechu and Gambier are very valuable for tanning, and are alluded to under the heads GAMBIER and ARECA PALM.

CATECHU is obtained from the *Acacia Catechu*, an arboreous tree growing from fifteen to twenty feet high, with a brown and scabrous bark. The interior wood is brown, dark red or blackish, and the exterior white, one or two inches thick. It inhabits various parts of the East Indies, of which it is a native, and is also now common in Jamaica. It bears whitish or pale yellow flowers.

The catechu obtained from this tree in Pegu, is celebrated throughout India, and fetches L4 to L5 more per ton than gambier and other astringent extracts. When of good quality, catechu is more powerful as an astringent than kino. Of all the astringent substances we know, catechu appears to contain the largest proportion of tannin, and Mr. Purkis found that one pound was equivalent to seven or eight of oak bark for tanning leather.

The term catechu, observes Dr. Pereira, is applied to various astringent extracts imported from India and the neighbouring countries. A few years ago the terms catechu, terra japonica, and cutch were employed synonymously; they are now, however, for the most part used in trade somewhat distinctively, though not uniformly in the same sense. The manufacture of catechu from the *Acacia catechu* as practised in Canara and Behar, has been described by Mr. Kerr ("Med. Obs. and Inquiries," vol. v.), and Dr. Hamilton ("Journey through Mysore," &c., vol. iii.), while Professor Royle has explained the process followed in Northern India. According to the last-mentioned gentleman, "the kutt manufacturers move to different parts of the country in different seasons, erect temporary huts in the jungles, and selecting trees fit for their purpose, cut the inner wood into small chips. These they put into small earthen pots, which are arranged in a double row, along a fireplace built of mud; water is then poured in until the whole are covered; after a considerable portion has boiled away, the clear liquor is strained into one of the neighbouring pots, and a fresh supply of the material is put into the first, and the operation repeated until the extract in the general receiver is of sufficient consistence to be poured into clay moulds, which, in the Kheree Pass and Doon, where I have seen the process, are generally of a quadrangular form. This catechu is usually of a pale red color, and is considered there to be of the best quality. By the manufacturers it is conveyed to Saharunpore and Moradabad, whence it follows the course of commerce down the Ganges, and meets that from Nepaul, so that both may be exported from Calcutta."

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GAMBIER.

The Gambier plant (*Uncaria Gambler*, Roxburgh, *Nauclea Gambir*, Hunter), has been described by Rumphius under the name of *Funis uncatus*. It is a stout, scandent, evergreen shrub, which strongly resembles the myrtle. It is generally cultivated in the same plantation with pepper, as the leaves and shoots, after undergoing the process by which their juice is extracted, to furnish a kind of catechu, are found to be an excellent manure for the pepper vines. The leaves and young shoots of the gambier plant are collected as soon as they have attained a sufficient size, and boiled in iron pans until the juice acquires the consistence of treacle. The decoction is poured out into narrow troughs, dried, and afterwards cut up into small cakes, and packed in baskets for exportation. The gambier extract, which is of a yellowish brown color, and has the consistence of hard cheese, is much esteemed by the Malays for mixing with the preparation of betel, which they are in the habit of chewing; and considerable quantities have lately been imported to this country, where it is used for dyeing colors, and for tanning leather. The demand for gambier here is on the increase; and when better known to our chemists, it will probably be found applicable to many other purposes than those to which it is at present applied.

There were, in 1850, 400 gambier and pepper plantations on the island of Singapore; each measures or occupies on an average an area of 500 fathoms square, and employs eight to ten hands to cultivate and manufacture the gambier and pepper. There are some pepper plantations in addition, and they have been found to answer very well without any gambier being cultivated with them. Gambier cultivation is generally a losing undertaking, but it is adopted to obtain the refuse of the leaves for manuring the pepper vines, and also to employ the people in the plantations; it besides affords the proprietors the means of getting monthly sums to carry on the cultivation of pepper, which affords two crops yearly. There were formerly 600 plantations in Singapore, but the reason already assigned, and the formation of spice plantations contiguous have caused the abandonment of all those near the town. Each plantation must have an equal extent of forest land to that cultivated with gambier and pepper, to enable the manufacture of the gambier being carried on, and each gambier plantation, of 500 fathoms square, contains about 3,500 pepper vines, which yield on an average two catties per vine, or 70 piculs of pepper, and about 170 piculs of gambier annually; —a good plantation will, however, yield sometimes as much as 120 piculs of pepper, and 200 piculs of gambier, and a bad one as little as 40 to 50 piculs of pepper, and 60 to 80 piculs of gambier. Were it not for the enormous commission charged by the agents of these plantations, from whom the cultivators get all the

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advances, it would prove a profitable cultivation. The rates of commission charged generally are as follows:—Per picul of gambier, fifteen to twenty-five cents; per picul of pepper, thirty to forty cents; and if the price of the former is below one-and-a-half dollars, and the latter below three-and-a-half dollars per picul, a small reduction is made in the rates of commission. On every picul of rice supplied to the planters twenty to twenty-five cents commission is charged; this includes the interest of money advanced, which is never charged. A gambier and pepper plantation is valued or estimated at about 400 dollars on an average. The following is supposed to be a correct estimate, on an average, of the yearly expenditure and returns of a gambier and pepper plantation of 500 fathoms square, viz:—

EXPENDITURE.
drs. c. men. drs. c.
Eight men at 31/2 dollars and 7 Java rupees per
month, wages for headman and labourers
respectively 22.70 12 272.40
Five piculs of rice, including commission, say 6.50 12 81.60
Fish, &c. 5 12 60.0
Boat or cart hire to carry rice and produce 13/4 12 21.0

435.0

PRODUCE.

170 piculs of gambier, valued at l dollar 45 cents per picul, less 15 cents commission chargeable, nett 221.30 — —– 70 piculs of pepper, at 41/2 dollars, less 40 cents per picul commission, nett 287.0 — 508.0

Yearly profit, 73 dollars, or about L15.

Several gambier and pepper plantations have been abandoned in Singapore, partly from the ground being impoverished, but more particularly from the exhaustion of the forest adjacent to their estates. The exhaustion of the trees by yearly consumption deprives the planters of the necessary fire wood which is used for the boiling down of the gambier. A gambier plantation gets exhausted in fifteen years, either from the want of firewood or the land getting impoverished.

There are about 200 plantations at Johore, and the produce of gambier for the season of 1851 was calculated at 30,000 piculs.

This shrub was, at one period, cultivated with success at Pinang and other places to the eastward, but as Java was the principal market for the produce, and the Dutch had levied a duty of twelve Java rupees per picul on it, the cultivation at the former island did not repay its cost, and it was accordingly abandoned. Prices have been lately advancing, and the Chinese are talking of trying it again. The plant is partial to hilly land or slopes at the skirts of hills. Two hundred plants are usually placed on one orlong of land, being six feet asunder. They are raised from seed, and are topped to eight or ten feet, when the gambier is to be prepared. The Chinese dry the seed slightly, and sow in rainy weather.

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The seeds vegetate in forty days, and are planted out in the second or third month afterwards.

At the expiration of fourteen months, the first cutting of the branches, with the leaves on, is made. These are put into a boiler, and when the juice has been extracted, the branches and refuse are thrown away, and the boiling is continued until the liquor has obtained the proper consistence, when it is put into shallow troughs, dried, and cut into slices for sale. The second cutting takes place eight months subsequently to the first. The plant now grows strong and admits of frequent cropping, and it will endure for twenty years. No manure is used, but the plantation is kept clean.

Estimated cost of cultivating ten orlongs, about 13 acres, according to Colonel Low:—

Spanish dollars.
Value of cleared land, ten orlongs 200
Six laborers per annum 360
Quit rent 7
Boilers, firewood, and implements 20
Houses 50
Incidental 30
——
Total first year 667
Second year 397
——
1,064

The six laborers on the plantation will, after the above period, be constantly employed in cutting and preparing the gambier: the average product will be 15 piculs monthly, which, at two dollars per picul, will be 30 dollars monthly, or 360 dollars per annum. This is the account obtained by collating different Chinese statements.

The *Nauclea Gambir* is placed by Jussieu under the natural order *Rubiaceae*; it is a shrub attaining the height of six to eight feet, branchy; the leaves are ovate, pointed, smooth, waving, distinctly veined transversely underneath, of dark green color, and, when chewed, they have a bitter astringent taste, leaving however, afterwards, a sweetish taste in the mouth, not unlike liquorice; the flowers are aggregate, globular, composed of numerous florets, crowded on a globular naked receptacle; tubes of the corolla of a pinkish color; the upper part of the corolla fine, cleft, and of a greenish yellow color; the staminae are five in number, and short; the pistil is longer than the corolla; the flowers are destitute of fragrance; the capsules (as correctly stated by Mr. Hunter) are stalked oblong, incrusted, and crowned with a calyx; tapering to a point below; two celled, two valved, the valves adhering at the apex, splitting at the sides; seeds very numerous, oblong, very small, compressed, furnished at both ends with a membraneous pappus.

The gambier plant is propagated either by seeds or cuttings, but the latter are preferred. It is cultivated to some extent at Singapore, but it is said that the gambier can be imported cheaper from the islands in the vicinity, more especially at the Dutch settlement at Rhio. The extract is used extensively by the natives of India, Eastern Archipelago, Cochin-China, and Cambodia, as a masticatory, wrapped up with the betel.

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There are three different qualities of extract; the first and best is white, brittle, and has an earthy appearance when rubbed between the fingers (which earthy appearance gave it the name of Terra Japonica, being supposed, at first also, to come from Japan), and is formed into very small round cakes. This is the dearest sort, and most refined, but it is not unfrequently adulterated with sago; this kind is brought in the greatest quantity from the island of Sumatra. The second quality is of a brownish yellow color, is formed into oblong cakes, and, when broken, has a light brown earthy appearance; it is also made into a solid cube form; it is sold in the bazars in small packets, each containing five or six. The third quality contains more impurities than the preceding, is formed into small circular cakes, and is sold in packages of five or six in the bazar.

The method employed in preparing the extract is thus correctly related by Finlayson:—-"The leaves are collected three or four times a year; they are thrown into a large cauldron, the bottom of which is formed of iron, the upper part of bark, and boiled for five or six hours, until a strong decoction is obtained; the leaves are then withdrawn, and allowed to strain over the vessel, which is kept boiling for as many hours more, until the decoction is inspissated; it is then allowed to cool, when the catechu subsides, The water is drawn off; a soft soapy substance remains, which is cut into large masses; these are further divided by a knife into small cubes, about an inch square, or into still smaller pieces, which are laid in frames to dry. This catechu has more of a granular, uniform appearance than that of Bengal; it is, perhaps, also less pure."

The younger leaves of the shrub are said to produce the whitest and best gambier; the older, a brown and inferior sort. There are other species of *Nauclea* indigenous to Singapore, but they do not produce any extract.

Dr. Bennett has particularised four qualities of gambier:—

1. Small round cakes, about the size of a small lozenge. Color pale, purplish, yellowish, white.

2. Cubes, in which shape it is principally imported into England, and square prisms, or oblong pieces.

3. Circular discs, or short cylindrical pieces.

4. Cubical amylaceous pieces, of a darker brown than the other kinds.

Gambier is one of the most powerful of the pure astringents.

The chief places of manufacture are Saik, Malacca, Singapore, and Rhio or Bintang. Bennett, in his "Wanderings," says there are 60,000 plantations of gambier on this island. After that of Rhio, the next best gambier is that of Lingin. That used by the Malays, with the leaves of betel, in the same manner as cutch in other parts of India, is the finest and whitest; the red being stronger tasted and rank, is exported to Batavia, China, and England, for the purposes of tanning and dyeing. It is frequently adulterated with sago powder, but it may be detected by solution in water.

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Large quantities of gambier are imported, under the corrupted name of cutch, into Calcutta, from Pegu. The quantity of gambier produced in Rhio, by the Chinese settlers, amounts to about 4,600 tons a year, about 2,000 of which are exported for the consumption of Java, the rest being sent to Cochin-China and other neighbouring countries.

Two methods of obtaining gambier are described. One consists in boiling the leaves in water, and in inspissating the decoction; the other, which yields the best gambier, consists in infusing the leaves in warm water, by which a fecula is obtained, which is inspissated by the heat of the sun, and formed into cakes.

The injudicious practice adopted by the Land Office in Singapore, of granting indiscriminate licenses, or “cutting papers” as they are formed, seems open to objection, and is driving many of the Chinese cultivators to the neighbouring island of Johore, where they readily obtain permission to cultivate, without obstruction, this important article of commerce. Parties of 300 or 400 at a time left in 1846. It appears that, under his permissive license, the squatter obtains permission to clear as much land as he possibly can, but the order does not define any extent beyond which no cutting should take place. The squatter clears as much land as the means at his disposal will allow, in the hope and expectation that the jungle contiguous to the cleared ground will be at his command for fuel—a supply of fuel, easy of access, and adequate to the number of plants grown, being indispensable to the culture and manufacture of gambier. When the time for gathering the leaves arrives, another squatter (perhaps from motives of envy or malice) obtains a “cutting paper,” and commences clearing in close proximity to the already-formed gambier plantation; obviously depriving the owner of the fuel he has reasonably calculated upon. The established planter cannot of course eject the intruder from the land, since the latter possesses an equal right to it, in virtue of his “cutting paper,” which, as it specifies no limits, leaves him the disposer or destroyer of the crop of the industrious planter. Instead of the present system, a better practice ought to be introduced, defining the boundaries to be included in a “cutting paper,” and effectually preventing a trespass on the fuel-land of the industrious planter. This might easily be effected by specifying the number of acres, as well as the direction, in every clearing paper granted.

The average produce of gambier in Singapore is between 7,000 and 8,000 piculs monthly. The ordinary price is about 11/4 dollars per picul. A deficiency of rain, labor, or other causes, will occasionally reduce the annual produce from 90,000 or 100,000 piculs, to 60,000 or 70,000, and this diminished supply will raise the market price of the article probably 35 cents per picul. But, in addition to the effect occasioned by a deficient supply, there are other

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causes in operation exercising a powerful influence in reducing prices. Gambier was first exported in 1830, from Singapore, to the extent of 2,587 piculs, at 41/2 dollars per picul. As a rival to bark it failed at so costly a price to meet with encouragement; the culture and manufacture consequently declined until 1834, when 1,858 piculs were shipped to England at a somewhat lower rate. The demand then became active, the exportations were at first multiplied, then doubled every succeeding year, until they reached, in 1846-47 no less than 173,117 piculs. The price has gradually declined to 11/4 dollars per picul, at which rate it displaces its rival, bark. This price, however, is unremunerative to the grower, so that, unless more encouragement offers, the supply will decline.

The number of Chinese employed in the cultivation, &c., of gambier and pepper in Singapore is about 11,000. Their rate of wages fluctuates with the price of gambier. If a picul of gambier realizes 11/2 dollars, the monthly pay will be about three dollars; if gambier fetches two dollars, their pay will amount to four dollars in the month. The workmen who clean the plantation always receive a dollar less than those who cut and boil the gambier.

A good deal of gambier seems now to be grown in Java, for 58,305 piculs were exported from that island in 1843. A small quantity is taken by the Chinese ports, but whether as a masticatory or for tanning and dyeing I am not aware.

VALUE OF THE TERRA JAPONICA IMPORTED INTO CEYLON.

	L
1840	611
1841	1,053
1842	768
1843	471
1844	1,153
1845	537
1846	824
1847	1,549
1848	1,095
1849	896
1850	265
1851	386

In the Customs' returns of imports to this country, two articles are enumerated, under the separate names of cutch and terra japonica; the former is catechu and the latter the produce of the gambier plant. The imports of gambier were, in 1836, 970 tons; 1837, 2,738 tons; 1838, 1,600 tons; 1839, 5,213 tons.

	Cutch.	Terra Japonica.
	tons.	tons.
1848 Imported to the United Kingdom	1,186	5,623
Retained for home consumption	765	5,102
1849 Imported	1,636	6,851
Retained for home consumption	869	5,400
1850 Imported	1,172	4,585
Home consumption	787	3,655
1851 Imported	2,401	4,783
Home consumption	2,020	4,431
1852 Imported	2,236	3,244
Home consumption	1,708	3,003

Catechu, imported under its Indian name of cutch, is brought over in bales or baskets of from one to four cwt., the price being L18 to L25 per ton. About 450 cwt. of terra japonica or gambier is annually imported into Hull from the East Indies. The imports of the two substances into Liverpool is about 900 tons. Gambier is only worth L13 to L14 the ton; a few years ago it fetched 26s. the cwt. The imports into the port of London average 1,500 tons annually.

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4,679 bales, and 14,436 baskets of terra japonica were imported into Liverpool in 1851, and 14,000 bales and baskets in 1852. The imports of cutch were 10,290 bags, and 2,592 baskets, in 1851, and 11,873 bags and baskets in 1852; the prices, which were from 16s. 6d. to 18s. per cwt. for each article, in 1851, were rapidly run up in Liverpool, in 1853, owing to short supplies, to 25s. for gambier, and 22s. to 24s. per cwt. for cutch, or catechu.

EXPORTS OF GAMBIER FROM SINGAPORE, WITH THE OFFICIAL VALUE IN RUPEES.

		Piculs.	Value in rupees.
1840-41	Exported	79,508	457,560
"	Growth of Singapore	59,325	
1841-42	Exported	93,340	470,790
"	Growth of Singapore	47,696	
1842-43	Exported	148,746	548,281
"	Growth of Singapore	110,151	
1843-44	Exported	139,050	584,449
"	Growth of Singapore	121,791	
1844-45	Exported	157,654	539,978
"	Growth of Singapore	134,528	
1845-46	Exported	110,766	425,643
"	Growth of Singapore	75,797	
1846-47	Exported	173,117	591,943
"	Growth of Singapore	143,795	

The exports of gambier from Singapore were as follows:—

	To England.	To the Continent.	Total.
	piculs.	piculs.	piculs.
1849	134,546	6,121	140,667
1850	87,611	16,166	103,777
1851	68,365	11,639	80,004
1852	68,045	9,006	77,051

The exports of cutch from Pinang, in the last four years, have been:—1849, 3,693 piculs; 1850, 900; 1851, 4,143; 1852, 3,880; or, on an average, 197 tons.

DIVI-DIVI is the commercial name for the curved pod of a leguminous shrub, *Caesalpinia coriaria*, which is sometimes imported from Carthage. Its tannin differs materially from that of nutgalls. The quantity of mucilage which it contains precludes it from the use of dyers; but, as it furnishes nearly 50 per cent. of tannin, it is largely used by curriers. It is imported into Liverpool from Rio de la Hacha, Maracaibo, and Savanila. 400 tons of the seed pods and bark of the Algaroba, or Locust-tree (*Prosopis pallida*) were imported in 1849 into Liverpool from Valparaiso, as a substitute for divi-divi in tanning. 3,200 lbs. of divi-divi were exported from the port of Augostara, in 1846.

Specimens of divi-divi which had been raised at Calcutta were shown in the Indian department of the Great Exhibition.

Dr. Hamilton states that, according to some admirably conducted experiments of Mr. Rootsey, of Bristol, undertaken at his request, the pods of divi-divi contain above 50 per cent. of tannin. It appears also, from trials made, that one part of divi-divi is sufficient for tanning as much leather as four parts of bark, and the process occupies but one-third of the time.

The average produce of pods from a full-grown tree has been estimated at 100 lbs. weight, one-fourth of which consists of seeds or refuse, leaving about 75 lbs. of marketable matter.

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At an interval of six feet apart, an acre of ground will contain 1,210 trees, yielding an average of 810 cwts., and 30 pounds, or above 401/2 tons of marketable matter, worth, at only L5 per ton, L200. Should the interval between the trees be extended two feet more, we shall still have 680 to the acre, the produce of which would not improbably be increased by the increased space given for the extension of the branches.

The ground in which this tree admits of being cultivated is that which is least adapted to the staple products of tropical agriculture; guinea grass may be profitably raised beneath its shade and as with the exception of the three years which precede the commencement of its bearing, there is hardly any deduction to be made from its returns, it promises to be among the most valuable objects of a planter’s attention.

Jacquin describes the *Caesalpinia coriaria* as a handsome branching tree, of about fifteen feet in stature, covered with a dark spotted bark. Its leaves are doubly pinnate, and the leaflets of twelve pair without a terminal one; they are oblong, obtuse, smooth, very entire. The flowers are disposed in spikes issuing from the extremities of the branches; they are small, yellowish, and slightly fragrant. To these succeed oblong, compressed, somewhat obtuse pods, curved laterally, the inner side being concave and the other convex. The seeds rarely exceed three or four in each pod, and are of a brownish color.

Divi-divi resembles a dried pea-shuck curled up, filled with yellow powder, and a few dark brown seeds. The price ranges from L8 to L13 per ton.

The imports into the United Kingdom in 1844, were 3,900 tons; in 1845 and 1846, about 1,400 tons each year; during the subsequent three years the imports were merely nominal, but in 1850 a renewed demand seems to have sprung up, for 2,770 tons were imported into Liverpool, and a few tons into London.

CORK-TREE BARK (*Quercus suber*) has been imported into Ireland to a considerable extent, frequently to the amount of 1,500 tons annually. The quantity of cork imported annually into the United Kingdom is about 3,000 tons. It is brought from Spain, Italy, and Barbary. Oak bark and valonia being very cheap and plentiful, the price of cork hark is only nominal, being, for Spanish cork-tree bark, L7 10s. to L8 per ton; Leghorn ditto, L6 to L7 per ton. It is less astringent than oak bark, and is more generally useful for stoppers of bottles and bungs for casks. 160 tons of cork-tree bark were imported into Liverpool from Rabat in 1849, and 150 tons in 1850.

1,867 cwts. of bark for tanning were imported from Chili in 1844, of which 292 were Quillai bark.

MIMOSA BARK.—The bark of the *Mimosa decurrens*, which abounds in Australia and Van Diemen’s Land, is found to be a very powerful tanning agent.

The first shipment of tannin was made from Sydney to England as far back as 1823, in the shape of an extract of the bark of two species of mimosa, which was readily purchased by the tanners at the rate of L50 per ton. One ton of bark had produced four cwts. of extract of the consistency of tar.

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In 1843, 3,078 tons of mimosa bark was shipped from Port Phillip to Great Britain. The price then realised in the London market was L12 to L14 per ton, but it has since declined to L8 a ton. The quantity of this bark to be procured in the colony is quite inexhaustible. The price of chopped mimosa bark in Australia, for export, in the close of 1846, was L2 5s. per ton. Bark valued at L912 was exported from Van Diemen's Land in 1848.

The imports of mimosa bark have only been to a limited extent within the last few years, reaching 350 tons in 1850, against 110 tons in 1849, 230 tons in 1848, and 600 tons in 1847. The prices realised were L10 to L11 for chopped, L12 to L12 10s. for ground, and L8 to L9 per ton for unchopped bark. Whilst the imports were 3,900 tons in 1814, they dwindled to less than 400 tons in 1850.

From an experiment, conducted by Professor Brandt, the strength of the mimosa bark, as compared with that of young English oak bark, is found to be in the proportion of 57 to 39, so that the mimosa bark is half as strong again as the best English bark.

Mr. Samuel Mossman, in a communication to the Botanic Society of Edinburgh, in 1851, stated that the bark of *A. dealbata* pays to ship to England, notwithstanding the distance, from the fact of its containing a greater per centage of tannin than any other bark. It is a handsome tree, from fifteen to thirty feet high, forming luxuriant groves on the banks of streams, most abundant in Port Phillip and Twofold Bay, between the parallels of latitude 34 and 30 degrees.

New Zealand is rich in barks and dyes. The bark of the Tanahaka (*Phyllodadus trichomanoides*, of Don) is used by the natives as a red dye for the ornamental parts of their kaitahas, their best border garments. There is also another red dye, called Tawaivwai, the bark of which is very profuse. A black dye is procured from the hinau. They are of a rich hue, and exceedingly fast colors. The barks are to be found all over the colony. The hinau and tanahaka are employed in tanning, all the leather used in the colony being tanned either at the Bay of Islands or Port Nicholson.

The bark of the Rimu or red pine (*Dacrydium Cupressinum*, of Solander), a very common tree, possesses tanning qualities far superior to any of the Australian barks. One pound of the bark yields 85 grains of extract.

The native tanning barks of New Zealand are various and easily obtained. Specimens of the bark and dye, &c., of most of these trees were sent home to the Great Exhibition. One pound of the Tanahaka bark is said to yield 63 grains of tannin. The sails of boats are dyed with it to preserve them. The Towai (*Licospermum racemosum*, of Don, *Weinmaunia racemosa*, Decandole), is supposed to be valuable for the purposes of the tanner, and is said to yield 104 grains of tannin for every pound of bark. The bark of the Pohutu kawa of the natives, the *Metrosideros tomentosa*of Richard, and *Callistemon* *ellipticum* of Allan Cunningham, would also be useful for tanning, one pound of it furnishing about 60 grains of tannin.

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The bark of the Hino tree, the *Elaeocarpus hinau* of Cunningham, the *Dicera dentata* of Forster, is used by the natives for dyeing black.

The black mangrove (*Rhizophora mangle*) is a tree attaining an altitude of from 30 to 50 feet, and occupying marshy situations in the vicinity of the sea. Almost every part of the mangrove—the bark, roots, and the fruit more particularly—abounds in an astringent principle, which is successfully applied to the purposes of tanning. As the tree is so abundant within the tropics, it might be worth the while of some practical speculator to make an extract on the spot, and introduce it into the English market, for the use of tanners and dyers. For tanning, the mangrove is said to be infinitely superior to oak bark, completing in six weeks an operation which with the latter occupies at least six months, and the sole-leather so tanned is said to be more durable than any other. The bark and leaves, which contain nearly as much tannin as the oak, are made use of in the West Indies, as well as in Scinde and other parts of Asia.

3,713 piculs of mangrove bark, valued at L819, were shipped from Shanghae, one of the Chinese ports, in 1849.

MYROBALANS.—This is a name applied to the almond-like kernels of a nut or dried fruit of the plum kind, of which there are several sorts known in the East. They are the produce of various species of *Terminalia*, as *T. Bellerica, chebula, citrina*, and *angustifolia*. They vary from the size of olives to that of gall nuts, and have a rough, bitter, and unpleasant taste. Many of the trees of this tribe, which are all natives of the tropical regions of Asia, Africa, and America, are used for tanning, and some for dyeing. They are highly valued by dyers, creating, when mixed with alum, a durable dark brown yellow. Myrobalans fetch in the Bombay market 8s. to 26s. the Surat candy of 821 lbs. The bark and leaves of *T. Catappa* yield a black pigment, with which Indian ink is made; the seeds are eaten like almonds. A milky juice is said to flow from *T. angustifolia*, which, when dried, is fragrant, and, resembling Benzoin, is used as a kind of incense in the Catholic churches in the Mauritius. The fruit of *T. Bellerica*, and of *T. Chebula*, both useful timber trees, indigenous to the East Indies, are used medicinally as a tonic and astringent. 117 cwts. of myrobalans were shipped from Ceylon in 1845.

The annual imports of myrobalans into Hull, amount to about 1,600 cwts. The quantity which arrived at Liverpool was 185 tons in 1849, 851 tons in 1850; 27,212 bags in 1851, and 19,946 bags in 1852; they come from Calcutta and Bombay, and are also used for dyeing yellow and black. The price in January, 1853, was 6s. to 12s. per cwt. The average annual imports into the United Kingdom may be taken at 1,200 tons.

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KINO.—The Kino, of Botany Bay and Van Diemen's Land, is the produce of the iron bark tree, *Eucalyptus resinifera*. White ("Journal of a Voyage to New South Wales"), says this tree sometimes yields, on incision, 60 gallons of juice. Kino is imported in boxes. The tincture of kino is used medicinally, but an inconvenience is frequently found to arise, from its changing to the gelatinous form. Dr. Pereira seems to think this species of kino consists principally of pectin and tannic acid. That chiefly used as East Indian kino, is an extract formed by inspissating a decoction of the branches and twigs of the gambler plant. Vauquelin analysed it, and found it to consist of, tannin and peculiar extractive matter, 75; red gum, 24; insoluble matter, 1.

The East Indian kino, imported from Bombay and Tellicherry, is the produce of *Pterocarpus marsupium*, a lofty, broad-spreading forest tree, which blossoms in October and November. The bark is of a greyish color, and is upwards of half an inch in thickness on the trunk. When cut, a blood-red juice speedily exudes and trickles down; it soon thickens, and becomes hard in the course of fifteen or sixteen hours. The gum is extracted in the season when the tree is in blossom, by making longitudinal incisions in the bark round the trunk, so as to let the gum ooze down a broad leaf, placed as a spout, into a receiver. When the receiver is filled it is removed. The gum is dried in the sun until it crumbles, and then filled in wooden boxes for exportation.

P. erinaceus, a tree 40 to 50 feet in height, a native of the woods of the Gambia and Senegal, furnishes kino, but none is collected in or exported from Africa. *Butea frondosa*, or the dhak tree of the East Indies, furnishes a similar product, in the shape of a milky, colored, brittle, and very astringent gum. Kino is used as a powerful astringent, and is administered in the form of powder and tincture. Some specimens of Butea kino, analysed by Prof. Solly, after the impurities had been separated, yielded 731/4 per cent. of tannin.

VALONIA is the commercial name of the cupula or cup of the acorn, produced by the *Quercus aegilops* and its varieties, the Balonia or Valonia oak, natives of the Levant, from whence, and the Morea, they form a very considerable article of export; containing abundance of tannin they are largely used by tanners. The tannin differs materially from that of nutgalls. The bark of *Q. tinctorea*, a native of North America, yields a yellow dye.

The quantity of valonia imported for home consumption, in 1836, was 80,511 cwts., of which Turkey furnished 58,724 cwts., and Italy and the Ionian islands 7,209 cwts. Of 163,983 cwts. imported in 1840, 143,095 cwts. were brought from Turkey, 15,195 cwts. from Italy, and the residue from Greece and the Ionian Islands. The entries for home consumption in the three years ending with 1842, amounted to about 8,200 tons a year. The increase since has been considerable, the imports having been, in 1848, 10,237 tons; in 1849, 16,671 tons; in 1850, 12,526 tons; in 1851, 10,639 tons; in 1852, 13,870 tons. We receive about 14,000 to 20,000 cwts. annually from Leghorn. The imports into the port of Hull are 3,900 cwts. per year.

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The prices of Smyrna valonias are from L13 to L14 per ton; those of picked Morea, L10 per ton. The duty received on valonias imported in 1842 was about L4,000.

The annual produce is sufficient to meet the wants of all Europe. It can be had in Turkey to any extent and at all periods. Many cargoes are sent to Dublin, and the German markets. A little valonia is exported from Manila, the shipments having been about 150 tons per annum.

Camata and Camatina are two varieties of very young valonias, which are found more valuable for some processes of tanning than the common kinds.

Extensive as has been the enumeration of the vegetable substances used in the various branches of art and manufacture which have formed the principal subjects of this section, it is probable that with the progress of knowledge, of scientific experiment, and of investigation into the properties of given commodities, the list will be indefinitely increased. What I have stated will suffice to give the reader an idea of the surprising variety of sources from which we receive the raw materials which enable us to perfect some of the most elegant processes of manufacturing skill and ingenuity, and will further afford some criterion—though, of course, not a perfect one—for estimating the relative importance of the tanning and dyeing substances.

SECTION V.

OLEAGINOUS PLANTS, AND THOSE YIELDING FIXED OR ESSENTIAL OILS.

Few cultivators are probably aware of the great importance of oil to this country, and the number of purposes for which it is employed in the arts and manufactures. It is extensively used for candle and soap making, for burning in lamps, for diminishing friction in machinery of all kinds, and especially for locomotives—in wool-dressing, in the manufacture of paints and varnishes, as an article of food, for medicinal purposes, &c.

So important are vegetable oils deemed, that the Society of Arts, in its prize list for 1851, offered gold medals for the importation or introduction into this country of any new plants or trees from China, India, or elsewhere, producing oils or fatty substances, such as can be used as food, or are applicable to manufacturing purposes; and also to the person who shall manufacture and import the finest specimen of oil, not less than ten gallons, the produce of olives grown in any British colony in Africa or Australasia.

The time of burning of equal quantities of the following oils has been found to be—

Hours.

Oil of poppy	14
" sunflower	13
" rape	11
" mustard	111/2
" flax seed	10
" gold of pleasure (*Camelina sativa*)	91/2
" olives	9
" hemp seed	8
" tallow	101/2

FOREIGN VEGETABLE OILS IMPORTED.

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	1821.	1845.	1850.
	tuns.	tuns.	tuns.
Coco-nut oil	—	2,148	98,040
Olive oil	1,900	12,315	20,783
Palm oil	3,200	25,285	448,589 cwts.
Rape seed oil	800	3,973	—
Linseed oil	10,500	38,634	—
	------	------	-------
	16,400	82,355	
Fish oils	32,356	22,626	21,328

The total quantity of all kinds of wool annually consumed in England and Wales, in 1843, was estimated at 801,566 packs. Now, five gallons of olive, rapeseed or other oils, being used in the preparation of every pack of wool, for cloth (independent of the quantity used in soap, applicable to the woollen manufactures), it follows that five gallons on 801,566 packs are equal to 4,007,830 gallons, or 15,904 tuns; and adding for olive or sperm oil used in machinery 1-11th of the whole, 1,446 tuns, the total quantity consumed is 17,350 tuns.—("Enderby on the South Whale Fishery.")

Fixed oils are found in the cells and intercellular spaces of the fruit, leaves, and other parts of plants.

Some of these are drying oils, as linseed oil, from *Linum usitatissimum*; some are fat oils, as that from olives (fruit of *Olea sativa* or *Europaea*); whilst others are solid, as palm oil.

The solid oils or fats procured from plants are, butter of cacao, from *Theobroma cacao*; of cinnamon from *Cinnamomum verum*; of nutmeg, from *Myristica moschata*; of coco-nut, from *Cocos nucifera*; of laurel, from *Laurus nobilis*; of palm oil, from *Elais guianiensis*; Shea butter, from *Bassia Parkii*; Galam butter, or Ghee, from *Bassia butyracea*; and vegetable tallow, from *Stillingia sebifera* in China, from *Vateria indica* in Canara and China, and from *Pentadesma butyracea* in Sierra Leone, and from the almond. These oils contain a large amount of stearine, and are used as substitutes for fat. Some of them are imported in large quantities, and enter into the composition of soap, candles, &c.

Castor oil, from the seeds of *Ricinus communis*, differs from other fixed oils in its composition.

Decandolle states the following as the quantity of oil obtained from various seeds:—

Per cent. in weight.	
Hazel-nut	60
Garden cress	57
Olive	50
Walnut	50
Poppy (*Papaver somniferum*)	48
Almond	46
Caper-spurge (*Euphorbia Lathyris*)	41
Colza (*Brassica oleracea*)	39
White mustard (*Sinapis alba*)	36
Tobacco	34
Plum	33
Woad	30

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Hemp	25
Flax	22
Sunflower	15
Buckwheat	14
Grapes	12

The following table, quoted from Boussingault, shows the results of some experiments made by M. Grauzac, of Dagny:—

	Seed produced per acre.			Oil obtained per acre, in lbs.		Oil per cent.	Cake per cent.
	cwts.	qrs.	lbs.	lbs.	ozs.		
Colewort	19	0	15	875	4	40	54
Rocket	15	1	3	320	8	18	73
Winter rape	16	2	18	641	6	33	62
Swedish turnips	15	1	25	595	8	33	62
Curled colewort	16	2	18	641	6	33	62
Turnip cabbage	13	3	19	565	4	33	61
Gold of pleasure	17	1	16	545	8	27	72
Sunflower	15	3	14	275	0	15	80
Flax	15	1	25	385	0	22	69
White poppy	10	1	18	560	8	46	52
Hemp	7	3	21	229	0	25	70
Summer rape	11	3	17	412	5	30	65

The subjoined list will serve to exhibit the richness of the produce of different Indian seeds, from which varieties of oil are extracted; it gives the proportion of oil per cent. in weight:—

Sesame oil (*Sesamum indicum*) 46.7
Black til, coloured variety of ditto (*Verbesena sativa*) 46.4
Gingelie oil (*S. orientale*) 46.7
Ground nuts, produced by *Arachis hypogoea* 45.5
Wounded seeds obtained from the Poonnay-tree (*Calophyttum Inophyllum*), a bitter lamp oil 63.7
Karunj seeds, from the *Pongamia glabra* 26.7
Ram til, the seeds of the nuts Ellu, or *Guizotia oleifera* 35
Poppy seeds (*Papaver somniferum*) 43 to 58

Silaam, an oil seed from Nepaul 41
Rape seed (*Brassica napus*) 33

The foregoing are not all the seeds from which oil is extracted by the natives of the East. In addition to this there are cottonseed oil, used for their lamps. Castor oil and Argemone seed, similarly used. Oil obtained from the fruit of *Melia Azadriachta*, for medicine and lamps. Apricot oil in the Himalayas, sunflower oil, oil of cucumber-seed for cooking and lamps, oil of colocynth seed, a lamp oil.

The seeds of bastard saffron (*Carthamus tinctorius*) yield oil.

Mustard oil, the produce of various species of *Sinapis*, &c. Shanghae oil, from *Brassica Chinensis*. Illiepie oil, from *Bassia longifolia*, which is used for frying cakes, &c., in Madras; and Muohwa oil, from another species of the same genus in Bengal, *B. latifolia*. Oil is expressed from the seeds of *Caesalpina oleosperma*, a native of the East. The neem tree seeds afford a very clear or bitter oil, used for burning.

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Wood oil is a remarkable substance, obtained from several species of *Dipterocarpus*, by simply tapping the tree.

The horse-eyes and cacoons of Jamaica (*Fevillea scandens*) yield a considerable quantity of oil or fat, as white and hard as tallow. It has been employed for similar purposes on the Mosquito shores.

The seeds of the *Argemone mexicana*, and of the *Sanguinaria canadensis*, also contain a bland, nutritious, colorless, fixed oil. The mass from which the seed is expressed is found to be extremely nutritious to cattle.

The *Camelina sativa* is cultivated in Europe, for the extraction of an oil used only by the soap makers, and for lamps.

A solid oil, of a pale greenish color, a good deal resembling the oils of the Bassia in character, though rather harder, and approaching more in properties to myrtle wax, was shown at the Great Exhibition, from Singapore. It is supposed to be the produce of the tallow tree of Java, called locally “kawan,” probably a species of Bassia. It is very easily bleached; indeed, by exposure to air and light, it becomes perfectly white; if not too costly, it promises to become a valuable oil.

According to Mr. Low, there are several varieties of solid oil commonly used in the Islands of the Archipelago, and obtained from the seeds of different species of *Dipterocarpus*.

Piney tallow is obtained from the fruit of the *Vateria Indica*, a large and quick-growing tree, abundant in Malabar and Canara. It is a white solid oil, fusible at a temperature of 97 degrees, and makes excellent candles, especially when saponified and distilled in the manner now adopted with palm oil, &c. It has one great advantage over coco-nut oil, that the candles made of it do not give out any suffocating acrid vapors when extinguished, as those made with the latter oil do.

An oil is produced from the inner shell of the cashew-nut (*Anacardium occidentale* var. *indicum*), in the East.

In Japan a kind of butter, called *mijo*, is obtained from a species of the Dolichos bean (*Dolichos soya*).

The kernel of the seeds of the tallow tree of China, *Stillingia sebifera*, an evergreen shrub, contains an oil, which, when expressed, consolidates through the cold to the consistence of tallow, and by boiling becomes as hard as bees’ wax. The plant also yields a bland oil. A similar fatty product is obtained from a shrub in British Guiana, the *Myristica (Virola) sebifera*.

Oil is obtained in South America from the sand box tree *(Hura crepitans*), and from the *Carapa guianensis*.

A fatty oil is obtained in Demerara from the seeds of the butter tree, *Pekea* (?) *Bassia butyrosa*, and also from the Saouari (*P. tuberculosa*).

The fleshy seeds contained in the woody capsules of the Monkey pot (*Lecythis Tabucajo*), which derive their generic name from their similarity to an oil jar, are common in the West India Islands and South America, and yield a considerable quantity of oil.

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The seeds of the plants of the cucumber family frequently supply a bland oil, which is used in the East as a lamp oil and for cooking. Among the vegetable oils imported into Ningpo, and other Chinese ports, from Shantong, Leatong, and Teisin, are oil of teuss, obtained from green and dried peas; black oil of the fruit of the tree *kin* (?) and oil from the pea of suchau.

The seeds of *Spergula saliva*, a large, smooth-seeded variety of the common cow spurrey, which is cultivated in Flanders as a pasture grass and green crop, afford, on expression, a good lamp oil.

A pale brownish yellow oil is obtained from the seeds of *Carthamus tinctorius*, in Bombay; the seeds contain about 28 per cent. of oil.

Excellent oil is expressed in various parts of India from the seeds of different species of *Sinapis*, especially from the black mustard seed. *S. glauca, S. dichotorna*, and *S. juncea* are extensively cultivated in the East for their oil. The *Erysimum perfoliatum* is cultivated in Japan for its oil-seeds.

A beautiful pale yellow oil is procured from the seeds of the angular-leaved physic nut, *Jatropha curcas*, a shrub which is often employed in the tropics as a fence for enclosures. It is used by the natives in medicine and as a lamp oil. About 700 tons of this oil was imported into Liverpool in 1850 from Lisbon, for the purpose of dressing cloth, burning, &c.

A rich yellow oil, perfectly clear and transparent, is obtained from the seeds of *Bergera koenigii*.

RAPE OIL.—The imports of rape oil, from *Brassica napus*, into Liverpool, are about 15 to 20 tuns annually.

Rape oil has been found to be better suited than any other oil for the lubrication of machinery, when properly purified from the mucilage, &c., which it contains in the raw state. Rape oil is now used extensively for locomotives, for marine engines, and also for burning in lamps. It is stated that a locomotive consumes between 90 and 100 gallons of oil yearly; and the annual consumption of oil by the London and North-Western Railway, for this purpose alone, is more than 40,000 gallons. The oil obtained from good English rape seed is purer and of superior quality to that from foreign or colonial seed; and as an acre of land yields nearly five quarters of seed, which is worth at present 50s. per quarter, it is a profitable crop.

Rape seed is now largely imported for expressing oil. The imports, which in 1847 were but 87,662 quarters, weighing 17,532 tons, had reached, in 1851, 107,029 quarters, weighing 21,606 tons. The price of new seed is L25 to L27 the last of ten quarters. The oil is L34 per tun.

The refuse cake, after the seed is crushed for oil, is in demand as food for cattle, being worth L4 the ton.

We imported in 1851, from Trance, 289 tuns of rapeseed oil, worth about L17,000, on which there was no duty levied.

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There are exported annually from Hesse Darmstadt, 34,660 cwts. of poppy and rape oils.

The oil of the colza is much used in Europe, and highly prized. In France it has been adopted for all the purposes of lighthouses. In this country it has lately come into extensive domestic use, for burning in the French moderateur lamps, being retailed at from 3s. 4d. to 4s. the gallon.

DOMBA OIL.—The Poonay or Palang tree (*Calophyllum Inophyllum*), the Alexandrian laurel, is a beautiful evergreen, native of the East Indies, which flourishes luxuriantly on poor sandy soils, in fact where scarcely anything else will grow. The seeds or berries contain nearly 60 per cent. of a fragrant, fixed oil, which is used for burning as well as for medicinal purposes, being considered a cure for the itch. As commonly prepared it has a dark green color. It is perfectly fluid at common temperatures, but begins to gelatinise when cooled below 50 degrees.

THE EARTH-NUT (*Arachis hypogaea, or hypocarpogea*).—This very singular plant has frequently been confounded with others, partly through the carelessness of travellers, and by the improper use of names, which tended to mislead and confuse. Its common appellative, the earth-nut, has led to the conclusion that it was a species of nut, such as is known in England under the name of “pig nut,” “hawk nut,” and “ground nut.” This, as well as the “earth chesnut,” belongs to a totally different genera. On the Continent and in the East Indies a similar confusion had long existed by the appellation of “ground pistachio,” which caused the fruit to be confounded with the nut of the tree *Pistacia vera*. Some resemblance, on the other hand, existing between these—as well as from their being eaten by different nations, and used as an article of food, and also for producing oil—rendered the true description still more difficult. Botanists are, however, no longer at a loss, having well established the nature and character of all these plants. The Arachis “nut” partakes of the nature of the pea or bean of our own country, and is a low annual plant of the order *Diadelphia decandria* of Linn.; originally from Africa, but now extensively cultivated in every quarter of the globe. It has been naturalised in Europe, and with the climate of the South of France it may be turned to good account.

It has been said to be indigenous in Florida, Peru, Brazil, and Surinam; but the plant may be grown on a light sandy soil, under a moderate heat, equal to that of Italy or the South of France. The class to which it belongs approaches to the pea tribe; but its remarkable difference to this, as to the pulse we know as a bean, is the circumstance of its introducing its fruit or pod—if we may so call it—into the earth, for the purpose of ripening its seed. The Arachis, or earth nut, has obtained its name from this operation. The flowers, leaves, and stems are produced in the ordinary manner we see in the pea tribe. When the yellow flower has withered and the seed fertilised, there is nothing left but the bare stem which had supported it. This stem, in which is the germ of the future fruit and pod, now grows rapidly in a curved manner, with a tendency to arrive shortly on the surface of the ground, into which it penetrates this now naked stem, and sinks into the earth several inches. It is in this obscure position that the fruit takes its ripened form, and is either gathered from its hiding place or left to the future season, when its time of rising into new existence calls it from what was thought its unnatural position.

When mature, it is of a pale yellow color, wrinkled, and forms an oblong pod, sometimes contracted in the middle; it contains generally two seeds. The nuts or peas are a valuable article of food in the tropical parts of Africa, America, and Asia. They are sweetish and almond-like, and yield an oil, when pressed, not inferior in use and quality to that obtained from the olive. The leaf resembles that of clover, and, like it, affords excellent food for cattle. The cake, after the oil is expressed, forms an excellent manure.

The Arachis is usually sown in dry, warm weather, from May to June, and are placed at the distance of eighteen inches from each other. Insects are fond of them; and if the season is cold and unfavorable to them, or the growth retarded, they become musty and bad, or are eaten by insects.

The mode of obtaining the oil is nearly the same as for other pulse or seeds; and under favorable circumstances the Arachis will produce half its weight of oil. When heated and pressed the quantity is very considerably increased. This oil is good for every purpose for which olive or almond oil is used. For domestic purposes it is esteemed, and it does not become rancid so quickly as other oils. Experiments have been made on its inflammable properties, and it is proved that the brilliancy of light was superior to that of olive oil, and its durability was likewise proved to be seven minutes per hour beyond the combustion of the best olive oil, with the additional advantage of scarcely any smoke. In Cochin-China and India it is used for lamps. It is known as Bhoe Moong or Moong Phullee in Bengal, and as Japan or Chinese pulse in Java.

From China this plant was probably introduced into the continent of India, Ceylon, and the Malayan Archipelago, where it is generally cultivated.

In South Carolina the seed is roasted and used as chocolate. The leaves are used medicinally.

It is grown in Jamaica, and there called Pindar nut.

That the culture of the Arachis in warm climates, or even in a temperate one, under favorable circumstances, should be encouraged, there can be but one opinion. And when it is considered that its qualities are able to supersede that of the olive and the almond, which are but precarious in their crops—to which may be added, that as a plant it is greedily devoured in the green state by cattle—how much may it not serve to assist the new settler in regions of the world which have a climate suited to it.

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It is known by various local names—such as *mani manoti* by the Spaniards, and has obtained also that of *cacahuete* in some countries. It has the additional term *hypogea* attached to it, which literally signifies subterranean. This is apt to mislead; for the plant grows above ground as other pulse, whereas only its seed and pericarp are inserted, after blooming, into the earth. Hence the better term *hypocarpogea*.

It appears to form an important article of cultivation along the whole of the west coast of Africa, and probably on the east coast, on several parts of which it was found by Loureiro ("Flor. Cochin," p. 430). It was doubtless carried from Africa to various parts of equinoctial America, for it is noticed in some of the early accounts of Peru and Brazil. 800 quarters of this nut were imported into Liverpool from the West Coast of Africa, in 1849, for expressing oil, and about half that quantity in 1850.

Eighty to 90 tuns of the expressed oil are now annually imported. The seeds contain about 44 per cent. of a clear pale yellow oil, which is largely used in India as food, and for lamps, particularly at Malwa and Bombay, &c. Two varieties are grown in Malacca, the white seed and the brown seed, and also in Java, in the vicinity of sugar plantations; the oil cake being used as manure. It is there known as katjang oil.

This plant, which seems to be a native of many parts of Asia, has within the last ten years been much cultivated about Calcutta. The seeds contain abundance of fixed oil, have a faint odor, and very mild agreeable taste; 1,950 parts of seed, separated from their coverings and blanched, give 1,405 of kernels, from which, by cold pressure, 703 parts of oil are procured. The seeds are consumed as a cheap popular luxury, being half roasted, and then eaten with salt. The oil is calculated to serve as an efficient and very cheap substitute for olive oil, for pharmaceutical purposes. It burns with little smoke, with a clear flame, and affords a very full bright light, answering perfectly in Argand lamps.

The oil cake affords, also, an excellent food for cattle.

The ground nut has of late become of considerable importance as an article of exportation, by English houses; yet more so by French houses at Ghent, Rouen, and Bordeaux; some of whom have contracted with the merchants of the African colonies for large quantities, sending shipping for the cargoes. One house alone contracted for 60,000 bushels in the years 1844 and 1845. This nut oil is so very useful to machinery that the naval steam cruisers on the coast have adopted it. A ground-nut oil factory exists in the colony of Sierra Leone; but from the want of steam power and proper machinery, and from bad management, together with the inferior attainments of the African artisan, when compared with the European mechanic, and their facilities in quantity or quality, there is abundant scope for improvement. The price in the colony

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is 4s. 6d. per gallon. It is capable of being refined so as to answer the purpose of a salad oil; the nut is prolific, and eaten by the natives and Europeans, boiled, roasted, or in its raw state; and frequently introduced at the table as we do the Spanish Barcelona nut at dessert. It grows in the rainy season, and is collected in the dry, and sold in the colony for one shilling to eighteen-pence per bushel, in goods and cash. Form of the nut, long, light shell, contains two kernels covered with a brown rind, when shelled white in appearance.

It is a low creeping plant, with yellow flowers; after they drop off, and the pods begin to form, they bury themselves in the earth, where they come to maturity. The pod is woody and dry, containing from one to three peas, or nuts, as they are called, hence the common names, ground-nut or pea-nut. They require to be parched in an oven before they are eaten, and form a chief article of food in many parts of Africa.

From a narrow strip of land, extending about 40 miles northerly from Wilmington (North Carolina), comes nearly the entire quantity of earth nuts (known as pea-nuts) grown in the United States for market. From that tract and immediate vicinity, 80,000 bushels have been carried to Wilmington market in one year.

The plant has somewhat the appearance of the dwarf garden-pea, though more bushy. It is cultivated in hills. The pea grows on tendrils, which put out from the plant and take root in the earth, where the nut is produced and ripened. The fruit is picked from the root by hand, and the vines are a favorite food for horses, mules, and cattle. From 30 to 80 bushels are produced on an acre. There are some planters who raise from 1,000 to 1,500 bushels a year.—("Hunt’s Merchant’s Magazine,” vol. xv., p. 426.)

The ground-nut is exceedingly prolific, and requires but little care and attention to its culture, while the oil extracted from it is quite equal to that yielded by the olive. Almost any kind of soil being adapted for it, nothing can be more simple than its management. All that is required is the soil to be turned over and the seed sown in drills like potatoes; after it begins to shoot it may be earthed with a hoe or plough. In many parts of Western Australia they are now grown in gardens for feeding pigs, the rich oil they are capable of yielding being entirely overlooked. In regard to their marketable value at home, I will give a copy of a letter of a friend of mine, received from some London brokers, largely engaged in the African trade:—

“Wilson and Rose present compliments to Mr. N., and beg to inform him the price of African ground nuts is as under:—Say for River Gambia, L11 per ton here. Say for Sierra Leone, L10 per ton here. For ground nuts free on board at the former port, L8 per ton is demanded; these are the finest description of nut, the freight would be about L4 per ton; the weight per bushel imperial measure, and in the shell, is about 25 lbs.”

The following, also, is an extract from a letter written in 1842, by Mr. Forster (the present M.P. for Berwick), an eminent African merchant. Speaking of the staple of Africa, he says:—

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"I have lately been attempting to obtain other oils from the coast, and it was only yesterday I received from the hands of the oil presser the result of my most recent experiment on the ground nut, which I am happy to say is encouraging. I send you a sample of the oil extracted from them. They are from the Gambia. It is a pure golden colored oil, with a pleasant flavor, free from the frequent rancidity of olive oil."

Since then the cultivation has gone on, and the exportation largely increased. The French also have entered into the trade, and several vessels are exclusively employed in exporting this product from the river Gambia, conveying it to oil factors on the continent, who extract its oil. Seeing, then, the many advantages the cultivation of such a product bestows, and its adaptation to the soil and climate of Australia, I cannot refrain from expressing a hope that some of the influential landowners in the cultivated districts will give the matter their consideration.

I am informed by an American merchant that he cleared 12,000 dollars in one year, on the single article of ground or pea nuts obtained from Africa. Strange as it may appear, nearly all these nuts are transhipped to France, where they command a ready sale; are there converted into oil, and thence find their way over the world in the shape of olive oil; the skill of the French chemists enabling them to imitate the real Lucca and Florence oil, so as to deceive the nicest judges. Indeed, the oil from the pea nuts possesses a sweetness and delicacy that cannot be surpassed.

Advices from the West Coast of Africa to the 16th August, 1853, report that the ground nut season had closed; the quantity shipped during the season having exceeded 900,000 bushels. The yield has increased 20 per cent, each year for the last three years, and it is expected the increase will be still greater in the forthcoming season.

TEUSS OIL.—The Chinese use what is called teuss or tea oil, for food and other purposes. I have alluded to it under the head of pulse, at page 312. It is obtained, however, from a species of the ground nut, and is sold in Hong Kong, at 2s. 6d. the gallon, being imported from the main land. By a local ordinance it is imperative on every householder at Victoria, Hong-Kong, to have a lamp burning over his door at night. When burning, this oil affords a clear, bright light, and is not so offensive to the smell as train and other common lamp oils.

TOBACCO SEED OIL.—A discovery, which may prove of some commercial importance, appears to have been made by a British resident in Russia, namely, that the seed of the tobacco plant contains about fifteen per cent. of an oil possessing peculiar drying properties, calculated to render it a superior medium, especially for paints and varnishes. The process employed for the extraction of the oil is to reduce the seed to powder, and knead it into a stiff paste with *quantum sufficit* of hot water, and then submit it to the action of strong fires. The oil thus obtained is exposed to a moderate heat, which, by coagulating the vegetable albumen of the seed, causes all impurities contained in the oil to form a cake at the bottom of the vessel employed, leaving the oil perfectly limpid and clear.

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POPPY OIL.—About 80 cwt. of poppy seed is imported annually into Hull, and small quantities come into other ports to be crushed into oil. The seeds of the poppy yield, by expression, 56 per cent. of a bland and very valuable oil, of a pale golden color, fluid to within ten degrees of the freezing point of water. It dries easily, is inodorous, and of an agreeable flavor like olive oil.

Dr. J.V.C. Smith, writing from Switzerland, to the editor of the "Boston Medical Journal," says:—

"Immense crops are raised here of articles wholly unknown to the American farmers, and perhaps the kinds best fitted to particular localities where grain and potatoes yield poorly under the best efforts. One of these is poppies. Thousands of acres are at this moment ready for market—which the traveller takes for granted, as he hurries by, are to be manufactured into opium. They are not, however, intended for medical use at all, but for a widely different purpose. From the poppy seed a beautiful transparent oil is made, which is extensively used in house painting. It is almost as colorless as water, and possesses so many advantages over the flax seed oil that it may ultimately supersede that article. Where flax cannot be grown poppies often can be, in poor sandy soil. Linseed oil is becoming dearer, and the demand for paint is increasing. With white lead, poppy oil leaves a beautiful surface, which does not afterwards change, by the action of light, into a dirty yellow. Another season some one should make a beginning at home in this important branch of industry. The oil may be used for other purposes, and even put in the cruet for salads."

TALLICOONAH or KUNDAH OIL, is obtained from the seeds of the *Carapa Touloucouna* (of the Flore de Senegambie). The tree grows to the height of 40 feet; the fruit is a large, somewhat globular five-celled capsule. The seeds (of which there are from 18 to 30 in each capsule), vary in size from that of a chesnut to a hen's egg. They are three-cornered, of a brownish or blackish red color. It is found abundantly in the Timneh country, and over the colony of Sierra Leone. It is manufactured in the following manner:—The nuts having been well dried in the sun, are hung up in wicker racks or hurdles, and exposed to the smoke of the huts, after which they are roasted and subjected to trituration in large wooden mortars, until reduced to a pulp. The mass is then boiled, when the supernatant oil is removed by skimming. The natives principally prepare the oil to afford light; the leaves are used by the Kroomen as a thatch. It is held in high estimation as an anthelmintic. The oil is sold in Sierra Leone at 2s. a gallon, and could be procured in abundance from the coast as an article of commerce.

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CARAP or CRAB OIL (*Carapa guianensis*).—This is a sort of vegetable butter, being sometimes solid and sometimes half fluid, which is obtained from the seed of a large tree abundant in the forests of Guiana, and also found in Trinidad. It is said to turn rancid very soon when exposed to the air, but this is probably caused by the presence of impurities, arising from the crude and imperfect way in which it is prepared by the natives, who boil the kernels, leave them in a heap for a few days, then skim them, and lastly reduce them into a paste in a wooden mortar, which is then spread on an inclined board, and exposed to the heat of the sun, so that the oil may melt and gradually trickle down into a vessel placed below to receive it. A prize medal was awarded for this oil at the Great Exhibition in 1851.

Carap oil in Trinidad is highly esteemed as an unguent for the hair, and also for applying to the wounds of animals, for destroying ticks and other insects which infest cattle—also for the cure of rheumatism. An oil called Carap oil is also obtained in the East, from the almonds of *Xylocarpus granatum*, or *Carapa Molluccensis*, of Lanark, which is used by the natives to dress the hair and anoint the skin, so as to keep off insects.

Cacao fat, the butter-like substance obtained from the seeds of *Theobroma cacao*, is esteemed as an emollient.

The nuts of the Great Macaw tree (*Acrocomia fusiformis*), a majestic species of palm, furnishes much oil. This tree is the *Cocos fusiformis*, of Jacquin, and other intertropical botanists. It is a native of Trinidad and Jamaica, and is found also very commonly in South America.

The method of extracting the oil is as follows:—The nut or kernel is slightly roasted and cleaned, then ground to a paste, first in a mill, and then on a livigating stone. This paste, gently heated and mixed with 3-10ths of its weight of boiling water, is put into a bag, and the oil expressed between two heated plates of iron; it yields about 7-10ths or 8-10ths of oil. If discolored it can be purified, when melted, by filtration. It is then of the consistence of butter, of a golden yellow hue, the odor that of violets, and the taste sweetish. If well preserved it will keep several years without spoiling, which is known to have taken place by the loss of its golden hue and delightful aroma.

It is frequently sold in the shops as palm oil, and of late has entered largely into the composition of toilet soaps. As an emollient it is said to be useful in some painful affections of the joints; the negroes deem it a sovereign remedy in “bone ache.” The nut itself is sometimes fancifully carved by the negroes, and is highly ornamental, being of a shining jet black, and susceptible of a very high polish. This tree may be increased from suckers.

A. sclerocarpa is the Macahuba palm of Brazil.

THE AGAITI, as it is called by the Portuguese, or napoota by the natives and Arabs (*Didynamia Gymosperma?*), much cultivated in all Eastern Africa for its oil, which is considered equal to that of olives, and fetches as high a price in the Indian market. The plant, which is as tall and rank as hemp, and equally productive, having numerous pods throughout the stems, is found everywhere in a wild as well as cultivated state.

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The “Cape Shipping Gazette,” of August, 1850, says:—

“The attention of the George Agricultural and Horticultural Society having been drawn to the fact that an excellent oil, equal to the olive oil of Italy, can be extracted from the kernel of the fruit known by the name of “T Kou Pijte” and “Pruim Besje,” they have offered a reward of L10 for the best sample, not less than a half aum of this oil—and L15 if it shall be adjudged equal to the best oil of Italy. This fact is deserving of notice, as an instance of the advantages which are likely to result from the attention now being devoted to the natural productions of the colony.”

Madia sativa is a handsome annual plant, native of Chili, which has been naturalised in Europe. It grows about two feet high, and produces flowers in July and August, of a pale yellow color.

The whole plant is viscid and exhales a powerful odor, which is somewhat like heated honey. It requires rather a rich soil, of a ferruginous character. The root is fusiform, the stem cylindrical, and furnished with sessile, three to five longitudinally-nerved leaves, which are apposite on the lower portion of the stem, and alternate on the upper. M. Victor Pasquier, who has written on the culture of the plant, analysed the seed, and found 100 parts to consist of 26.5 of testa, and 73.5 of kernel; 100 parts of the latter yielded 31.3 of vegetable albumen, gum, and lignine, 56.0 of *fixed oil*, and 12.5 of water. In dry seasons the oil is both more abundant and better than in damp seasons. The produce of oil, compared with that of the poppy, is equal; with colza, as 32 to 28; with linseed, 32 to 21; with the olive, 32 to 16.

The leaves and stems of this plant are rejected by cattle; but the oil-cake, which always contains a considerable portion of the oil, forms a nutritive food, of which they are very fond. The oil expressed without heat is transparent, of a golden yellow color, inodorous, rather fatter than the oil of rape or olives, and of a soft, agreeable, nutty taste. It is fit to be employed in the preparation of food, in salads, and for all the purposes of the best and mildest fixed oils. It burns with a brilliant, reddish-white flame, and leaves no residue. It is little liable to become rancid, and is completely decolorised by animal charcoal.

The oil of the seeds of this plant, now extensively cultivated in France, will yield, according to the observations of Braconnet, a solid soap, similar to that made from olive oil. Boussingault obtained from the oil a solid, as well as a fluid acid. The solid one is probably palmic acid, it fuses at exactly 140 degrees of Fahrenheit. The fluid acid in its properties resembles the oleic acid discovered by Chevreul, and seems to dry easily.

The following is the composition of each, as determined by his analysis:—

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	Solid acid.	Fluid acid.
Carbon	74.2	76.0
Hydrogen	12.0	11.0
Oxygen	13.8	13.0
	------	------
	100.	100.

COCUM OIL, or butter, is obtained from the seeds of a kind of mangosteen (*Garcinia purpurea*), and used in various parts of India to adulterate ghee or butter. It is said to be exported to England for the purpose of mixing with bears' grease in the manufacture of pomatum. It is a white, or pale greenish yellow, solid oil, brittle, or rather friable, having a faint but not unpleasant smell, melting at about 95 degrees, and when cooled after fusion remaining liquid to 75 degrees.

An excellent solid oil, of a bright green color, is obtained from Bombay, having a consistence intermediate between that of tallow and wax, fusible at about 95 degrees, and easily bleached; it has a peculiar and somewhat aromatic odor. There is some uncertainty as to the plant from which it is obtained. It was referred to the *Salvadora persica*, and to the *Vernonia Anthelminticea*, a plant common in Guzerat and the Concan Ghats.

A pale yellow clear oil is obtained from the seed of *Dolichos biflorus*(_?_). Oil is also expressed in India from the seed of the *Argemone mexicana*, which is used for lamps and in medicine; and from the seeds of the cashew nut (*Anacardium occidentale*), from *Sapindus marginatus*, and the country walnut (*Aleurites triloba*.) The fruit of the *Chirongia sapinda*, (or *Buchanania latifolia*,) yields oil. From the seeds of the *Pongamia glabra*, or *Galidupa arborea*, a honey brown and almost tasteless oil is procured, which is fluid at common temperatures, but gelatinises at 55 degrees.

Other sources of oil are the *Celastrus paniculatus* (_?_) *Balanites Egyptictca* and the saul tree (*Shorea Robusta*).

THE CANDLE-TREE or PALO BE VELAS, (*Parmentiera cereifera*, Seemann.)—This tree, in the valley of the Chagres, South America, forms entire forests. In entering them a person might almost fancy himself transported into a chandler's shop. From all the stems and lower branches hang long cylindrical fruits, of a yellow wax color, so much resembling a candle as to have given rise to the popular appellation. The fruit is generally from two to three, but not unfrequently four feet long, and an inch in diameter. The tree itself is about 24 feet high, with, opposite trifoliated leaves, and large white blossoms, which appear throughout the year, but are in greatest abundance during the rainy season. The *Palo de Velas* belongs to the natural order *Crescentiaceae*, and is a *Parmentiera*, of which genus hitherto only one species, the *P. edulis*, of De Candolle, was known to exist. The fruit of the latter, called *Quauhscilote*, is eaten by the Mexicans, while that of the former serves for food to numerous herds of cattle.

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Bullocks especially, if fed with the fruit of this tree, guinea-grass, and *Batatilla* (*Ipomoea brachypoda*, Benth.), soon get fat. It is generally admitted, however, that the meat partakes in some degree of the peculiar apple-like smell of the fruit, but this is by no means disagreeable, and easily prevented, if, for a few days previous to killing the animal, the food is changed. The tree produces its principal harvest during the dry season, when all the herbaceous vegetation is burned up, and on that account its cultivation in tropical countries is especially to be recommended; a few acres of it would effectually prevent that want of fodder which is always most severely felt after the periodical rains have ceased.—("Hooker's Journal of Botany.")

CINNAMON SUET is extracted by boiling the fruit of the cinnamon. An oily fluid floats on the surface, which on cooling subsides to the bottom of the vessel, and hardens into a substance like mutton suet. The Singhalese make a kind of candles with it, and use it for culinary purposes. It emits a very pleasant aroma while burning. According to the analysis of Dr. Christison, it contains eight per cent, of a fluid not unlike olive oil; the remainder is a waxy principle.

CROTON OIL is obtained by expression from the seeds or nuts of *Croton Tiglium*, an evergreen tree, 15 to 20 feet in height, belonging to the same order as the castor oil plant, producing whitish green flowers, and seeds resembling a tick in appearance, whence its generic name. It is a native of the East Indies. 100 parts of seeds afford about 64 of kernel. 50 quarters of croton nuts for expressing oil were imported into Liverpool from the Cape Verd Islands, in 1849.

The *Croton Tiglium* grows plentifully in Ceylon, and the oil, if properly expressed, might be made an article of trade. The best mode of preparing it is by grinding the seeds, placing the powder in bags, and pressing between plates of iron; allow the oil to stand for fifteen days, then filter. The residue of the expression is triturated with twice its weight of alcohol, and heated on the sand-bath from 120 to 140 degs. Fahrenheit, and the mixture pressed again. In this step the utmost caution is necessary in avoiding the acrid fumes. One seer of seed furnishes by this process rather more than eleven fluid ounces of oil, six by the first step, and five by alcohol.

The oil acts as an irritant purgative in the dose of one drop. In large doses it is a dangerous poison. When applied externally it produces pustules.

In 1845, eight cases of croton oil and six cases of the seed were exported from Ceylon.

Other species of Croton, as *C. Pavana*, a native of Ava and the north-eastern parts of Bengal, and *C. Roxburghii*, yield a purgative oil. The bark of *C. Eleuteria*, *C. Cascarilla*, and other species is aromatic, and acts as a tonic and stimulant. It forms the cascarilla bark of commerce already spoken of. When bruised, it gives out a musky odor and is often used in pastilles.

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The oil obtained from the seeds of *Jatropha curcas*, a native of South America and Asia, is purgative and emetic, and analagous in its properties to croton oil. It is said to be a valuable external application in itch. In India it is used for lamps.

OIL OF BEN, known as Sohrinja in Bengal, and Muringo in Malabar is obtained from the seeds or nuts of the horseradish tree, *Moringa pterygosperma*, Burmann; the *Hyperanthera Moringa*, of Linnaeus. This clear limpid oil having no perceptible smell, is much esteemed by watchmakers and perfumers; it is expensive and not often to be procured pure, consequently the oil would be a very profitable export. It grows rapidly and luxuriantly everywhere in Jamaica, particularly on the north side of the island—as well as Trinidad and other quarters of the West. It is easily propagated either by cuttings from the tree (the branches) or by seeds, and bears the second year. The produce of each tree may be estimated at from one to two gallons. From the flowers a very pleasant perfume might be easily distilled.

The following account I derive from my friend Dr. Hamilton—

“It is a small tree, of about twenty feet in height, of most rapid growth, coming into flower within a few months after it has been sown, and continuing to produce seeds and blossoms afterwards throughout the year. The tree is now naturalised in the West Indies. The timber is said to dye a fine blue, and the gum, which, exudes from wounds in the bark, bears a strong resemblance to that obtained from the *Astragalus tragacantha*, for which it might, no doubt, be substituted.The numerous racemes of white blossoms with which the tree is constantly loaded, are succeeded by long triangular pods, somewhat tourlose at the ends, and about two feet in length, when arrived at the full growth. These pods, while yet young and tender, are not unfrequently cooked and served up at the planter’s tables like asparagus, for which they are not a bad substitute. The pods, when full grown, contain about fifteen seeds; each considerably larger than a pea, with a membraneous covering expanding into three wings, whence the specific name of *pterygosperma*. On removing the winged envelope the seeds appear somewhat like pith balls; but upon dividing them with the nail, they are found to abound in a clear, colorless, tasteless, scentless oil, of which the proportion is so large that it may be expressed from good fresh seeds by the simple pressure of the nail. Geoffry informs us, that he obtained 301/2 ounces of oil from eight pounds of the decorticated seeds, being at the rate of very nearly 24 lbs. of oil from 100 lbs. of seed.Notwithstanding the great value of its oil, and the facility with which it can be obtained in the West Indies, the moringa has been hitherto valued merely as an ornamental shrub, and cultivated for the sake of its young pods or the horseradish

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of its roots, as luxuries for the table.The oil is peculiarly valuable for the formation of ointments, from its capability of being kept for almost any length of time without entering into combination with oxygen. This property, together with the total absence of color, smell, and taste, peculiarly adapts it to the purposes of the perfumer, who is able to make it the medium for arresting the flight of those highly volatile particles of essential oil, which constitute the aroma of many of the most odoriferous flowers, and cannot be obtained by any other means, in a concentrated and permanent form. To effect this, the petals of the flowers, whose odor it is desired to obtain, are thinly spread over flakes of cotton wool saturated with this oil, and the whole enclosed in air tight tin cases, where they are suffered to remain till they begin to wither, when they are replaced by fresh ones, and the process thus continued till the oil has absorbed as much as was desired of the aroma; it is then separated from the wool by pressure, and preserved under the name of *essence*, in well stopped bottles.By digesting the oil thus impregnated in alcohol, which does not take up the fixed oil, a solution of the aroma is effected in the spirit, and many odoriferous tinctures or waters, as they are somewhat inaccurately termed, prepared. By this process most delicious perfumes might be obtained from the flowers of the *Acacia tortuosa*, *Pancratium carribeum*, *Plumeria alba*, *Plumeria rubra*, and innumerable other flowers, of the most exquisite fragrance, which abound within the tropics, blooming unregarded, and wasting their odors on the barren air.”

THE OIL PALM.

There are several species of this genus of beautiful palms of the tribe *Cococinae*, but that chiefly turned to account is *Elais guineensis*, a native of the Coast of Guinea to the south of Fernando Po, which furnishes the best oil.

There are three other varieties—*E. melanococca*, a native of New Granada, *E. Pernambucana*, common on the coast of Brazil, and *J. occidentalis*, indigenous to Jamaica. All the species grow well in a sandy loam and may be increased by suckers.

The value of the oil of this palm, as an article of commerce, is exemplified by the large annual imports, averaging more than 516,000 cwt. for many years past.

Our supplies of palm oil are almost wholly derived from the West Coast of Africa, of which it is the staple article of export.

Palm oil has the greatest specific gravity of any of the fixed vegetable oils. It is used principally in this country for making yellow soap. But the inhabitants of the Guinea coast employ it for the same purposes that we do butter.

The trade in palm oil has almost driven out the slave trade from the Bight of Benin, which was a few years ago one of its principal seats. The old slave traders at Whydah have generally gone into the palm oil trade, and are carrying it on to a very great extent. In August 1849, no less than twelve vessels were lying at that port taking in oil; whilst, only three years before, it was rare to see three vessels there at once, and of those in all probability two would be slavers.

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This palm is called Maba by the natives about the Congo river. It is moneocious, which indeed Jacquin, by whom the genus was established, concluded it to be, although first described as dioecious by Gaertner, whose account has been adopted, probably without examination, by Schroder, Willdenow, and Persoon.

The average imports of this oil into Liverpool alone, have now been for some years upwards of 18,000 tons, worth nearly L800,000 sterling, and giving employment to upwards of 30,000 tons of shipping; thus proving that the natives who formerly exported their brethren as a matter of traffic, now find, at least, an equally profitable trade in the exportation of the vegetable products of their native soil.

Palm oil is produced by the nut of the tree, which grows in the greatest abundance throughout Western Africa. The demand for it, both in Europe and America, is daily increasing, and there is no doubt it will, ere long, become the most important article of African trade.

IMPORTS INTO LIVERPOOL.

	casks.	tons.
1835	28,500	9,500
1836	33,500	11,000
1837	26,000	9,900
1838	27,520	10,320
1839	36,500	14,300
1852 about	—	23,500

In the colony of Liberia, I notice the manufacture of a new article of African production, which is called “Herring’s Palm Kernel Oil or African Lard.” It is thus spoken of in the newspapers of that Republic :—

We had been for a long time impressed with an idea that the oil contained in the kernel of the palm nut, was superior both in quality and appearance to that of palm oil, which is obtained from the exterior part.On making an effort to extract the oil from the kernel (which was by means of a little machine, of our own invention and contrivance), we found that our thoughts upon the matter were correct, that the oil possessed admirable beauty in its appearance, with a taste, when used for cooking purposes, unexcelled by that of the best lard.After being made and set by, it assumes a consistence like that of hard butter, and has to be cut out with a knife or spoon; its appearance in this state is very beautiful, presenting such richness, clearness, and adaptedness to table purposes, that one would not suppose that this oil is obtained from the same tree from which palm oil is, for there is as much disparity both in their appearance and taste as there is between lard and butter.The exquisite transparency which the kernel oil bears in a liquid state, especially when undergoing the purifying process, is a cause of admiration. On showing some of it to several foreigners, I was asked in two instances which was the oil and which the water, or whether it was oil or water; thus you may have an idea of its clearness. We make two qualities of this oil,

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differing however in taste only, the one being for table uses and the other for exportation and for whatever use they may choose to put it to abroad.There have been many conjectures in respect to the uses to which this oil might he put in foreign countries; but that it will be a useful article, and especially in our trade, when made more extensively, there can be no doubt, for the quantity in which it might be had would undoubtedly introduce it to a respectable rank among the other commodities of our productive country so eagerly sought after.There is nothing, to my knowledge, that can be turned to as good account and at the same time so abundant and easily obtained, as the palm kernel, for they are as common as the pebbles of stony land, especially in this section of the country, where we have palm orchards of spontaneous growth for miles together, and interspersing the surrounding country in almost innumerable numbers.According to statistical ascertainment, there is on an average exported from this port, thirty thousand gallons of palm oil annually, from which fact we ascertain demonstratively that the palm kernels which are thrown away here (leaving out the whole leeward coast of our possessions) are sufficient to make thirty thousand gallons of oil, more or less. This is not at all a problematical speculation of ours, but we feel authorised to advance this assertion from the fact that one bushel of kernels, completely worked up, will make two gallons of oil. But to work them up is the thing, plentiful as they are; we however, hesitate not to say, that it can be done and probably will be.Having now so far conquered the difficulties attending the manufacture of this oil, as that we can safely vouch a reasonable supply for home consumption, we most cheerfully recommend it to the citizens of this Republic, whose demands for it, for eating purposes, we doubt not can be supplied, and on very reasonable terms.

> We will assure our customers that there will not be an ounce of dirt
> or sediment in a hundred pounds of our oil.

The recent abolition of the soap duty, by stimulating the demand for palm oil, will have an instant effect on the trade and commerce of Western Africa, by confirming the suppression of the slave trade, and giving an additional impetus to negro improvement. It will also increase the production for England of ground nuts, whence the oil so largely used in making continental soaps is expressed. “When (observes a recent writer) the Portuguese first treated with that coast, they found palm oil and ground nuts articles of native food, and so they remained down to a period within living memory. So used, they neither required any cultivation nor gave rise to any notions of property. Though whole tracts of country are crowded by the oil-palm tree, little care was taken of what was, in fact, superabundant; and as for ground nuts, they were simply dug up as prudence or necessity dictated. Some thirty years ago a cask or two of palm oil was sent home from the Gold Coast; it met so ready a sale that it was further inquired after, and the total amount now imported into England ranges from 25,000 to 30,000 tons annually. The exportation of ground nuts is even larger; but, owing to our excise on soap, they had heretofore gone principally to France——to Marseilles especially.

“Of these two articles, it is to be observed, the Western Coast of Africa appears to have a monopoly; and with respect to palm oil, it is further to be remarked, that it is exactly behind those ports and up those rivers, which were formerly the great nests of the slave trade, that its production is largest; and just as the slave trade there has been crushed, a commerce in palm oil has sprung up and replaced it. There are men alive who recollect the slave trade flourishing on the Gold Coast; it has long been extinct there, and palm oil is now largely exported. It is but a very few years ago since that traffic appeared to be irrepressible at the mouths of the Niger: it is now expelled, and thence Liverpool obtains, instead, its supplies of palm oil. So also, later still, at Whydah, and the other ports of the kingdom of Dahomy, and along the Lagoon, which connects Dahomy with the Benin River, there the Spanish slave dealers are themselves inaugurating a commerce in palm oil. Already the trade in that quarter is considerable, and it would have extended much more rapidly than it has done, were it not that disorder and warfare in the interior have been promoted and prolonged by the indiscreet zeal of some of our own naval officers and by the desire of some of our missionaries to rule at Abeeokutu, at Lagos, and at Badagray. When, however, order and tranquillity are restored, a most important trade will undoubtedly arise there. A generation ago, when palm oil was merely an article of food, there was, we have said, no property in palm trees. Since, however, a large foreign demand has arisen for this oil, the plantations, as already they are called, begin to be cared for; and lately the title to some of them has been disputed in our courts on the Gold Coast: a contention which constitutes the first evidence we have received of the value of land, not actually under their own cultivation, being recognised by the natives. Thus the feeling of property and the desire for accumulation are springing up out of the palm oil trade; and they are everywhere the germs of nascent civilisation. It is no light question, therefore, thus involved in an increased demand for this article; it may produce African consequences of incalculable importance to the whole human race. It is in France hitherto that the great consumption of ground nut oil has occurred. It is there used in the manufacture of soaps, which, though preferred abroad, are little used in England—very much because of the Excise laws. The specific gravity of the soap made out of ground nut oil is higher than those laws permitted; in consequence we could neither make it for our own use nor for foreign exportation; and thus France has substantially the soap trade of the world. By the repeal of the duty, England will be enabled to compete—in this, as in all other trades—with France abroad.”

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The price, in Liverpool, for palm oil, in October, 1853, was L38 10s. to L39 per ton.

We export annually nearly four million gallons of oil made from linseed, hemp seed, and rape seed.

PALM OIL RETAINED FOR HOME CONSUMPTION

	cwts.
1835	242,733
1836	234,357
1837	211,919
1838	272,991
1839	262,910
1840	314,881
1841	300,770
1842	353,672
1843	377,765
1844	363,335
1848	510,218
1849	493,331
1850	448,589
1851	493,598
1852	408,577

The quantity of the four principal vegetable oils annually imported into Great Britain, is shown by the following figures:—

	Palm oil.	Coco-nut oil.	Castor oil.	Olive oil.
	cwts.	cwts.	cwts.	tuns.
1848	510,218	85,463	4,588	10,086
1849	493,331	64,452	9,681	16,964
1850	448,589	98,040	—	20,738
1851	608,550	55,995	—	11,503
1852	623,231	101,863	—	8,898

THE OLIVE-TREE (*Olea Europea*).—There are several varieties of this plant, two of which have been long distinguished—the wild and the cultivated. The former is an evergreen shrub or low tree, with spiny branches and round twigs; the latter is a taller tree, without spines, and with four-angled twigs. The fruit is a drupe about the size and color of a damson. Its fleshy pericarp yields by expression olive oil, of which the finest comes from Provence and Florence. Spanish or Castile soap is made by mixing olive oil and soda, while soft soap is made by mixing the oil with potash.

The wild olive is indigenous to Syria, Greece, and Africa, on the lower slopes of Mount Atlas. The cultivated species grows spontaneously in Syria, and is easily reared in Spain, Italy and the South of France, various parts of Australia and the Ionian Islands. Wherever it has been tried on the sea-coasts of Australia, the success has been most complete. There are several fine trees near Adelaide, some of them fourteen feet high, bearing fruit in abundance. Unfortunately no one has attempted to cultivate the plant on a large scale, but in a few years Australia ought to suply herself with olive oil.

The olive tree is also grown in Hong-Kong.

There are five or six varieties of *O. Europoea*, or *sativa*, grown in the south of Europe, of which district they are for the most part natives.

The entire exports of olive oil from the kingdom of Naples have been estimated at 36,333 tuns a year, which, taken at its mean value when exported at L62 per tun, is equivalent to the annual sum of L2,252,646.

There are one or two distinct species, natives of the East Indies and the Cape of Good Hope. This genus of plants, besides their valuable products of oil and fruit, are also much admired for the fragrance of their white flowers. There is a yellow-blossomed variety, native of China, *O. fragrans*, the Lan-hoa of the Chinese, which is used to perfume their teas.

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Olive oil now forms an article of export from Chili, being grown in most parts of that republic, particularly in the vicinity of St. Jago, where trees of three feet in diameter, and of a proportionate height, are common. The olive was first carried from Andalusia to Peru in 1560, by Antonio de Ribera, of Lima. Frezier speaks of the olive being used for oil in Chili, a century and a half ago.

The culture of the olive has been recommended for Florida and most of the Southern States of America. Formerly, on account of its slow growth, the olive was not considered very useful; but some years since a new variety was introduced into France, and into some parts of Spain and Portugal, which yields an abundant crop of fruit the second year after planting. They are small trees or rather shrubs, about four or five feet high. The fruit is larger than the common olive, is of a fine green color when ripe, and contains a great deal of oil, The advantages accruing from this new mode of cultivating the olive tree, are beyond all calculation. By the old method an olive tree does not attain its full growth, and consequently does not yield any considerable crop under thirty years; whereas the new system of cultivating dwarf trees, especially from cuttings, affords very abundant crops in two or three. An acre of land can easily grow 2,500 trees of the new variety, and the gathering of the fruit is easy, as it can be done by small children. At Beaufort, South Carolina, the olive is cultivated from plants which were obtained in the neighbourhood of Florence, Italy.

A gentleman in Mississippi is stated, by an American agricultural journal, to have olive trees growing, which at five years from the cutting bore fruit, and were as large at that age as they usually are in Europe at eight years old. The olive then, it is added, will yield a fair crop for oil at four years from the nursery, and in eight years a full crop, or as much as in Europe at from fifteen to twenty years of age.

The lands and climate there are stated to be as well adapted to the successful cultivation of the olive for oil, pickles, &c., as any part of Europe. Some hundreds of the trees are grown in South Carolina, and the owner expressed his conviction that this product would succeed well on the sea-coast of Carolina and Georgia. The frosts, though severe, did not destroy or injure them, and in one case, when the plant was supposed to be dead, and corn was planted in its stead, its roots sent out shoots. It is well known to be a tree of great longevity, even reaching to 1,000 or 1,200 years; so that, when once established, it will produce crops for a great while afterwards. The expense of extracting the oil is also stated to be but trifling.

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The olive is of slow growth; trees 80 years of age measure only from 27 to 30 inches in circumference at the lower part of their trunks. An olive tree is mentioned by M. Decandolle as measuring above 23 feet in circumference, which, judging from the above inferences, may be safely estimated at 700 years old. Two other colossal olives are recorded, one at Hieres, measuring in circumference 36 feet, and one near Genoa, measuring 38 feet 2 inches. The produce in fruit and oil is regulated by the age of the trees, which are frequently little fortunes to their owners. One at Villefranche produces on an average, in good seasons, from 200 to 230 pounds of oil. The tree at Hieres, above-mentioned, produces about 55 imperial gallons.

The olive is found everywhere along the coast of Morocco, but particularly to the south. The trees are planted in rows, which form alleys, the more agreeable because the trees are large, round, and high in proportion. They take care to water them, the better to preserve the fruit. Oil of olives might be here plentifully extracted were taxation fixed and moderate; but such has been the variation it has undergone, that the culture of olives is so neglected as scarcely to produce oil sufficient for domestic consumption.

Olive oil might form one of the most valuable articles of export from Morocco. It is strong, dark, and fit only for manufacturing purposes. This is, perhaps, not so much the fault of the olive as of the methods by which it is prepared. No care is taken in collecting the olives. They are beaten from the trees with poles, as in Portugal and Spain, suffered to lie on the ground in heaps until half putrified, then put into uncleaned presses, and the oil squeezed through the filthy residuum of former years. Good table oil might be made, if care were taken, as in France and Lucca, to pick the olives without bruising them, and to press only those that were sweet and sound. But such oil would ill suit the palate of a Maroqueen, accustomed to drink by the pint and the quart the rancid product of his country.

The olive is the great staple of Corfu, which has, in fact, the appearance of an extensive olive grove. It produces annually about 200,000 barrels. Olive oil is also produced for the purposes of commerce, and for local consumption, by France, Algiers, Tuscany, Spain, Sardinia, Portugal, Madeira, and South Australia.

Olive plantations are extending considerably both in Upper and Lower Egypt. Large quantities of trees were planted under the direction of Ibrahim Pasha.

The olive tree might be expected to be quickly matured at the Cape. The native olive, resembling the European, is of spontaneous growth and plentiful, so that if the Spanish or Italian tree were introduced, there is no doubt of its success. The wood of the olive is exceedingly hard and heavy, of a yellowish color, a close fine grain, capable of the highest polish, not subject to crack nor to be affected by worms. The root, in consequence of its variety of color, is much used for snuff-boxes and similar bijouterie.

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The wood is beautifully veined, and has an agreeable smell. It is in great esteem with cabinet makers, on account of the fine polish of which it is susceptible.

The sunny slopes of hills are best suited to its natural habits. Layering is the most certain mode of propagating this fruit, although it grows freely from the seed, provided it has first been steeped for twelve hours in hot water or yeast.

Olives intended for preservation are gathered before they are ripe. In pickling, the object is to remove their bitterness and preserve them green, by impregnating them with a brine. For this purpose various methods are employed. The fruit being gathered are placed in a lye, composed of one part of quicklime to six of ashes of young wood sifted. Here they remain for half a day, and are then put into fresh water, being renewed every 24 hours; from this they are removed into a brine of common salt dissolved in water, to which add some aromatic plants. The olive will in this manner remain good for twelve months. For oil, the ripe fruit is gathered in November; the oil, unlike other plants, being obtained from the pericarp, and immediately bruised in a mill, the stones of which are set so wide as not to crush the kernel. The pulp is then subjected to the press in bags made of rushes; and, by means of a gentle pressure, the best or virgin oil flows first. A second, and afterwards a third quality of oil is obtained, by moistening the residuum, breaking the kernel, &c., and increasing the pressure. When the fruit is not sufficiently ripe, the recent oil has a bitterish taste, and when too ripe it is fatty.

The following are the present market prices of olive oil in Liverpool, (October, 1853,) and they are 40 per cent, higher than a few years ago:—Galipoli, per tun of 252 gallons, L68; Spanish, L64; Levant, L60. French olives, in half barrels of two gallons, are worth L3 to L4; Spanish, in two gallon kegs, 9s. to 10s.

The preserved or pickled olives, so admired as an accompaniment to wine, are, as we have seen the green unripe fruit, deprived of part of their bitterness by soaking them in water, and then preserved in an aromatised solution of salt.

The marc of olives after the oil has been expressed, indeed, the refuse cake of all oil plants, is most valuable, either as manure or for feeding cattle.

More than 29,000 acres are under culture with the olive in the Austrian empire, Venice, Dalmatia, Lombardy, Carinthia, and Carniola. The climate of Dalmatia is highly suitable for the olive, and the oil is better than that produced in most parts of Italy. Nearly 17,000 cwt. are annually obtained.

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In 1837 there were 11,526 acres of ground under cultivation with olives in Southern Illyria, which yielded 261,800 gallons. Olives and sumach form the principal crops of the landholder. I have not been able to get any recent correct statistics of the culture and produce. The oil of Istria is considered equal to that of Provence. The stones and refuse are used there for fuel. The olive is also extensively cultivated in the Quarnero Islands, especially Veglia and Cherso, and in Corfu. There were in 1836, 219,339 acres under cultivation in the Ionian Islands, producing 113,219 barrels. The olive is gathered there in December. The average price of the barrel of olive oil was 48s. 3d. Nearly two millions of gallons of olive oil were exported from Sicily in 1842. Naples alone shipped five millions of gallons in 1839, and about 2,500 cwts. of oil is shipped annually from Morocco. Russia imports about 500,000 poods (40 lbs. each) of olive oil annually.

“Provence oil, the produce of Aix, is the most esteemed. Florence oil is the virgin oil expressed from the ripe fruit soon after being gathered; it is imported in flasks surrounded by a kind of network formed by the leaves of a monocotyledonous plant, and packed in half chests; it is that used at table under the name of salad oil. Lucca oil is imported in jars holding nineteen gallons each. Genoa oil is another fine kind. Galipoli oil forms the largest portion of the olive oil brought to England, it is imported in casks. Apulia and Calabria are the provinces of Naples most celebrated for its production; the Apulian is the best. Sicily oil is of inferior quality; it is principally produced at Milazzo. Spanish oil is the worst. The foot deposited by olive oil is used for oiling machinery, under the name of’ droppings of sweet oil.’”—("Pereira’s Materia Medica.”)

The manufacture of olive oil in Spain has undergone very considerable improvement during the last few years; in particular, the process for expressing the oil has been rendered more rapid and effectual by the introduction of the hydraulic press, and thus the injurious consequences which resulted from the partial fermentation of the fruit are avoided.

There are four different kinds of oil known in the districts where it is prepared.

1. *Virgin oil*—A term which is applied, in the district Montpellier, to that which spontaneously separates from the paste of crushed olives. This oil is not met with in commerce, being all used by the inhabitants, either as an emollient remedy, or for oiling the works of watches. A good deal of virgin oil is, however, obtained from Aix.

2. *Ordinary oil*.—This oil is prepared by pressing the olives, previously crushed and mixed with boiling water. By this second expression, in which more pressure is applied than in the previous one, an oil is obtained, somewhat inferior in quality to the virgin oil.

3. *Oil of the infernal regions*.—The water which has been employed in the preceding operation is in some districts conducted into large reservoirs called the *infernal regions*, where it is left for many days. During this period, any oil that might have remained

mixed with the water separates and collects on the surface. This oil being very inferior in quality, is only fit for burning in lamps, and is generally locally used.

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4. *Fermented oil* is obtained in the departments of Aix and Montpellier, by leaving the fresh olives in heaps for some time, and pouring boiling water over them before pressing the oil. But this method is very seldom put in practice, for the olives during this fermentation lose their peculiar flavor, become much heated, and acquire a musty taste, which is communicated to the oil.

The fruity flavor of the oil depends upon the quality of the olives from which it is pressed, and not upon the method adopted in its preparation,"—(French "Journal de Pharmacie.")

The price of olive oil is sufficiently high to lead to its admixture with cheaper oils. The oil of poppy seeds is that which is usually employed for its adulteration, as it has the advantage of being cheap, of having a sweet taste, and very little smell. M. Gobley has invented an instrument which he calls an areometer, to detect this fraud. It is founded on the difference between the densities of olive oil and oil of poppies.

The imports, which in 1826 were only 742,719 gallons, had risen in 1850 to 5,237,816 gallons. The following figures show the progressive imports and consumption:—

	Imported.	Retained for home consumption.
	gallons.	gallons.
1827	1,028,174	1,070,765
1831	4,158,917	1,928,892
1835	606,166	554,196
1839	1,793,920	1,806,178
1843	3,047,688	2,516,724
1847	2,190,384	—
1848	2,541,672	—
1849	4,274,928	—
1850	5,860,806	—
1851	2,898,756	2,749,572
1852	2,242,296	1,066,400

The imports of olive oil into the port of Liverpool were 9,815 tuns in 1849, and 10,038 tuns in 1850. It was brought from Manila, Malaga, and Corfu, but chiefly from Barbary, Palermo, Gallipoli, and the Levant. In 1850 we imported from France 259,646 imperial gallons of olive oil, officially valued at L34,638; the average in ordinary years is only about 20,000 gallons from the continent.

ALMOND OIL.—To the south of the Empire of Morocco there are forests of the Arzo tree, which is thorny, irregular in its form, and produces a species of almond exceedingly hard. Its fruit consists of two almonds, rough and bitter, from which an oil is produced, very excellent for frying. In order to use this oil it requires to be purified by fire, and set in a flame, which must be suffered to die away of itself; the most greasy particles are thus consumed, and its arid qualities wholly destroyed. “When the Moors gather these fruits they drive their goats under the trees, and as the fruit falls the animals carefully nibble off the skins, and then greedily feed.

The oil of almonds is more fluid than olive oil, and of a clear, transparent, yellowish color, with a very slight odor and taste. It is occasionally employed for making the finer kinds of soap, and also in medicine.

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In manufacturing it the fruit are first well rubbed or shaken in a coarse bag or sack, to separate a bitter powder which covers their epidermis. They are then pounded to a paste in mortars of marble, which paste is afterwards subjected to the action of a press, as in the case of the olive.

About 80 tuns of almond oil are annually imported into this country, the price being about 1s. per pound. Five-and-a-half pounds of almond oil will yield by cold expression one pound six ounces of oil, and three-fourths of a pound more if the iron plates are heated.

SESAME OR TEEL.—Of this small annual plant there are two or three species. *Sesamum orientale*, the common sort; and *S. indicum*, a more robust kind, cultivated at a different season, are both natives of the East Indies. *S. indicum* bears a pale purple flower, and *S. orientals* has a white blossom. It is the latter which is chiefly grown, and the seeds afford the Gingellie oil or suffed-til, already extensively known in commerce in the East. The expressed oil is as clear and sweet as that from almonds, and probably the Behens oil, used in varnish, is no other. It is called by the Arabs “Siriteh,” and the seed, “bennie " seed, in Africa. *S. orientals* is grown in the West Indies under the name of “wangle.” It is said to have been first brought to Jamaica by the Jews as an article of food. 1,050 bags of gingelly teel, or sesame seed, were imported into Liverpool, in 1849, from the East, South America, and Africa, for expressing oil, and 3,700 bags in 1850. There are two kinds of seed, light and dark, and it is about the same size as mustard seed, only not round.

A hectare of land in Algeria yields 1,475 kilogrammes of seed, which estimated at 50 cents the kilogramme, amounts to 737 francs, whilst the cost of production is only 259 francs, leaving a profit of 478 francs (nearly L20). The oil obtained from this seed is inferior to good olive oil, but is better adapted for the manufacture of soap.

This plant is not unlike hemp, but the stalk is cleaner and semi-transparent. The flower also is so gaudy, that a field in blossom looks like a bed of florist’s flowers, and its aromatic fragrance does not aid to dispel such delusion. It flourishes most upon land which is light and fertile. The fragrance of the oil is perceptibly weaker when obtained from seed produced on wet, tenacious soils. A gallon of seed seems to be the usual quantity sown upon an acre. In Bengal, *S. orientale* is sown during February, and the crop harvested at the end of May; but *S. indicum* is sown on high, dry soil, in the early part of the rains of June, and the harvest occurs in September. About Poonah it is sown in June and harvested in November. In Nepaul two crops are obtained annually; one is sown as a first crop in April and May, and reaped in October and November; the other as an autumn crop, after the upland rise in August and September, and reaped in November and December.

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In Mysore, after being cut it is stacked for a week, then exposed to the sun for three days, but gathered into heaps at night; and between every two days of such drying, it is kept a day in the heap. By this process, the pods burst and shed their seeds without thrashing.

The seeds contain an abundance of oil, which might be substituted for olive oil; it is procured from them in great quantities, in Egypt, India, Kashmir, China, and Japan, where it is used both for cooking and burning. It will keep for many years and not acquire any rancid smell or taste, but in the course of a year or two becomes quite mild, so that when the warm taste of the seed, which is in the oil when first expressed, is worn off, it is used for all the purposes of salad oil. It possesses such qualities as fairly entitle it to introduction into Europe; and if divested of its mucilage, it might perhaps compete with oil of olives, at least for medicinal purposes, and could be raised in any quantity in the British Indian Presidencies. It is sufficiently free from smell to admit of being made the medium for extracting the perfume of the jasmine, the tuberose, narcissus, camomile, and of the yellow rose. The process is managed by adding one weight of flowers to three weights of oil in a bottle, which being corked is exposed to the rays of the sun for forty days, when the oil is supposed to be sufliciently impregnated for use. This oil, under the name of Gingilie oil, is used in India to adulterate oil of almonds.

The flour of the seed, after the oil is expressed, is used in making cakes, and the straw serves for fuel and manure.

The oil is much used in Mysore for dressing food, and as a common lamp oil. From 200 to 400 quarters under the name of Niger seed are imported annually into Liverpool for expressing oil.

Three varieties of Til are extensively cultivated throughout India, for the sake of the fine oil expressed from their seeds, the white seeded variety, the parti-colored, and the black. It is from the latter that the sesamum or gingelly oil of commerce is obtained. Sesamum seed contains about 45 per cent. of oil. Good samples of the oil were shown at the Great Exhibition from Vizianagram, Ganjain, Hyderabad, Tanjore, the district of Moorshedabad, and Gwalior. The gingelly seed is stated to be worth about L4 per ton in the North Circars.

An oil resembling that of sesamum is obtained from the seed of *Guizotea oleifera* and *Abyssinica*, a plant introduced from Abyssinia, and common in Bengal. The ram til, or valisaloo seeds, yield about 34 per cent, of oil. The oil is generally used for burning, and is worth locally about 10d. per gallon.

BLACK TIL (*Verbesena sativa*).—This is known as kutsela or kala til, in the Deccan. It is chiefly cultivated in Mysore and the western districts of Peninsular India, as well as in the Bombay presidency.

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About Seringapatam, as soon as the millet crop has been reaped the field is ploughed four times, and the seed sown, a gallon per acre, during the month of July or August, after the first heavy rain. No manure or weeding is required, for the crop will grow on the worst soils. It is reaped in three months, being cut close to the ground, and stacked for a week. After exposure to the sun for two or three days, the seed is beaten out with a stick. The crop in Mysore rarely yields two bushels per acre, but about Poonah the produce is much larger. The seed is sometimes parched and made into sweetmeats, but is usually grown for its oil. This is used in cooking, but it is not so abundant in the seed, nor so good as that of the sesame. Bullocks will not eat the stems unless pressed by hunger.

About 5,000 maunds are exported annually from Calcutta. 3,703 bags were imported into Liverpool in 1851. The price per quarter of eight bushels, in January, 1853, was from 30s. to L2; of teel oil, in tins, weighing 60 to 100 pounds, L2 to L2 4s.

Bombay linseed was worth L2 11s. to L2 12s. the quarter of eight bushels, in January, 1853. Bengal ditto 2s. less. The imports into Liverpool were 68,468 bags and 54,834 pockets in 1851, and 14,490 bags and 33,700 pockets in 1852. About 9,000 bags of mustard seed and from 18,000 to 20,000 bags of rape seed are also imported thence. The price of the latter is about L2 the quarter.

NATIVE OIL MILLS.—The principal native oil mill of India, of which, however, there are some varieties, consists of a simple wooden mortar with revolving pestle. It is in common use in all Belgaum and Bangalore. Two oxen are harnessed to the geering, which depends from the extremity of the pestle,—a man sits on the top of the mortar, and throws in the seeds that may have got displaced. The mill grinds twice a day; a fresh man and team being employed on each occasion. When sesame oil is to be made, about seventy seers measure, or two and a half bushels of seeds are thrown in; to this ten seers, or two quarts and three-quarters of water, are gradually added; this on the continuance of the grinding, which lasts in all six hours, unites with the fibrous portion of the seeds, and forms a cake, which, when removed, leaves the oil clean and pure at the bottom of the mortar. From this it is taken out by a coco-nut shell cup, on the pestle being withdrawn. Other seed oils are described by Dr. Buchanan, as made almost entirely in the same way as the sesamum. The exceptions are the hamlu, or castor oil, obtained from either the small or large varieties of *Ricinus*. This, at Seringapatam, is first parched in pots, containing something more than a seer each. It is then beaten in a mortar, and formed into balls; of these from four to sixteen seers are put in an earthenware pot and boiled with an equal quantity of water, for the space of five hours; frequent care being taken to stir the mixture to prevent it from burning. The oil now floats on the surface, and is skimmed off pure. The oil mill made use of at Bombay, and to the northward, at Surat, Cambay, Kurrachee, &c., differs a little from that just described, in having a very strong wooden frame round the mouth of the mortar; on this the man who keeps the seeds in order sits. In Scinde a camel is employed to drive the mill instead of bullocks.

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Castor oil seed is thrown into the mill like other seeds, as already described; when removed it requires to be boiled for an hour, and then strained through a cloth to free it from the fragments of the seed.

It is a curious fact, and illustrative of the imperfect manner in which the oil is separated from the seeds, that while the common pressman only obtained some 261/4 per cent., Boussingault, in his laboratory, from the same seeds, actually procured 41 per cent. When the oil cakes are meant for feeding stock, this loss is of little consequence, inasmuch as the oil serves a very good purpose, but when the cake is only intended to be used as a manure, it is a great loss, inasmuch as the oil is of little or no use in adding any food for crops to the soil.

The chief oil made on the sea board of India, is that yielded by the coco-nut palm. The nut having been stripped of the husk or coir, the shell is broken, and the fatty lining enclosing the milk is taken out. This is called cobri, copra, or copperah in different localities. Three maunds, or ninety pounds of copperah, are thrown into the mill with about three gallons of water, and from this is produced three maunds, or seven and three-quarter gallons of oil. The copperah in its unprepared state is sold, slightly dried in the market. It is burned in iron cribs or grates, on the top of poles as torches, in processions, and as means of illumination for work performed in the open air at night. No press or other contrivance is made use of by the natives in India for squeezing out or expressing the oil from the cake, and a large amount of waste, in consequence of this, necessarily ensues.—*Bombay Times*, June 5, 1850.

Oil, of the finest kind, is made in India by expression from the kernels of the apricot. It is clear, of a pale yellow color, and smells strongly of hydrocyanic acid, of which it contains, usually, about 4 per cent.

“On inquiring into the use made of the sunflower, we were given to understand that it is here (in Tartary) raised chiefly for the oil expressed from it. But it is also of use for many other purposes. In the market places of the larger towns we often found the people eating the seeds, which, when boiled in water, taste not unlike the boiled Indian corn eaten by the Turks. In some districts of Russia the seeds are employed with great success in fattening poultry; they are also said to increase the number of eggs more than any other kind of grain. Pheasants and partridges eat them with great avidity, and find the same effects from them as other birds. The dried leaves are given to cattle in place of straw; and the withered stalks are said to produce a considerable quantity of alkali.”—*Bremner’s Interior of Russia.*

658 barrels linseed oil were brought down to New Orleans from the interior in 1849, and 1009 in 1848.

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During the period of the Great Exhibition special enquiry was made by many manufacturers as to the different oils of Southern India, suitable for supplying the place of animal fat in the manufacture of candles, and generally adapted for various other purposes. Enquiries should be directed to the specific gravity, the boiling point, the per centage of pure oil in the seeds, and the means of obtaining a regular supply. The demand for vegetable oils in European commerce has been steadily on the increase for several years past, and the quantities consumed are now so large that the oleaginous products of India and the colonies must sooner or later have a considerable commercial importance, from the value which they are likely to acquire. Indeed some have already established a footing in the home market, and Drs. Hunter, Cleghorn, and others in India, have specially directed the attention of the natives and merchants to the subject.

MARGOSE, OR NEEM OIL.—From the pericarp or fleshy part of the fruit of the *Melia Azederachta*, the well known Margosa oil is prepared; which is cheap and easily procurable in Ceylon. Dr. Maxwell, garrison surgeon of Trichinopoly, states that he has found this oil equally efficacious to cod-liver oil in cases of consumption and scrofula. He began with half-ounce doses, morning and evening, which were gradually reduced.

ILLEPE OIL.—The seeds of three species of Bassia, indigenous to India, yield solid oils, and are remarkable for the fact, that they supply at the same time saccharine matter, spirit, and oil, fit for both food and burning in lamps. The Illepe(*B. longifolia*) is a tree abundant in the Madras Presidency, the southern parts of Hindostan generally, and the northern province of Ceylon. In Ceylon the inhabitants use the oil in cooking and for lamps. The oil cake is rubbed on the body as soap, and seems admirably adapted for removing the unctuosity of the skin caused by excessive perspiration, and for rendering it soft, pliable, and glossy, which is so conducive to health in a tropical climate. The oil is white and solid at common temperatures, fusing at from 70 to 80 degrees. It may be advantageously employed in the manufacture of both candles and soap; in Ceylon and some parts of India this oil forms the chief ingredient in the manufacture of soap.

Mahower (*B. latifolia*) is common in most parts of the Bengal Presidency. The oil a good deal resembles that last described, obtained from the Illepe seeds; and may be used for similar purposes. It is solid at common temperatures, and begins to melt at about 70 degrees.

Vegetable butter is obtained from the Choorie (*B. butyracea*). This tree, though far less generally abundant than the other two species, is common in certain of the hilly districts, especially in the eastern parts of Kumaon; in the province of Dotee it is so abundant that the oil is cheaper than ghee, or fluid butter, and is used to adulterate it. It is likewise commonly burnt in lamps, for which purpose it is preferred to coco-nut oil. It is a white solid fat, fusible at about 120 degrees, and exhibits very little tendency to become rancid when kept.

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Shea, or galam butter, is obtained in Western Africa from the *Bassia Parkii*, or *Pentadisma butyracea*, a tree closely resembling the *B. latifolia*, and other species indigenous to Hindostan. According to Park, the tree is abundant in Bambara, the oil is solid, of a greyish-white color, and fuses at 97 degrees. Its product is used for a variety of purposes—for cooking, burning in lamps, &c.

This tree has much of the character of the laurel, but grows to the height of eighteen or twenty feet. Its leaf is somewhat longer than the laurel, and is a little broader at the point; the edges of the leaf are gently curved, and are of a dark sap green color. The nut is of the form and size of a pigeon's egg, and the kernel completely fills the shell. When fresh it is of a white drab color, but, if long kept, becomes the color of chocolate. The kernel, when new, is nearly all butter, which is extracted in the following manner:—-The shell is removed from the kernel, which is also crushed, and then a quantity is put into an earthen pot or pan, placed over the fire with a portion of water and the nut kernels. After boiling slowly about half an hour the whole is strained through a grass mat into a clean vessel, when it is allowed to cool. Then, after removing the fibrous part from it, it is put into a grass bag and pressed so as to obtain all the oil. This is poured into the vessel along with the first-mentioned portion, and when cold is about the consistence of butter.

The nuts hang in bunches from the different boughs, but each nut has its own fibre, about seven or eight inches long, and about the thickness and color of whip-cord. The nut is attached to the fibre in a very singular manner. The end of the fibre is concealed by a thin membrane, about half an inch wide and three-quarters of an inch long. This membrane is attached to the side of the nut, and, when ripe, relinquishes its hold, and the nut falls to the ground, when it is gathered for use. A good-sized healthy tree yields about a bushel of nuts, but the greater number are not so prolific. The trees close to the stream present a more healthy appearance, probably on account of being better watered, and the fire being less powerful close to the stream.

THE CANDLE NUT TREE (*Aleurites triloba*, of Foster) grows in the Polynesian Islands, and is also met with in some parts of Jamaica and the East Indies. In the latter quarter it is known as the Indian Akhrowt. A very superior kind of paint oil is produced from the nut, and the cake, after the expression of the oil, forms an excellent food for cattle, and a useful manure. 311/2 gallons of the nut yield ten gallons of oil, which bears a good price in the home markets.

The yearly produce of this oil in the Sandwich Isles, where it is called kukui oil, is about 10,000 gallons. It has been shipped to the markets of Chili, New South Wales, and London, but not as yet with much profit. It realized about L20 per imperial ton in the port of London. In 1843, about 8,620 gallons were shipped from Honolulu, valued at 1s. 8d. per gallon.

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In Ceylon the oil is known as kekune oil, and a good deal of it might be obtained there from the district of Badulla. From the trials made it appears that it cannot be used as a drying oil, but will probably answer best as a substitute for rape oil. Samples have been sent to several clothiers, and the nature and quality of the oil renders it most applicable to their purposes.

COLZA (*Brassica oleracea*), a variety of the common cabbage, is much grown in the South of Europe and other parts, for the oil obtained by pressure from its seeds, and which is used for lamps and other purposes. The plant will not thrive on sand or clay, but requires a rich light soil. After the ground has been well ploughed and manured, the seed should be sown in July, in furrows eight or ten inches asunder. The plants are transplanted about October. When ripe the stalks are reaped with a sickle, and the seeds threshed out with a flail. The cake, after the oil is expressed, is an excellent food for cattle.

Like all the oleaginous plants cultivated for their seed, colza greatly impoverishes the soil.

In Peru the caoutchouc is used as a substitute for candles. A roll of it (which is generally about a yard long and three inches in diameter) is cut lengthways into four parts, but before it is lighted the piece is rolled up in a green plantain leaf, to prevent it from melting or taking fire down the sides. The natives of Peru also bruize the beans of a species of wild cacao after they have been well dried, and use the substance instead of tallow in their lamps.

Mr. Dearman, writing from Dacca, to Dr. Spry, Secretary to the Agricultural and Horticultural Societies of India, in 1839, says—"I will send you some seeds from a tree, which resemble chestnuts. One of these seeds, after taking off the shell, being stuck on the point of a penknife, and lighted at a candle flame, will burn without the least odor for four or five minutes, giving a light equal to two or three candles. From the flower of the tree (he adds), I am told, is distilled a delightful scent." [I presume this must be the candle-nut tree.]

At the Feejee and Hawaian islands, the seeds of the castor oil plant and of the candle-nut tree (*Aleurites triloba*) are strung together and used for candles. Species of torches are also made from the candle wood in Demerara.

THE CANDLEBERRY MYRTLE (*Myrica cerifera*) abounds in the Bahama Islands. The shrub produces a small green berry, which, like the hog plum, puts out from the trunk and larger limbs. Much patient labor is required in gathering these berries, and from them is obtained a beautiful green wax, which burns very nearly, if not fully, as well as the spermaceti, or composition candles imported from abroad. Not long since Mr. Thos. B. Musgrove, of St. Salvador (or Cat Island), obtained about 80 lbs. of this wax, and made some excellent candles of it. The method of procuring this wax is by boiling the berries in a copper or brass vessel for some time. Iron pots are found to darken and cloud the wax. The vessel after a sufficient time is taken from the fire, and when cool the hardened wax, floating on the top of the water, is skimmed off.

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MYRTLE WAX.—According to the experiments of M. Cadet and Dr. Bostock, myrtle wax differs in many respects from bees' wax, Specimens of it assume shades of a yellowish green color. Its smell is also different; myrtle wax, when fresh, emitting a fragrant balsamic odor. It has in part the unctuosity of bees' wax, and somewhat of the brittleness of resin. Its specific gravity is greater, insomuch that it sinks in water, whereas bees' wax floats upon it; and it is not so easily bleached to form white wax. The wax tree of Louisiana contains immense quantities of wax.

Mr. Moodie ("Ten Tears in South Africa") says,—

"I occasionally employed my people, at spare times, in gathering wax berries that grow in great abundance upon small bushes in the sand hills, near the sea, and yield a substance partaking of the nature of wax and tallow, which is mixed with common tallow, and used by the colonists for making candles. The berry is about the size of a pea, and covered with a bluish powder. They are gathered by spreading a skin on the sand, and beating the bush with a stick. When a sufficient quantity of the berries are collected, they are boiled in a great quantity of water, and the wax is skimmed off as fast as it rises; the wax is then poured into flat vessels and allowed to cool, when it becomes hard and brittle, and has a metallic sound when struck. The cakes thus formed are of a deep green color, and are sold at the same price as tallow. The wild pigs devour these berries when they come in their way, and seem very fond of them."

A good specimen of myrtle, or candleberry wax, accompanied by candles made from it in the crude unbleached state in New Brunswick, was shown at the Great Exhibition.

Vegetable wax was also sent from Shanghae, in China; from St. Domingo, in the northern parts of which the plant is indigenous; and a remarkable specimen from Japan. This substance, from its high melting point and other physical characteristics, has of late attracted a good deal of attention; it is admirably suited as a material for the manufacture of candles.

At a meeting of the Central Board, at Cape Town, in March, 1853, the members voted about L300, to employ some 20 or 30 men, in gathering berries from the Downs, and making wax during the winter months, that is, from the beginning of May to the end of September. The wax fetches a good price in the Cape market.

In the annual report of the Cape of Good Hope Agricultural Society, in May, 1853, a very fine sample of myrtle, or terry wax, grown on the Cape Flats, was exhibited by Mr. Feeny, Superintendent of the Road Plantation, by direction of the Commissioners of the Central Road Board, in different stages of purification, from green to white, as also some candles; and it being conceived by the meeting that this article might ultimately become one of considerable importance for purposes of export, a letter of thanks was addressed to Mr. Feeny;

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and Nathaniel Day, the constable who assisted him, was presented with the sum of L5, as a remuneration for his trouble in assisting to purify and prepare the wax. On reference to the juror's report on the Great Exhibition, it will be gratifying to find that the berry wax, forwarded by this Society, had attracted peculiar notice, and a prize medal been awarded for it; the following reference is therein made to it: "some fine specimens of myrtle or berry wax, from the Cape of Good Hope, are exhibited by J. Lindenberg, of Worcester. This is an excellent material for the manufacture of candles, when employed in conjunction with other solid fats. The jury awarded a prize medal for these specimens."Your Committee would suggest every possible attention being drawn to this subject, in which they are gratified to state, the Commissioners of the Central Road Board have evinced a readiness to co-operate, by offering to place at the Society's disposal the sum of L10 10s., "to be given as a premium for the best information respecting the wax berry plant, the soils and situations in which it is found to grow most luxuriantly: the best mode of propagating and cultivating it, of collecting the berries, and extracting and preparing the wax, &c." And from a letter received from the Secretary to the Central Road Board, it appears that the Board had authorised the shipment to England of 2,561 lbs. of the wax, by the *Queen of the South* in November last, which, from the account sales lately received from Messrs. J.R. Thomson & Co., realised as follows, *viz*.:—

4 cases weighing nett 856 lbs. a 8d. L28 10 8
4 " 1040 lbs. a 9d. 39 0 0
3 " 745 lbs. a 11d. 34 2 11
3 " 6 lbs. a 11d. 0 5 6

L101 19 1
Discount 21/2 per cent. 2 11 0

L99 8 1

CHARGES.
Warehouse Entry 3s. 6d. Fire Insurance
2s., Ports 2s. 6d L0 8 0
Freight 7 3 3
Primage 0 14 4
Dock Charges 3 9 6
Sale Expenses 0 9 0
Brokerage 1 0 6

L13 4 7

Commission at 21/2 per cent 2 11 0

Carried forward L16 15 7

Brought forward L15 15 7

L83 12 6
Deduct Bills of Lading, &c. 0 19 6

L82 13 0
Deduct the Board's expenses for gathering and preparing, &c 28 8 7

Leaving a clear profit of L54 4 5

This statement shows that from a plant,

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which is indigenous to the colony, and might he cultivated to almost any extent, and mostly on soils unavailable for other purposes, an article of great export could be derived at a comparatively small expense; it is with that view that I desire to direct public attention more prominently to it.

In the Museum of the Royal Botanic Gardens, at Kew, wax is shown as scraped from the trunk of the wax palm (*Ceroxylon andicola*), and candles made from it, as also some made of acorns and closely resembling common tallow. Concrete milk and butter made from the Shea butter tree, and others growing in Para, are also exhibited.

Wax candles have been made from the seeds of *Myrica macrocarpa* in Colombia, and also from vegetable wax in Java. Some of these are to be seen in the Museum of the Pharmaceutical Society of London.

CASTOR OIL PLANT.

Castor oil is expressed from the seeds of *Ricinus communis (Palma Christi)*, a plant with petale-palmate leaves, which is found native in Greece, Africa, the South of Spain, and the East Indies, and is cultivated in the West Indies, as well as in North and South America. In the temperate and northern parts of Europe, the plant is an herbaceous annual, of from three to eight feet high; in the more southern parts it becomes scrubby and even attains an height of twenty feet; while in India it is often a tree thirty to forty feet high. The best oil is obtained by expression from the seeds without heat, and is hence called “cold drawn oil.” A large quantity of oil may be produced by boiling the seeds, but it is less sweet and more apt to become rancid than that procured by expression.

The *Palma Christi* grows continuously for about four years, and becomes a large tree in constant bearing, ripening its rich clusters of beans in such profusion, that 100 bushels may be obtained annually from an acre, and their product of oil two gallons per bushel.

There are several species, all of which yield oil of an equally good quality. A shrubby variety is common in South Australia, and other parts of New Holland. *Ricinus lividus* is a native of the Cape of Good Hope. It is a hardy plant, of the easiest culture, and will thrive in almost any soil, whether in the burning plains or the coldest part of the mountains. The seed should be planted in the tropics in September, singly, and at the distance of 10 or twelve feet apart. They will bear the first season, and continue to yield for years. When the seed-pods become brown, they are in a fit state to pluck. It is often grown in the East intermixed with other crops. The primitive mode of obtaining the oil is to separate the seeds from the husks, and bruise them by tying them up in a grass mat. In this state they are put into a boiler amongst water, and boiled until all the oil is separated, which floats at the top, and the refuse sinks to the bottom; it is then skimmed off, and put away for use. The purest oil is obtained, as before-mentioned, by crushing the seeds (which are sewed up in horsehair bags), by the action of heavy iron beaters. The oil, as it oozes out, is caught in troughs, and conveyed to receivers, whence it is bottled for use.

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Castor oil is used for lamps in the East Indies, and the Chinese have some mode of depriving it of its medicinal properties, so as to render it suitable for culinary purposes.

That which we import from the East Indies comes from Bombay and Calcutta, and is obtained at a very low price. It is exceedingly pure, both in color and taste.

In the West Indies the shrub grows about six feet high. The stalks are jointed, and the branches covered with leaves about eighteen inches in circumference, forming eight or ten sharp-pointed divisions, of a bluish green color, spreading out in different directions. The flowers contain yellow stamina; the seed is enclosed in a triangular husk, of a dark brown color, and covered with a light fur, of the same color as the husk. When the capsule is thoroughly ripened by the sun, it bursts, and expels the seeds, which are usually three in number.

In Jamaica this plant is of such speedy growth, that in one year it arrives at maturity, and I have known it to attain to the height of twenty feet. A gallon of the seed yields by expression about two pounds of oil.

The wholesale price in Liverpool, in October, 1853, was 3d. to 5d. per lb.

It is brought over from the East Indies in small tin cases, soldered together and packed in boxes, weighing about 2 cwt. each.

In Ceylon castor oil is obtained from two varieties of the plant, the white and the red.

The native mode of preparing the oil is by roasting the seed; this imparts an acridity to the oil, which is objectionable. By attending to the following directions, the oil may be prepared in the purest and best form. The modes of preparation are—1. By boiling in water. 2. By expression. 3. Extraction by alcohol. In the first the seeds are slightly roasted to coagulate the albumen, cleaned of the integuments, bruised in a mortar, and the paste boiled in pure water. The oil which rises on the surface is removed, and treated with an additional quantity of fresh water; 10,000 parts of clean seed give by this process (in Jamaica) 3,250 of oil, of good quality, though amber-colored. 2. Expression is the simplest and most usually adopted process; the cleaned kernels are well bruised, placed in cloth bags, and compressed in a powerful lever and screw press. A thick oil is obtained, which must be filtered through cloth and paper to separate the mucilage. In Bengal the manufacturers boil the oil water, which coagulates some albumen, and they subsequently filter through cloth, charcoal, and paper. 3. The extraction by alcohol is practised by some druggists. Each pound of paste is triturated with four pounds of alcohol, specific gravity 8.350, and the mixture subjected to pressure. The oil dissolved by the alcohol escapes very freely: one half is recovered by the distillation of the spirit, the residue of the distillation is boiled in a large quantity of water. The oil separates and is removed, and gently heated to expel any adherent moisture; then filtered at the temperature of 90 deg. Fahrenheit; 1,000 parts of the paste have by this process given 625 of colorless and exceedingly sweet oil.

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The cultivation of the *Palma christi*, and the manufacture of castor oil, is extensively carried on in some parts of the United States, and continues on the increase. A single firm at St. Louis has worked up 18,500 bushels of beans in four months, producing 17,750 gallons of oil, and it is stated that 800 barrels have been sold, at 50 dollars per barrel. The oil may be prepared for burning, for machinery, soap, &c., and is also convertible into stearine. It is more soluble in alcohol than lard-oil.

American castor oil is imported for the most part from New York and New Orleans, but some comes from our own possessions in North America. In the United States, according to the “American Dispensatory,” the cleansed seeds are gently heated in a shallow iron reservoir, to render the oil liquid for easy expression, and then compressed in a powerful screw press, by which a whitish oily liquid is obtained, which is boiled with water in clean iron boilers, and the impurities skimmed off as they rise to the surface. The water dissolves the mucilage and starch, and the heat coagulates the albumen, which forms a whitish layer between the oil and water. The clear oil is now removed, and boiled with a minute portion of water until aqueous vapors cease to arise: by this process an acrid volatile matter is got rid of. The oil is put into barrels, and in this way is sent into the market. American oil has the reputation of being adulterated with olive oil. Good seeds yield about 25 per cent. of oil. A large proportion of the drug consumed in the eastern section of the Union is derived by way of New Orleans from Illinois and the neighbouring States, where it is so abundant that it is sometimes used for burning in lamps.

In Jamaica the bruised seeds are boiled with water in an iron pot, and the liquid kept constantly stirred. The oil which separates swims on the top, mixed with a white froth, and is skimmed off. The skimmings are heated in a small iron pot, and strained through a cloth. When cold it is put in jars or bottles for use.

Castor oil imported.		Retained.
lbs.	lbs.	
1826	263,382	453,072
1831	393,191	327,940
1836	981,585	809,559
1841	871,136	732,720
1846	1,477,168	—
1849	1,084,272	—
1850	3,495,632	—

The imports of castor oil come chiefly from the East India Company’s possessions, and were as follows, nearly all being retained for home consumption:—

lbs.	
1830	490,558
1831	343,373
1832	257,386
1833	316,779
1834	685,457
1835	1,107,115
1836	972,552
1837	957,164
1838	837,143
1839	916,370
1840	1,190,173
1841	869,947
1842	490,156
1843	717,696

In 1841, 12,406 Indian maunds of castor oil were shipped from Calcutta alone, and 7,906 ditto in 1842.

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In 1842, 8 cases were shipped from Ceylon, 10 in 1843, 24 in 1844, and 14 in 1845.

1,439 barrels were shipped from New Orleans in 1847. The quantity brought down to that city from the interior was 1,394 barrels in 1848, and 1,337 barrels in 1849.

Within the last year or two, an attempt has been made to introduce the cake obtained in expressing the seeds of the castor oil plant as a manure, which is deserving attention, both because it is in itself likely to prove a serviceable addition to the list of fertilizers which may be advantageously employed, and because it may lead to the use of similar substances, which are at present neglected, or thrown aside as refuse.

The castor oil seed resembles in chemical composition the other oily seeds. It consists of a mixture of mucilaginous, albuminous, and oily matters; and the former two of these are identical in constitution and general properties with the substances found in linseed and rape cake, while the oil is principally distinguished by its purgative properties. The cake obtained is in the form of ordinary oil-cake, but is at once distinguished from it by its color, and by the large fragments of the husk of the seeds which it contains. It is also much, softer, and may be easily broken down with the hand. I have analysed two samples of castor cake, stated to have been obtained by different processes; and though I have not been informed of the exact nature of these processes, I infer, from the large quantity of oil, that one must have been cold-drawn. The first of the following analyses is that of the sample which I believe the cold-drawn. It is the most complete of the two, and contains a determination of the amount of oil. In the other analysis this was not done, but there was no doubt on my mind that its quantity was much smaller.

	No. 1.	No. 2.
Water	8.32	16.31
Oil	24.32	—
Nitrogen	3.05	3.35
Ash	7.22	4.95
The ash contains—		
Siliccous matters	1.96	—
Phosphates	3.36	2.27
Excess of phosphoric acid	0.64	—

In order to give a proper idea of the value of this substance as a manure, I shall quote here, for comparison sake, the average composition of rape cake, as deduced from the analyses contained in the Transactions of the Highland Society of Scotland:—

Water 10.68
Oil 11.10

Nitrogen 4.63
Ash 7.79
The ash contains—
Siliccous matters 1.18
Phosphates 3.87
Excess of phosphoric acid 0.39

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It will be at once seen that there is a close general resemblance between these two substances, although there is no doubt that the castor cake is inferior to rape cake; still I believe that this inferiority is fully counterbalanced by the difference in price, which is such that, compared with rape cake, the castor cake is really a cheap manure. There is only one of its constituents which it contains in larger quantity, and that is the oil. No weight is, however, to be attached to the quantity of oil in a manure. In a substance to be used as food, it is of very high importance; but so far as we at present know, its value as manure is extremely problematical. Whale, seal, and other coarse oils have been used as manures, and by some few observers benefits have been derived from their application, but the general experience has not been favorable to their use, nor should we chemically be induced to expect any beneficial effect from them. We have every reason to believe that the oils which are found in plants are produced there as the results of certain processes which are proceeding within the plant, and there is no evidence to show that any part of it is ever absorbed in the state of oil by the roots when they are presented to them. On the other hand, the oils are extremely inert substances, and undergo chemical changes very slowly; so that there is no likelihood of their being converted into carbonic acid, or any other substance which may be useful to the plant; and as they contain no nitrogen, and consist only of carbon, hydrogen, and oxygen, they can yield only those elements of which the plant can easily obtain an unlimited supply. I can conceive cases in which the oil might possibly produce some mechanical effect on the soil, but none in which it could act as a manure, in the proper sense of the term.

KANARI on.—Mr. Crawfurd, in his “History of the Indian Archipelago,” speaks most favorably of an oil obtained from the “Kanari,” a tree which, he says, is a native of the same country as the sago palm, and is not found to the westward, though it has been introduced to Celebes and Java. I have not been able to distinguish its botanical name; but Mr. Crawfurd describes it as a large handsome tree, and one of the most useful productions of the Archipelago. It bears a nut of an oblong shape, nearly the size of a walnut, the kernel of which is as delicate as that of a filbert, and abounds with oil. The nuts are either smoked and dried for use, or the oil is expressed from them in their recent state. It is used for all culinary purposes, and is purer and more palatable than that of the coco-nut. The kernels, mixed up with a little sago meal, are made into cakes and eaten as bread.

THE COCO-NUT PALM.

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This palm (*Cocos nucifera*) is one of the most useful of the extensive family to which it belongs, supplying food, clothing, materials for houses, utensils of various kinds, rope and oil; and some of its products, particularly the two last, form important articles of commerce. An old writer, in a curious discourse on palm trees, read before the Royal Society, in 1688, says, “The coco nut palm is alone sufficient to build, rig, and freight a ship with bread, wine, water, oil, vinegar, sugar, and other commodities. I have sailed (he adds) in vessels where the bottom and the whole cargo hath been from the munificence of this palm tree. I will take upon me to make good what I have asserted.” And then he proceeds to describe and enumerate each product. Another recent popular writer speaks in eloquent terms of the estimation in which it is held, and the various uses to which it is applied.

“Its very aspect is imposing. Asserting its supremacy by an erect and lofty bearing, it may be said to compare with other trees, as man with inferior creatures. The blessings it confers are incalculable. Year after year the islander reposes beneath its shade, both eating and drinking of its fruit; he thatches his hut with its boughs, and weaves them into baskets to carry his food; he cools himself with a fan plaited from the young leaflets, and shields his head from the sun by a bonnet of the leaves; sometimes he clothes himself with the cloth-like substance which wraps round the base of the stalks, whose elastic rods, strung with filberts, are used as a taper. The larger nuts, thinned and polished, furnish him with a beautiful goblet; the smaller ones with bowls for his pipes; the dry husks kindle his fires; their fibres are twisted into fishing-lines and cords for his canoes. He heals his wounds with a balsam compounded from the juice of the nut; and with the oil extracted from its pulp embalms the bodies of the dead. The noble trunk itself is far from being valueless. Sawn into posts, it upholds the islander’s dwelling; converted into charcoal, it cooks his food; and, supported on blocks of stones, rails in his lands. He impels his canoe through the water with a paddle of the wood, and goes to battle with clubs and spears of the same hard material. In Pagan Tahiti, a coco-nut branch was the symbol of regal authority. Laid upon the sacrifice in the temple, it made the offering sacred; and with it the priests chastised and put to flight the evil spirits which assailed them. The supreme majesty of Oro, the great god of their mythology, was declared in the coco-nut log from which his image was rudely carved. Upon one of the Tonga Islands there stands a living tree, revered itself as a deity. Even upon the Sandwich Islands the coco palm retains all its ancient reputation; the people there having thought of adopting it as the national emblem.”

Besides the foregoing and following uses, I am aware of several scents and spirituous liquors being procured from the flowers and pulp of the coco-nut.

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This palm tree is one of the finest objects in nature. Its stem is tall and slender, without a branch; and at the top are seen from ten to two hundred coco-nuts, each as large as a man's head: over these are the graceful plumes, with their green gloss, and beautiful fronds of the nodding leaves. Nothing can exceed the graceful majesty of these intertropical fruit trees, except the various useful purposes to which the tree, the leaf, and the nut are applied by the natives.

1. The stem is used for—Bridges, posts, beams, rafters, paling, ramparts, loop-holes, walking sticks, water butts, bags (the upper cuticle), sieves in use for arrowroot.

2. The coco-nut is used for—milk, a delicious drink; meat from the scraped nut, for various kinds of food; jelly, *kora*, pulp, nut, oil, excellent and various food for man, beast, and fowl.

The shell for vessels to drink out of, water pitchers, lamps, funnels, fuel, *panga* (for a game).

The fibre for sinnet, various cordage, bed stuffing, thread for tying combs, scrubbing-brushes, girdle (ornamental), whisk for flies, medicines, various and useful.

3. The leaf is used for—Thatch for houses, lining for houses, *takapau* (mats), baskets (fancy and plain), fans, *palalafa* (for sham fights), combs (very various), bedding (white fibre), *tafi* (brooms), *Kubatse* (used in printing), *mama* (candles), screen for bedroom, waiter's tray.

Here are no less than forty-three uses of which we know something; and the natives know of others to which they can apply this single instance of the bounty of the God of nature. For house and clothes, for food and medicine, the coco-nut palm is their sheet anchor, as well as their ornament and amusement, who dwell in the torrid zone.

This fine palm, which always forms a prominent feature in tropical scenery, is a native of Southern Asia. It is spread by cultivation through almost all the intertropical regions of the Old and New Worlds; but it is cultivated nowhere so abundantly as in the Island of Ceylon, and those of Sumatra, Java, &c. On the shores of the Red Sea it advances to Mokha, according to Niebuhr; but it does not succeed in Egypt. It is cultivated in the lower and southern portions of the Asiatic Continent, as on the coasts of Coromandel and Malabar, and around Calcutta. In the island of Ceylon, where the fruit of this tree forms one of the principal aliments of the natives, the nuts are produced in such quantities that in one year about three millions were exported, besides the manufactured produce in oil, &c. According to Marshall it requires a mean temperature of 72 deg. Its northern limit, therefore, is nearly the same as the southern limit of our cereals.

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Rumphius enumerates thirteen varieties of this palm, but many of these have now been placed under other genera, and Lindley resolves them into three species—*C. nucifera*, the most generally diffused species, a native of the East Indies; and *C. flexuosa* and *plumosa*, natives of Brazil. The trunk, which is supported by numerous, small fibrous roots, rises gracefully, with a slight inclination, from forty to sixty feet in height; it is cylindrical, of middling size, marked from the root upwards with unequal circles or rings, and is crowned by a graceful head of large leaves. The terminal bud of this palm, as well as that of the cabbage palm (*Euterpe montana*), is used as a culinary vegetable. The wood of the tree is known by the name of porcupine wood. It is light and spongy, and, therefore, cannot be advantageously employed in the construction of ships or solid edifices, though it is used in building huts; vessels made of it are fragile and of little duration. Its fruit, at different seasons, is in much request; when young, it is filled with a clear, somewhat sweet, and cooling fluid, which is equally refreshing to the native and the traveller. When the nut becomes old, or attains its full maturity, the fluid disappears, and the hollow is filled by a sort of almond, which is the germinating organ. This pulp or kernel, when cut in pieces and dried in the sun, is called copperah, and is eaten by the Malays, Coolies, and other natives, and from it a valuable species of oil is expressed, which is in great demand for a variety of purposes. The refuse oil cake is called Poonae, and forms an excellent manure.

A calcareous concretion is sometimes found in the centre of the nut, to which peculiar virtues have been attributed.

Along the Gulf of Cariaco there are many large coco walks. In moist and fertile ground it begins to bear abundantly the fourth year; but in dry soils it does not produce fruit until the tenth. Its duration does not generally exceed 80 or 100 years, at which period its mean height is about 80 feet. Throughout this coast a coco tree supplies annually about 100 nuts, which yield eight flascos of oil. The flasco is sold for about 1s. 4d. A great quantity is made at Cumana, and Humboldt frequently witnessed the arrival there of canoes containing 3,000 nuts.

Throughout the South Sea Islands, coco-nut palms abound, and oil may be obtained in various places. Some of the uninhabited islands are covered with dense groves, and the ungathered nuts, which have fallen year after year, lie upon the ground in incredible quantities. Two or three men, provided with the necessary apparatus for pressing out the oil, will, in the course of a week or two, obtain enough to load one of the large sea canoes. Coco nut oil is now manufactured in different parts of the South Seas, and forms no small part of the traffic carried on with trading vessels. A considerable quantity is annually exported from the Society Islands to Sydney. They bottle it up in large bamboos, six or eight feet long, and these form part of the circulating medium of Tahiti. The natives use the bruised fronds of *Polypodium crassifolium* to perfume this oil. *Evodia triphylla*, a favorite evergreen plant with the natives of the Polynesian Islands, is also used for this purpose.

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The most favorable situation for the growth of the coco palm is the ground near the sea-coast, and if the roots reach the mud or salt water, they thrive all the better for it. The coco-nut walks are the real estates of India, as the vineyards and olive groves are of Europe. I have seen these palms growing well in inland situations, remote from the sea, but always on plains, never upon hills or very exposed situations, where they do not arrive to maturity, wanting shelter, and being shaken too violently by the wind. The stems being tall and slight, and the whole weight of leaves and fruit at the head, they may not unaptly be compared to the mast of a ship with round top and topmast without shrouds to support it. Ashes and fish are good manures for it.

The coco-nut is essentially a maritime plant, and is always one of the first to make its appearance on coral and other new islands in tropical seas, the nut being floated to them, and rather benefiting than otherwise by its immersion in the salt water. Silex and soda are the two principal salts which the coco-nut abstracts from the soil, and hence, where these do not exist in great abundance, the tree does not thrive well. I do not know myself what is the practice in Ceylon, but in Brazil, Dr. Gardner tells me, salt is very generally applied to the coco-nut when planted. Far in the interior, he states, he has seen as much as half a bushel applied to a single tree, and that too when it cost about 2s. a pound, from the great distance it had to be brought. That the application, therefore, of salt, of seaweed, and saline mud, does more than supply soda, must be very evident, if we only recollect how difficult it is to dry any part of our dress that has been soaked in salt water, and what effect damp weather has on table salt, which, in a balance, has often been made use of as an hydrometer. Moisture is always attracted by salt, and the more sea mud and other such little matters that coco-nut planters can apply round the roots of their trees, there will most assuredly be the less occasion for watering them in the dry season. Sea weed contains but very little fibrous matter, being chiefly composed of mucilage and water; and the experiments of Sir J. Pringle and Mr. C. W. Johnson, prove that salt in small quantities assists the decomposition of both animal and vegetable substances. Decomposed poonac, or oil-cake, is one of the best manures that can be applied, as it returns to the soil the component parts of which it has beau deprived to form the fruit.

The primary direction of the planter’s industry will be to the establishment of a nursery of young plants. In Ceylon, for this purpose, the nuts are placed in squares of 400, covered with one inch of sand, or salt mud; are watered daily till the young shoots appear, and are planted out after the rains in September. Sand and salt mud are to be found on almost all the coasts where it would be desirable to plant nuts, and if they are put into the ground at the commencement of the rainy season, artificial watering will scarcely be necessary. Any period, when there are showers, would answer for transplanting them. I should say from the middle to the end of January would be best, when they are placed in the nursery in October and November; and in October when they are planted in June.

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It is said that they should be allowed from 20 to 30 feet space apart, but I will calculate their return when planted 27 feet apart every way. This will give 58 coco-nut trees per acre. If manured, for the first two years, with seaweed and salt mud, and supplied with water in dry weather, there need be no loss, and the plants will thrive the better. The land must be kept clear of weeds till the plants are matured, in order to permit them abundance of air and light. In five years, when well cared for, the flower may be expected, but the plants will not be in full bearing before the seventh or eighth year. From 50 to 80 nuts are the annual crop of a tree; but I will calculate at the lowest rate. One hundred nuts will yield, when the oil is properly expressed, at least two gallons and a half. I shall not take into account the making of jaggery sugar and toddy, or spirit from the sap, as I do not consider that the manufacture would be remunerative; and it must be attended with much trouble, besides requiring a great deal of care and some skill.

Take the case now of a plantation of 100 acres in extent. This would give us 5,800 trees, which, at 50 nuts per tree, 290,000 nuts, at 21/2 gallons of oil per hundred, would yield 7,250 gallons of oil, the value of which any person may calculate, but which, at the low rate of 3s. over charges, would furnish, as the gross plantation return in oil, a sum of L1,087 10s. sterling. If the cultivator, instead of making his produce into oil, were to sell it in its natural state, his gross return in the West Indies would be nearly L600 sterling, at the rate of ten dollars per thousand.

Either of these sums would be a handsome return from 100 acres of any land, *requiring no cultivation or care whatever, after the fourth year, and yielding* the same amount for upwards of half a century! But this is not all. An outlay of a few pounds will secure other advantages, and ought to enable the owner of a coco-nut plantation to turn his gross receipts for oil into nett profits. The coir made from the husk of the nut is calculated to realise nearly one-fourth of the proceeds of the oil, but if we put it down at one-fifth, we shall have, in addition to the value of the oil, L217 10s., thus making a total of L1,305 sterling. If we obtained 60 nuts from each tree, the return would be L1,566 sterling, and if 75, L1,957 8s. sterling; and this from 100 acres of sea side sand! But even *this* does not exhibit the whole return of this article of culture. Each nut may be calculated to give a quarter of a pound of poonac, or oil-cake, being the refuse after expression, fit for feeding all kinds of stock, which may be estimated as worth L10 per ton. We must, therefore, add on this account to our first calculation, the sum of say L325; to the second, L390; and to the third, L485. This would give, in round numbers, the entire returns of the 100 acres planted:—At 50 nuts per tree, L1,630; at 60 ditto, L1,957; at 75, ditto, L2,446.

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These are striking results, and may appear exaggerated; but I will, to show how very moderate has been my calculation, give two returns, with which I have been favored from Ceylon. These, it will be seen, differ materially, but the latter I can rely on as a practical result, from a plantation in Jaffna, the peninsula of the northern portion of the island. After estimating the expense of establishing the plantation, the first writer sets down his return thus:—

“The produce, calculating 90 trees to an acre, and 75 nuts to a tree, sold at L2 per 1,000, would yield 675,000 nuts, worth L1,350; or if converted into oil, calculating 30 to give one gallon, it would produce 22,500 gallons, or about 90 tons from 100 acres.”

From Jaffna, the following is an abridged estimate of return of 100 acres in full bearing:—“At 27 feet apart, 58 trees per acre, 5,800 trees, at 60 nuts per tree, 3,480 nuts per acre, 100 acres, 348,000 nuts, at 40 nuts per imperial gallon, 8,700 gallons of oil, at 2s. per gallon, netted L8 14s. per acre. The poonac left will pay the expense of making the oil. If shipped to England, at the present time (close of 1848), the selling price there being 55s. per cwt., measuring 12 imperial gallons, say, 4s. 7d. per gallon, and the cost and charges of sending it home and selling it being 23s., it would leave 3s. per gallon, or L13 per acre.” This sum is *nett proceeds*.

It will be seen by the above, that I have been extremely moderate in my computation of the return which may be anticipated, for there is no doubt that planters can, in favorable localities, on the coasts of most of our colonies, cultivate this palm with as much success as attends its culture in Ceylon. By the first of the calculations I have cited from, that island, the gross return appears thus:—

22,500 gallons at 4s. 7d L5,156 5
Coir—one-fifth of value 1,031 4
Cake from 675,000 nuts, say 1/4 lb. each, 75 tons at L10 750 0

Total gross return from 100 acres 6,937 9

According to the other calculation, the return will stand thus:—

8,700 gallons at 4s. 7d L1,993 15
Coir 398 15
Cake from 348,000 nuts, 34 tons 340 0

Total gross return from 100 acres 2,732 10

It will be seen that in my calculation I have set down the return lower than it is rendered in the less favorable statement from Ceylon by a sum of upwards of L1,000 sterling. But even supposing *one-half* of the amount of the lower Ceylon estimate could be realised, we should have a return of L1,366 5s. sterling from 100 acres of sea side sand.

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I now proceed to point out the very small outlay required to obtain these results. In places where the coco-nut would be grown, there is generally no heavy woodland requiring great labor with axe and fire, and consequently one able-bodied man should get through the felling and clearing away bush, on an acre of the land to be prepared for the plant, in a short period,—say, on an average, four days. I will calculate, that for wages and rations, each hand employed will cost sixteen dollars per month, an outside price. Let us then say that ten laborers shall be at work. They fell two acres and a half per diem. In one month there should be nearly 70 acres felled; but I will say that the 100 acres will occupy them two months in felling and stacking the wood. During this period our planter may be considered to have had the aid of two more hands, engaged in the preparation, planting out, and care of the nursery of young plants. Two more hands must also be occupied in the construction of tanks and sheds, except where there is a stream of fresh water. For grubbing up the roots, if not very large size, the assistance of about a dozen cattle would be required, a labor which would be performed by means of the common grubbing machine, an implement in the form of a claw. We will consider that all hands are occupied another month in this manner, and in removing and re-stacking the wood, and turning up the land. The planting out would require but little time and labor. At the end of three months then, one-half of the hands, besides those engaged in the nursery and tanks, might be discharged. We must make an allowance for provision for the fodder of the cattle. Six thousand nuts would be required.

Let us now see what are the planter’s expenses; making ample allowance on account of each item:—

dollars.
6,000 picked nuts at 10 dollars per 1,000 60
Hire and rations of 12 hands, at 16 dollars for 3 months 676
Two hands at nursery, for same period 96
Purchase of 12 cattle at 20 dollars 240
Foddering cattle one month 32
Hire of two extra hands, making tanks and sheds 3 months 96
Hire of 6 hands for 9 months 864
Tools (including plough) 100

Total 2,064

About L415 sterling for expenses for the first year.

Where fencing is required, we must add for making about three miles of fence, say L30 sterling. Two carts would also have to be provided, which will cost, say L20 more. In all we may compute the first year’s expenditure at L460 sterling.

Second year's expenditure: ploughing land, or hoeing it twice, watering plants, manuring, repairing fences, and supplying plants, say hire of eight men for six months, about L150 sterling. The same for the third.

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Fourth year's expenditure: hire of six hands for three months, cleaning land, and manuring plants, about L60 sterling, and the like, at the cultivator's option, for the fifth year.

SUMMARY OF EXPENSES.
L
First year 460
Second year 150
Third year 150
Fourth year 60
Fifth year 60
—–
Total expenditure 880
Add for buildings 80

And we have a grand total of L960 sterling expended; for what purpose? To secure a net income of *at least* L1,200 sterling per annum for at least 50 years!

In the first year's expenses many items might be cut down, but I leave the calculation as one to be considered by a party with small capital, intending to establish a coco-nut plantation. I have allowed nothing for the cost of land, as it is impossible to compute that. In general it would cost next to the nothing mentioned. I have, by careful calculation, arrived at the conclusion that by combining the cultivation of provisions with the gradual but steadily progressive establishment of a coco-nut plantation, any man of energy and perseverance may, with the aid of but four hands, clear, fence, and plant, in a favorable locality, 50 acres of coco-nuts within the year, yet have a balance in his pocket at its close. Such a person would, ere doing anything beyond putting in his nursery plants, establish a provision ground, of considerable extent, for the purpose of supplying himself and his laborers with bread kind, and vegetables, and of enabling him, by the disposal of the surplus produce in the market, to raise a sufficient sum of money to furnish the wages and rations of the men. I need not enter into a calculation to show how this could be done, as every one must be aware of an easy method of following out so simple a suggestion. Of course he would have to bear in mind that the provision ground is of secondary importance, and limit his exertions in that line accordingly; devoting to the coco-nut plantation the strictest daily attention.

The cultivation of this tree deserves much more attention than has hitherto been paid to it, particularly in the East, where it not only forms part of the daily food of all classes of the community, but is an exportable article to neighbouring regions, the oil which it yields having of late years become in great demand in England, for the manufacture of composite candles and soap, and there is no doubt of its continually extended application to such purposes. Supposing, nevertheless, the result of an increased cultivation of the coco-nut should be such as to cause a fall in price, and sink the nett return in England to 2s. per gallon; this being clear profit, would make this kind of plantation a safe and sure investment for both capital and labor in the Colonies.

A kind of sugar made from the sap is called “jaggery,” and the sap when fermented forms an intoxicating beverage known as toddy. The fibrous outer covering, or husk of the nut, when macerated and prepared, is termed “coir,” and is spun into yarn and rope. It is extensively shipped from Ceylon, in coils of rope, bundles of yarn, and pieces of junk.

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The coco-nut is usually planted as follows:—Selecting a suitable place, you drop into the ground a fully ripe nut, and leave it. In a few days a thin lance-like shoot forces itself through a minute hole in the shell, pierces the husk, and soon unfolds three pale green leaves in the air; while, originating in the same soft white sponge which now completely fills the nut, a pair of fibrous roots pushing away the stoppers which close two holes in an opposite direction, penetrate the shell, and strike vertically into the ground. A day or two more, and the shell and husk, which in the last and germinating stage of the nut are so hard that a knife will scarcely make any impression, spontaneously burst by some force within; and, henceforth, the hardy young plant thrives apace, and needing no culture, pruning, or attention of any sort, rapidly arrives at maturity. In four or five years it bears; in twice as many more it begins to lift its head among the groves, where, waxing strong, it flourishes for near a century. Thus, as some voyager has said, the man who but drops one of these nuts into the ground, may be said to confer a greater and more certain benefit upon himself and posterity, than many a life's toil in less genial climes. The fruitfulness of the tree is remarkable. As long as it lives it bears, and without intermission. Two hundred nuts, besides innumerable white blossoms of others, may be seen upon it at one time; and though a whole year is required to bring any one of them to the germinating point, no two, perhaps, are at one time in precisely the same stage of growth.

Coco-nuts form a considerable article of export from many of the British colonies: 375,770 were exported from Honduras in 1844, and 254,000 in 1845; 105,107 were shipped from Demerara, in 1845; 3,500,000 from Ceylon in 1847.

They are very abundant on the Maldive Islands, Siam, and on several parts of the coast of Brazil. Humboldt states, that on the south shores of the Gulf of Cariaco, nothing is to be seen but plantations of coco-nut trees, some of them containing nine or ten thousand trees.

Ceylon is one of the localities where the greatest progress has been made in this species of culture.

In 1832 several Europeans settled at Batticaloa, expressly for the purpose of cultivating this palm to a large extent. They planted cotton bushes between the young trees, which were found to ripen well, and nurse and shade them.

There are now an immense number of coco-nut topes, or walks, on the coasts of the island, and about 20,000 acres of land are under cultivation with this tree.

The value of this product to Ceylon, may be estimated by the following return of its exports in 1847, besides the local consumption:—

L
Declared value of nuts 5,485

Ditto of Coir 10,318
Kernels, or Copperah 6,503
Shells 210
Oil 19,142
Arrack 11,657

Total L53,315

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The annually increasing consumption of the nuts holds out a great inducement to the native proprietors to reclaim all their hitherto unproductive land. The fruit commands a high price in the island, (ranging from 3/4d. to 3d. per nut), owing to the constant demand for it as an article of food, by both Singhalese and Malabars; there is not so much, therefore, now converted into copperah for oil making. In the maritime provinces of the island, it has been estimated that the quantity of nuts used in each family, say of five persons, amounts to 100 nuts per month, or 1,000 per annum. It needs only a reduction in the cost of transit, to extend the consumption in the interior of the island to an almost unlimited extent.

In 1842, Ceylon exported but 550 nuts, while in 1847 she shipped off to other quarters three millions and a half of nuts, valued at L5,500. The average value of the nuts exported may be set down at L7,000.

In Cochin China the cultivation of the coco-nut tree is much attended to, and they export a large quantity of oil. At Malacca and Pinang it shares attention with the more profitable spices. Since the palm has been acclimatised in Bourbon, about 20,000 kilogrammes of oil have been produced annually. About 8,000 piculs of oil are exported annually from Java.

A correspondent, under date December, 1849, has furnished me with the following particulars of coco-nut planting in Jaffna, the northern district of Ceylon, in which the culture has only recently been carried on; the facts and figures are interesting:—

The Karandhai estate, the property of the late Mr. J. Byles, was sold last month for L2,400, part of it bearing. It consisted of 303 acres, of which 228 are planted with coco nuts—about half the trees six years old.The Victoria estate, in extent 170 acres, planted and part in bearing, and about seventy acres of jungle, was also sold for L1,500. Mr. G. Dalrymple was the purchaser of the latter, and Mr. Davidson of the former. Both lots were cheap. The properties are among the best in the district, the latter, especially, is a beautiful estate.About two-thirds of the estates planted are looking well, and the remainder but indifferently, in fact, ought never to have been planted, and I believe will never give any return. About 7,000 acres are now under cultivation here, and clearing is still going on. Estates can now be put in for about one half what they cost formerly, *viz*., about L4 or L5 per acre, and can be kept in order, inclusive of all charges, for about 15s. to 20s. per acre for the first two years, and about half that afterwards. Estates, in some instances, have been put in for about L3 per acre.Elephants have almost disappeared; now and then a stray one comes. Figs are still a great nuisance, but the greatest anxiety among planters is regarding beetles. You will be sorry to hear

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that the first year the trees showed fruit or flower, one-tenth of them were destroyed by the beetle; the insects still go on destroying, and hardly a tree attacked ever recovers.This is a very serious evil, and upon which the fortunes of all those involved in coco-nut planting depend. The trees come into bearing but very slowly, and I consider no estate will give any return over its current expenses under twelve years. It takes twelve months from the formation of the flower, till the fruit ripens. On an estate, perhaps one of the oldest and best in this district, out of 120 acres, part seven and eight years old, about 12 per cent, are in flower or in bearing, and give a return of about twenty-four nuts per tree, on an average, yearly. On the next oldest, the return is not near so great. But few of the estates here will, I think, pay interest on the money laid out, and many will never pay anything over the expense of keeping them up, even after coming into bearing. I doubt if any estate in this district, however economically managed, will ever give a net return of more than L2, or perhaps of L2 10s. per acre, at least without there is a great increase in the consumption of oil in Europe. The consumption of this oil, in Europe, is under 5,000 tons. If the beetles do not destroy half the trees, the estates here when in bearing, if they yield anything, will give half that quantity; and it must be borne in mind that coco-nut oil is not a strong oil, like palm oil, and that soap boilers will never use it to any extent, for it will allow but little admixture of rosin, &c.; its use in Europe will be principally for candles and fancy soaps; but as by refining and compression they can now purify tallow, and make of it candles fully equal to those made from coco-nut oil, the consumption of the latter is not likely to increase. The consumption of candles is always limited on the continent of Europe, liquid oil being preferred, and in many instances gas is now being used where candles formerly were.

The return of land planted with coco-nut trees in Ceylon, in 1851, was 22,500 acres; but this refers only to regular estates recently opened and cultivated chiefly by Europeans. Let us suppose that the natives possess besides, twenty millions of trees; Butollac in his time estimated the number at thirteen millions. At 100 trees to the acre, twenty millions of trees give 100,000 acres, so that the total amount of land planted with coco-nut trees would be 122,500 acres.

An hydraulic press, for the manufacture of coco-nut oil, 1,200 horse power and weighing twenty-three tons, was cast at the Ceylon Iron Works, in 1850, by Messrs. Nelson and Son.

In the island of Singapore there are now many extensive plantations in a very flourishing condition, holding out favorable prospects to the proprietors. Hitherto the island has been supplied almost wholly from abroad with nuts and oil for its consumption, which will, before long, be obtained exclusively from its own soil. In 1846 there were 10,000 coco-nut trees in bearing in Singapore.

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I have omitted to notice, in the foregoing observations, a very mistaken notion which prevails in many quarters, that it is best to let the trees drop their fruit, and not to pick the nuts when ripe. Nature directs differently. As soon as the husk of the nut is more brown than green it should be picked. It then makes better oil and better coir, than when left to shrivel up and fall from the tree.

Colonel Low, in his “Dissertation on Pinang,” gives some interesting details and statistics on coco-nut planting:—

On a rough estimate—for an actual enumeration has not been lately taken—the total number of *bearing trees* in Pinang may be stated at 50,000, and those in Province Wellesley at 20,000; but very large accessions to these numbers have of late years been made. The tree is partial to a sandy soil in the vicinity of the sea, and Province Wellesley offers, therefore, greater facilities, perhaps, for its cultivation than Pinang does, as its line of clear beach is longer, and has many narrow slips of light or sandy land lying betwixt the alluvial flats inland. There are several kinds of this tree known here; one has a yellowish color, observable both on the branches and unripe fruit; its branches do not droop much. A second has green spreading branches, more drooping than the former, the fruit being green colored until ripe; this is, perhaps, the most prolific; it also bears the soonest, if we except the dwarf coco-nut, which fruits at the second or third year, before the stem has got above one foot high. This last kind was brought from Malacca; it attains in time to the height of the common sort. Its fruit is small and round, and of course less valuable than the other sorts. There is also a coco-nut so saturated with green, that the oil expressed from its kernel partakes of that color.It is a mistaken supposition that the coco-nut tree will flourish without care being taken of it. The idea has been induced by the luxuriant state of trees in close proximity to houses and villages, and in small cove’s where its roots are washed by the sea. In such circumstances, a tree, from being kept clear about the roots, from being shaded, and from occasional stimuli, advances rapidly to perfection; but in an extended plantation, a regular and not inexpensive system of culture must be followed to ensure success.The nuts being selected, when perfectly ripe, from middle-aged trees of the best sorts, are to be laid on the ground under shades, and after the roots and middle shoots, with two branches, have appeared, the sooner they are planted the better. Out of 100 nuts, only two-thirds, on an average, will be found to vegetate. The plants are then to be set out at intervals of thirty or forty feet—the latter if ground can be spared—and the depth will be regulated by the nature of the soil, and the nut must not be covered with earth. The plants require, in exposed situations, to

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be shaded for one and even two years, and no lalang grass must be permitted to encroach on their roots. A nursery must be always held in readiness to supply the numerous vacancies which will occur from deaths and accidents. The following may be considered the average cost of a plantation, until it comes into bearing:—

FIRST COST—100 ORLONGS OF LAND.
Spanish dollars.
Purchase money of land, ready for planting 1,000
7,000 nuts at 11/2 dollars, per 100 105
Houses of coolies, carts, buffaloes, &c., &c. 100

Spanish dollars 1,205

YEARLY COST OF SEVEN YEARS.

First year, 10 laborers at 3 dollars per month, including
carts, &c. 360
Wear and tear of buildings, carts, and implements 50
Overseer, at 7 dollars per month 84
Quit rent, average 50
Nursery and contingencies 50

Total per annum 594
Seven years at the rate will be 4,158

Total, Spanish dollars 4,752

To this sum interest will have to be added, making, perhaps, a sum total of 6,000 Spanish dollars, and this estimate will make each tree, up to its coming into bearing, cost one Spanish dollar at the lowest. The young tree requires manure, such as putrid fish and stimulating compounds, containing a portion of salt. On the Coromandel coast, the natives put a handful of salt below each nut on planting it.The cultivators of Kiddah adopt a very slovenly expedient for collecting the fruit. Instead of climbing the tree in the manner practised by the natives on the Coromandel coast, by help of a hoop passing round the tree and the body of the climber—and a ligature so connecting the feet as will enable him to clasp the tree with them—the Malays cut deep notches or steps in the trunk, in a zig-zag manner, sufficient to support the toes or the side of the foot, and thus ascend with the extra, aid only of their arms. This mode is also a dangerous one, as a false step, when near the top of a high tree, generally precipitates the climber to the ground. This notching cannot prove otherwise than injurious to the tree. But the besetting sin of the planter of coco-nuts, and other productive trees, is that of crowding. Coco-nut trees, whose roots occupy, when full grown, circles of forty to fifty feet in diameter, may often be found planted within eight or ten feet of each other;

and in the native campongs all sorts of indigenous fruit trees are jumbled together, with so little space to spread in, that they mostly assume the aspect of forest trees, and yield but sparing crops.The common kinds of the coco-nut, under

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very favorable circumstances, begin to bear at six years of age; but little produce can be expected until the middle or end of the seventh year. The yearly produce, one tree with another, may be averaged at 80 nuts the tree; where the plantation is a flourishing one —assuming the number of trees, in one hundred orlongs, to be 5,000—the annual produce will be 400,000 nuts, the minimum local market value of which will be 4,000 Spanish dollars, and the maximum 8,000 dollars. From either of these sums 6 per cent. must be deducted for the cost of collecting, and carriage, &c. The quantity of oil which can be manufactured from the above number of nuts will be, as nearly as possible, 834 piculs of 133-1/3 lbs.

The average price of this quantity, at 7 dollars per picul 5,838
Deduct cost of manufacturing, averaged at one-fourth, and
collecting, watching, &c 2,059

Profit, Spanish dollars 3,779

The Chinese, who are the principal manufacturers of the oil, readily give a picul of it in exchange for 710 ripe nuts, being about 563 piculs of oil out of the total produce of the plantation of 100 orlongs. The price of coco-nut oil has been so high in the London market as L35 per tun, or about an average of ten dollars per picul. It is said that English casks have not been found tight enough for the conveyance of this oil to Europe, but if the article is really in great demand, a method will no doubt be discovered to obviate this inconvenience.

> So long, however, as the cultivator can obtain a dollar and a half, or even one dollar for 100 nuts, he will not find it profitable to make oil, unless its price greatly rises.
>
> Soap is manufactured at Pondicherry from this oil, but it is not seemingly in repute; the attempt has not been made in Pinang with a view to a market.

There is scarcely any coir rope manufactured at this island, so that the profit which might (were labor cheaper) arise from this application of the coco-nut fibre, is lost. The shell makes good charcoal; the leaves are scarcely put to any purpose, the nipah or attap being a superior material for thatching.The coco-nut tree is extremely apt to be struck by lightning, and in such cases it is generally destroyed. It is a dangerous tree, therefore, to have close to a house. If the trees are widely planted, coffee may be cultivated under their shade. It is generally believed that the extracting of toddy from this tree hastens its decline. The Nicobar and Lancavi Islands used partly to supply the Pinang market with this indispensable article; but their depopulation has greatly reduced the quantity.On the whole it may be said that there is no cultivation which insures the return of produce with so much certainty as that of the coco-nut tree; and as Rangoon, the Tenasserim coast, and Singapore

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will, probably, always remain good markets for the raw nut, there appears to be every chance of the value of the produce affording ample remuneration to the planter.

Coco-nut beetle.—The chief natural enemy of this tree is a destructive species of elephant-beetle (*Oryctes Rhinoceros*), which begins by nibbling the leaves into the shape of a fan; it then perforates the central pithy fibre, so that the leaf snaps off; and lastly, it descends into the folds of the upper shoot, where it bores itself a nest, and if not speedily extracted or killed, will soon destroy the tree. At Singapore, on account of the depredations of this beetle, the difficulties have been considerable.

In Pinang and Province Wellesley it has only been observed within the last two years, and it is believed to have come from Keddah. A similar kind of beetle is, however, found on the Coromandel coast. The natives of Keddah say that this insect appears at intervals of two, three, or more years.

Its larvae, which are also very formidable insects or grubs, about three inches long, with large reddish heads, are found in decaying vegetable matter. It is when the tree has made considerable progress, however, that the parent insect does most mischief. When they are from one to two years old, throwing out their graceful branches in quick succession with the greatest vigor, and promising in three or four years more to yield their ruddy fruit, this destructive enemy begins to exercise his boring propensities; and, making his horn act as an auger, he soon penetrates the soft and yielding fibre of the young tree, and if not discovered in time, destroys the leading shoot or branch. The only remedy which has been adopted in Ceylon, is the following:—Several intelligent boys are provided each with an iron needle or probe, of about a foot long, with a sharp double barbed point, like a fish-hook, and a ring handle; they go through the plantation looking narrowly about the trees, and when they perceive the hole in the trunk, which indicates that the enemy is at work, they thrust in the barbed instrument and pull him out. Sometimes he may only have just commenced, when his capture is more easily effected, but even should he have penetrated to the very heart of the tree, the deadly needle does not fail in its errand, but brings the culprit out, impaled and writhing on its point. This is the only known way of checking the ravages of this beetle, except destroying its larvae. Some cultivators, however, think pouring salt water or brine on the top of the tree, so as to descend among the folds of the upper shoots, a good plan to get rid of the larvae.

Nearly two million coco-nuts are shipped annually from Bahia.

From Ceylon, 114,600 coco-nuts were shipped in 1851, and 70,185 in 1852.

Coco-nut oil; 98,159 gallons were shipped from Ceylon in 1852; 359,233 gallons in 1851.

The prices of Ceylon oil have ranged from L31 to L33 10s. per tun; of Cochin oil, L34 to L35, within the last two years. The price per leaguer in Colombo, without casks, has been L8 10s. to L9.

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Copperah is the name, given by the natives to the kernel of the ripe nut after it has been exposed to the sun on mats, until it has become rancid and dissolved. It has recently been shipped to England in this state for the purpose of converting into oil. The exports of copperah from Ceylon were, in 1842, 115 cwts.; in 1843, 2,194; in 1844, 2,397; and in 1852, 39,174 cwts.

The returned value of the copperah or kernels exported from Ceylon, as entered in the Custom House books, is—

1840 2,508 1841 1,460 1842 3,022 1843 5,795 1844 6,194 1845 3,282 1846 5,517 1847 6,503 1848 12,639 1849 7,819 1850 4,166 1851 9,678 1852 13,325

632 cwts. of poonac (being the refuse or cake, after expressing the oil) were exported from Ceylon in 1842. It is worth there about L10 the ton.

The oil from the nut is obtained for culinary purposes by boiling the fresh pulp, and skimming it as it rises. That for exportation is usually obtained by pressing the copperah in a simple press turned by bullocks. Recently, however, steam power has been applied in Colombo, with great advantage. About 21/2 gallons of oil per 100 nuts, are usually obtained. It is requisite that care should be taken not to apply too great and sudden a pressure at once, but by degrees an increasing force, so as not to choke the conducting channels of the oil in the press.

In many of the colonies the oil is expressed by the slow and laborious hand process of grating the pulp.

The quantity shipped from Ceylon was 2,250 tuns, in 1842; 3,985 in 1843; 2,331 in 1844; 1,797 in 1845. The quantity in gallons shipped since, was 101,553 in 1846; 197,850 in 1847; 300,146 in 1848; 867,326 in 1849; 407,960 in 1850; 442,700 in 1851; and 749,028 in 1852.

The duty on importation is of and from British possessions, 7d. and 7/8ths. per cwt.; if the produce of foreign possessions, 1s. 33/4 d, per cwt. In the close of 1852, the price of coco-nut oil in the London market was, for Ceylon, L32, L33, to L33 10s. per ton; Cochin, middling to fine, L34 to L35.

The following return shows the Custom House valuation of the oil shipped from Ceylon for a series of years, and which is of course much below its real value:—

1839 L26,597 1840 32,483 1841 24,052 1842 34,242 1843 43,874 1844 24,067 1845 15,945 1846 7,939 1847 19,142 1848 24,839 1849 34,831 1850 35,035 1851 31,444 1852 58,045

Among the coco-nut oil exported from Ceylon, in 1849, there were 47,4271/2 gallons, valued at L3,595, the whole of which, I believe, was Cochin oil; the raw material of this kind not being, like the copperah generally in Ceylon, subjected to the action of fire, the product is finer, and fetches a better price in the London market.

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Amongst the imports from British possessions in Asia, were 2,600 cwts., of copperah (dried coco-nut kernels, from which oil is expressed), valued at L1,100; amongst the imports re-exported to Great Britain, we find 870 cwts. of the same article, valued at L300. Of the oil exported a quantity of 11,000 gallons was shipped for the United States. About 600,000 piculs of coco-nut oil are annually exported from Siam.

A large quantity of oil is made in Trinidad, chiefly on the east coast, where, in one locality, there is an uninterrupted belt of coco-nut palms fourteen miles in extent. They usually bear when five years old.

The cultivation of the coco-nut in a proper soil presents a very profitable speculation for small capitalists. Whether sold at the rate of a dollar per hundred in their natural state, to captains of ships, who freely purchase them, or manufactured into oil, they are a very remunerative product. Each tree in the West Indies is calculated to produce nuts to the value of one dollar yearly. There is one thing to which we would draw the attention of chemists and other scientific men.

For twenty-four or even forty-eight hours after its manufacture this oil is as free from any unpleasant taste as olive oil, and can be used in lieu of it for all culinary purposes, but after that time it acquires such a rancid taste as to be wholly unpalateable. If any means could be discovered of preventing this deterioration in quality, and preserving it fresh and sweet, it could compete with olive oil, and the price and consumption would be largely raised.

COCO-NUT OIL IMPORTED INTO THE UNITED KINGDOM.

	Imports.	Retained for home consumption.
	cwts.	cwts.
1835	19,838	14,015
1836	26,058	26,062
1837	41,218	28,641
1838	—	38,669
1839	—	15,153
1840	—	37,269
1841	—	26,528
1842	—	26,225
1843	—	29,928
1844	—	42,480
1848	85,453	54,783
1849	64,451	14,622
1850	98,040	46,494
1851	55,995	2,333

1852	101,863	27,112

A London coco-nut oil soap was found, on analysis by Dr. Ure, to consist of:—

Soda 4.5
Coco-nut lard 22.0
Water 73.5

100.0

This remarkable soap was sufficiently solid; but it dissolved in hot water with extreme facility. It is called marine soap, because it washes linen with sea water.

Of the six principal vegetable oils, namely—palm, coco-nut castor, olive, linseed, and rape, the first four are imported in the state of oil only; the two last chiefly as seed. The proportion in which they were imported is shown in the following tables; and if to these quantities are added about a million and a half cwt. of tallow, and nearly twenty thousand tuns of whale oil and spermaceti, they will nearly represent the total quantity of oil imported into Great Britain.

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IMPORTS IN 1846.

	Palm oil.	Olive oil.	Castor oil.
	cwts.	tuns.	cwts.
Western Africa	475,364	1	—
United States	13,349	—	290
Naples and Sicily	14	9,661	—
East Indies	—	—	6,315
Canary Islands	3,719	—	—
Malta	—	2,237	—
Turkish Empire	—	1,712	—
Tuscany	—	832	—
Spain	—	753	—
Brazil	525	—	—
Ionian Islands	—	506	—
Morocco	—	368	—
Madeira	353	—	—
Sardinia	—	333	11
Miscellaneous	7	471	65
	-------	-------	-------
Total	493,331	16,864	9,681

IMPORTS IN 1850

	Linseed.	Rape seed.
	quarters.	quarters.
Russia	482,813	3,235
Sweden	870	—
Norway	268	—
Denmark	37	3,092
Russia	87,273	645
Hanse Towns	1,153	2,872
Holland	7,734	201
Naples	1,476	—
Austrian Territories	40	2,580
Greece	—	1,637
Wallachia and Moldavia	910	1,280
Egypt	17,517	—
East Indian Empire	26,142	13,126
Miscellaneous	262	922
	--------	------
Total	626,495	29,495

OIL-CAKE.—It has been observed by Evelyn that one bushel of walnuts will yield fifteen pounds of peeled kernels, and these will produce half that weight of oil, which the sooner it is drawn is the more in quantity, though the drier the nut the better its quality. The cake or marc of the pressing is excellent for fattening hogs and for manure.

Oats contain, as a maximum, about seven per cent. of oil, and Indian corn nine per cent. The cake of the gold of pleasure contains twelve per cent. Indeed the most valuable oil-cakes are those of the *Camelina sativa*, poppies and walnuts, which are nearly equal; next to these are the cakes of hemp, cotton, and beech-mast. In France the extraction and purification of oil from the cotton seed is a recent branch of labor, the refuse of which is likely to prove useful in agriculture; its value as a manure being nearly ten times greater than that of common dung. Oil is obtained from maize or Indian corn in the process of making whiskey. It rises in the mash tubs and is found in the scum at the surface, being separated either by the fermentation or the action of heat. It is then skimmed off, and put away in a cask to deposit its impurities; after which it is drawn off in a pure state, fit for immediate use. The oil is limpid, has a slight tinge of the yellow color of the corn, and is inoffensive to the taste and smell. It is not a drying oil, and therefore cannot be used for paint, but burns freely in lamps and is useful for oiling machinery.

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Among the various seeds used in the manufacture of oil-cake, flour of linseed is the most important. Rape seed is also employed, but is considered heating. In Lubeck, a marc, called dodder cake, is made from the *Camelina sativa*. Inferior oil-cake is made from the poppy in India. Cotton-seed cake has lately been recommended on account of its cheapness, being usually thrown away as refuse by the cotton manufacturers. It is extensively used as a cattle food, in an unprepared state, in various parts of the tropical world, and to a limited extent in this country.

The cost of seed, freight included, was 2d. per lb. from Charlestown to Port Glasgow. Cotton oil-cake is now ordered at the same price as linseed cake. The produce of oil-cake and oil from cotton seed, is two gallons of oil to one cwt. of seed, leaving about 96 lbs of cake; 8 lbs. is the daily allowance for cattle in England.

Cotton seed oil, very pure, is manufactured to a considerable extent at Marseilles, by De Gimezney, from Egyptian seed; and he received a prize medal at the Great Exhibition.

Account of the export of linseed and rapeseed cakes from Stettin, principally to England, in—

	cwts.
1834	33,518
1835	27,038
1836	56,581
1837	70,643
1838	119,540
1839	115,416
1840	162,457
1841	143,816
1842	119,814

The quantity of oil-seed cakes imported into the United Kingdom was in—

	tons.
1849	59,462
1850	65,055
1851	55,076
1852	53,616

Cargoes of oil-cake, to the value of L22,207, were exported from the port of Shanghae, in China, in 1849.

2,467 tons of oil-cake were brought down to New Orleans from the interior in 1848, and 1,032 tons in 1849.

Seven samples of American oil-cake gave the following results:—

Oil	11.41
Water	7.60
Nitrogen	4.74
Ash	6.35

From the above figures, the scientific farmer will see that the manure formed by 100 lbs. of oil-cake is more than that derived from 300 lbs. of Indian corn. 300 lbs. of corn contain about l1/4 lbs. phosphoric acid; 100 lbs. oil-cake contain about 21/2 lbs.

VOLATILE OR ESSENTIAL OILS occur in the stems, leaves, flowers and fruit of many odoriferous plants, and are procured by distillation along with water. They are called “essences,” and contain the concentrated odor of the plant. They usually exist ready-formed, but occasionally they are obtained by a kind of fermentation, as oil of bitter almonds and oil of mustard. Some of them consist of carbon and hydrogen only, as oil of turpentine, from *Juniperus communis;* oil of savin, from *Juniperus Sabina;* oil of lemons and oranges, from the rind of the fruit; and oil of nerole, from orange flowers. A second set contain oxygen in addition, as oil of cinnamon, from *Cinnamonum verum;* otto or attar of roses, from various species of rose, especially *Rosa centifolia;* oil of cloves, from *Caryophyllus aromaticus*.

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Those principally obtained from tropical shrubs and plants are citronella, oil of oranges and lemons, from the rind of the fruit oil of cinnamon and cloves, croton oil, &c.

The oil of Sandal or Sanders wood *(Santalum album*), grown on the Malabar coast, is much esteemed as a perfume. Keora oil, from *Pandanus odoratissimus*, in Bengal. Oil of spikenard, so highly prized, on account of its perfume, by the ancients, may be procured in Sagur, Nepaul, and the mountains of the Himalaya.

956 lbs. of essential oils were imported into Hull in 1850. There were exported from Ceylon in 1842, 902 cases; in 1843, 138; in 1844, 20; in 1845, 25 cases of essential oils, and in the last two years as follows:—

	1852.	1851.
	cases.	cases.
Cinnamon oil	17	23
Citronella oil	110	87
Essential oil	72	35

Of chemical, essential, and perfumed oils imported from France, the quantity is about 35,000 lbs. annually, worth L10,000. The duty is 1s. per lb. We also imported from France, in 1851, 9,596 cwt. of oil or spirit of turpentine, worth L14,197, on which a duty of 5s. 3d. per cwt. is levied.

From Western Australia some distilled oil of the Liptospermum was shown at the Exhibition, which it is stated may be obtained in any quantity, and a similar oil produced, by distillation, from the *Eucalyptus piperita*, a powerful solvent of caoutchouc, evidently very similar, if not altogether identical, with the oil of cajeput. The characters of these two oils are much alike and without some care it is difficult to distinguish them from one another by the odor; the liptospermum oil has a slight tinge of yellow, its specific gravity is 0.9035; the eucalyptus oil is colorless, and has a density of 0.9145. It is probable that these oils might be used with great advantage in the manufacture of varnish, they readily dissolve copal, and when its solution is spread over any surface the oil soon evaporates, and leaves a hard, brilliant and uniform coating of the resin. These oils, according to Prof. Solly, are specially worthy of attention.

Dr. Bennett, in his “Wanderings in New South Wales,” states that a large quantity of camphorated oil, which closely resembles the cajeputi, is produced from the foliage of several species of *Eucalyptus*. Some of the leaves, which are of a bluish green, contain it in such abundance as to cover the hand with oil when one of the leaves is gently rubbed against it.

From the odorous leaves of the *Arbor alba* is extracted a portion of the aromatic cajeput oil. This celebrated medicinal oil is principally made in the island of Borneo, one of the Moluccas.

The leaf of the *Melaleuca minor* yields, by distillation, the volatile oil of cajeputi, well known as a powerful sudorific, and a useful external application in chronic rheumatism. It is an evergreen shrub, with white flowers like a myrtle, native of the East Indies, principally flourishing on the sea coasts of the Moluccas and other Indian islands. Two sacks full of the leaves yield scarcely three drachms of the oil, which is limpid, pellucid, and of a green color.

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Oil of cinnamon and oil of cassia, according to Mulder, have the same composition. When fresh they are pale yellow, but become brown on exposure to the air. On exposure they rapidly absorb cinnamic acid, two resins and water.

More than 22,000 lbs. of essence of bergamot was imported in 1848. It is obtained by distillation or pressure from the rind of the fragrant citron.

Andropogon calamus aromaticus, of Royle, *A. nardoides*, of Nees v. Esenb., according to some yields the grass oil of Namur.

The fruits of *Carum carui*, a hardy biennial British plant, popularly known as caraway seeds, supply a volatile oil, which is carminitive and aromatic. Oils of a similar kind are obtained from *Coriandrum sativum*, from anise (*Pimpinella Anisum*), and cumin (*Cuminum Cyminum*), a native of Egypt.

The production of cinnamon, clove, and cassia oils, have already been noticed in speaking of those spices.

In Malabar, a greenish sweet-smelling oil is obtained, by distillation, from the roots of *Unona Narum*, an evergreen climber, which is used medicinally as a Stimulant.

OIL OF PEPPERMINT.—Mr. De Witt C. Van Slyck, of Alloway, Wayne county, New York, furnished me with the following particulars on the cultivation of peppermint, in December, 1849, which may appropriately be introduced in this place:—

“As an agricultural production, the culture of peppermint in the United States is limited to few localities; this county and the adjoining ones, Seneca and Ontario, comprise the largest bed. In the year 1846 about 40,000 lbs. of oil were produced. In Lewis county, in this state, it is grown, though to a less extent; the amount of oil produced there in 1846 was estimated at 4,500 lbs. In Michigan about 10,000 lbs. are annually produced; Ohio furnishes about 3,000 lbs. and Indiana 700 lbs. per annum. The entire crop in the United States, in the year 1846, is estimated in round numbers at 58,000 lbs.The above comprises all the localities of any importance in the United States, and the above estimates of the annual product of oil were made from correct data for the year 1846, since which time the cultivation of mint has rapidly decreased in consequence of a speculative movement by a New York company, who in the spring of 1847 purchased nearly all the mint then growing in this State, and stipulated with the growers not to raise it for two years thereafter, which condition was generally observed on the part of the growers. The present year (1849), on account of the drought, has not realised the expectations of those engaged in its culture, although the amount of oil produced is much larger than the product of the two preceding years. In this mint district, 8,000 lbs. have been raised; Lewis county furnishes 1,000 lbs.; Michigan, 8.000 lbs.; Ohio, 1,000 lbs., and Indiana 500 lbs. So that the entire crop of 1849

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will not materially vary from 18,500 lbs.I have consulted several of the principal dealers in mint oil, whose opportunities have been ample to form a tolerably correct estimate of the amount of oil annually consumed, and their opinion fixes the total consumption, for the various purposes for which it is used in the United States and in Europe, at from 20,000 to 30,000 lbs. annually.The price of mint oil is extremely fluctuating. Like other unstaple commodities, the value of which depends upon their scarcity or abundance, it never has assumed a constant and standing value, but its price has generally been deranged by speculation and monopoly. It has happened that the amount of oil produced was for several years greater than the annual consumption, producing an accumulation in the market, and reducing the price to the very low rate of 75 cents per pound; on the other hand, when the article was scarce, it readily sold for 5 dollars 25 cents per pound. The average price for fifteen vears has been about 2 dollars 50 cents, per pound. This year (1849) it readily sells for 1 dollar 50 cents., (6s. 6d.).Peppermint began to be cultivated in this vicinity as an agricultural product about the year 1816, but for several years the want of a proper knowledge of its culture, and the expense and difficulty of extracting the oil, prevented its extension beyond a few growers, who, however, realised fortunes out of the enterprise. Almost any kind of soil that will successfully rear wheat and maize is adapted to the growth of mint. Rich alluvions, however, seem to be most natural, as would be inferred from the fact that the wild herb is almost uniformly found growing upon the tertiary formations on the margins of streams. The rich bottom lands along our rivers and the boundless prairies of the West are eminently adapted for its successful culture. It is believed by those best acquainted with the subject, that its cultivation must be ultimately confined to the western prairies, where it will grow spontaneously, and where the absence of noxious weeds and grasses, incident to all older settled lands, renders the expense of cultivation comparatively light, and where the low price of land will be an important item in the amount of capital employed, the expense of marketing being slight in comparison to that of the more bulky products of agricultural industry.The method of cultivation is nearly uniform. The mode of propagation is by transplanting the roots, which may be done in autumn or spring, though generally the latter, and as the herb is perennial, it does not require replanting till the fourth year. To ensure a good crop and obviate the necessity of extra attendance the first season, the ground intended for planting should be fallowed the preceding summer, though this is not necessary if the land is ordinarily clean. The ground should be prepared as for maize, as soon as possible

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in the spring furrowed, and roots planted in drills twenty inches apart, and covered with loose earth, two inches deep, the planter walking upon the drill and treading it firmly. The proper time to procure roots is when the herb is a year old, when from six to eight square rods of ordinary mint will yield a sufficient quantity of roots to plant an acre, and the crop from which the roots are taken will not be deteriorated, but rather benefited by their extraction. As soon as the herb makes its appearance it requires a light dressing with a hoe, care being taken not to disturb the young shoots, many of which have scarcely made their appearance above the ground. In the course of a week or two the crop requires a more thorough dressing, and at this stage of growth the cultivator may be used with advantage, followed by the hoe, carefully eradicating weeds and grass from the drills, and giving the herb a light dressing of earth. Another dressing a week or two later is all the crop requires.The two following years no labor is bestowed upon the crop, though it is sometimes benefited by ploughing over the whole surface, very shallow, in the autumn of the second year, and harrowing lightly the following spring, which frequently renews the vigor of the plant and increases the product.The mint should be cut as soon as it is in full bloom, and the lower leaves become sere; the first crop will not be fit to cut as early as the two succeeding ones. It is then to be hayed and put in cock, and is then ready for distillation.I have consulted many mint growers, who have cultivated it for a series of years, in regard to the average yield per acre, and have arrived at the following estimate, which I think is low, provided the land is suitable, and is properly cultivated. I estimate the average yield per acre for the first year at 18 lbs.; the second year at 14 lbs.; and the third year at 8 lbs.—making the product for three years 40 lbs., which I think will not materially vary from the actual result, though growers aver they have raised from 30 to 40 lbs. per acre the first season.Several years since, the only method of extracting the oil then known was by distilling the herb in a copper kettle, or boiler, and condensing in the usual manner; a slow and tedious process, by which about 12 or 15 pounds of oil could be separated in a day. But recently steam, that powerful agent, which has wrought such immense changes in our social and national economy, has been applied to this subject with its usual attendant success. The present method consists in the use of a common steam-boiler, of the capacity of from 100 to 150 gallons, from which the steam is conveyed by conductors into large wooden air-tight tubs, of 200 gallons capacity, containing the dried herb; from which it is conveyed, charged with the volatile principle of the plant, into a water-vat, containing the condenser.

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The water collected at the extremity of the condenser, although it does not readily commingle with the oil, is highly tinctured with it, and is used to feed the boiler. Two tubs are necessary, in order that when the “charge” is being worked off in one, the other can be refilled. The oil is then to be filtered, and is ready for market. The expense of a distillery is estimated at 150 dollars, which, with the labor of two men, and a cord of dry wood, will run 40 lbs. of oil per day. The usual price for distilling is 25 cents per pound.The cost of production is of course greatly modified by circumstances. If grown on rich bottom lands, or prairie, unusually free from weeds and grass, the labor required will be comparatively trifling. From information derived from the principal mint growers in this vicinity, I have prepared the following estimate of the cost of production of an acre of mint for three years:—

FIRST YEAR.

	Dollars.
Rent of an acre of land one year	8.00
One day plough and drag, one hand and team	2.00
Half day furrowing, digging roots, one hand and horse	1.00
Three days planting, at 75 cents	2.25
Two days dressing with hoe, at 75 cents	1.50
Two days with cultivator and hoe, 1.00	2.00
Two days with cultivator and hoe (third dressing)	1.50
One and a-half days cutting new mint, at 75 cents	1.13
Curing and drawing to distillery	1.50
Distilling 18 lbs. oil, at 25 cents	4.50
Can for oil	25

	25.63

SECOND YEAR.

Rent of an acre of land one year	8.00
Cutting one acre of old mint	75
Curing and hauling to distillery	1.50
Distilling 14 lbs. oil, at 25 cents	3.50
Can for oil	25

	14.00

THIRD YEAR.

Rent of an acre of land one year	8.00
Cutting, curing, &c.	2.25
Distilling 8 lbs. of oil, at 25 cents, and can	2.25

12.50

Total expenses for three years 52.13

Forty pounds of oil, at dollars 1.371/2 per pound 55.00
Deduct expenses 52.13

Net profit 2.87

In the above estimate I have omitted the expense of roots, for the reason that the crop will yield as many as are required for planting. The price of roots is about 50 cents per square rod, and if they are in demand, the profit of the crop will be greatly enhanced by selling them at that, or even a lower price.It will be readily perceived that the culture of peppermint promises no great return

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of profit in sections of country where land is valuable, and where the expense of production is nearly double what it is in newly-settled districts. It is a fact that in Michigan, and other Western States, the actual expense of production is about one-half less than the above estimate, and the yield is a fourth greater; the greater distance from market, which is usually New York city, not being taken into account, the freight on oil being comparatively trifling. Another consideration in favor of prairie cultivation is, that the mint will endure for years by simply ploughing over the surface every second year, which seems to invigorate the herb, and obviates the necessity of replanting every second or third year, as must be done in older settled localities."

In India the perfumed oils are obtained in the following manner:—The layers of the jasmine, or other flowers, four inches thick and two inches square, are laid on the ground and covered with layers of sesamum or any other oil yielding seed. These are laid about the same thickness as the flowers, over which a second layer of flowers like the fruit is placed. The seed is wetted with water, and the whole mass covered with a sheet, held down at the end and sides by weights, and allowed to remain for eighteen hours in this form. It is now fit for the mill, unless the perfume is desired to be very strong, when the faded flowers are removed and fresh ones put in their place. The seed thus impregnated is ground in the usual way in the mill and the oil expressed, having the scent of the flower. At Ghazipoor the jasmine and bela are chiefly employed; the oil is kept in the dubbers, and sold for about 4s. a seer.

The newest oils afford the finest perfume. In Europe a fixed oil, usually that of the bean or morerja nut, is employed. Cotton is soaked in this, and laid over layers of flowers, the oil being squeezed out so soon as impregnated with perfume. Dr. Johnson thus describes the culture and manufacture:—

Cultivation of Roses.—Around the station of Ghazipoor, there are about 300 biggahs (or about 150 acres) of ground laid out in small detached fields as rose gardens, most carefully protected on all sides by high mud walls and prickly pear fences, to keep out the cattle. These lands, which belong to Zemindars, are planted with rose trees, and are annually let out at so much per biggah for the ground, and so much additional for the rose plants—generally five rupees per biggah, and twenty-five rupees for the rose trees, of which there are 1,000 in each biggah. The additional expense for cultivation would be about eight rupees eight annas; so that for thirty-eight rupees eight annas you have for the season one biggah of 1,000 rose trees.If the season is good, this biggah of 1,000 rose trees should yield one lac of roses. Purchases for roses are always made at so much per lac. The price of course varies according

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to the year, and will average from 40 to 70 rupees.*Manufacture of Rose-water*.—The rose trees come into flower at the beginning of March, and continue so through April. Early in the morning the flowers are plucked by numbers of men, women, and children, and are conveyed in large bags to the several contracting parties for distillation. The cultivators themselves very rarely manufacture.The native apparatus for distilling the rose-water is of the simplest construction; it consists of a large copper or iron boiler well tinned, capable of holding from eight to twelve gallons, having a large body with a rather narrow neck, and a mouth about eight inches in diameter; on the top of this is fixed an old dekchee, or cooking vessel, with a hole in the centre to receive the tube or worm.This tube is composed of two pieces of bamboo, fastened at an acute angle, and it is covered the whole length with a strong binding of corded string, over which is a luting of earth to prevent the vapour from escaping. The small end, about two feet long, is fixed into the hole in the centre of the head, where it is well luted with flower and water. The lower arm or end of the tube is carried down into a long-necked vessel or receiver, called a bhulka. This is placed in a handee of water, which, as it gets hot, is changed. The head of the still is luted on to the body, and the long arm of the tube in the bhulka is also well provided with a cushion of cloth, so as to keep in all vapour. The boiler is let into an earthen furnace, and the whole is ready for operation. There is such a variety of rose-water manufactured in the bazar, and so much that bears the name, which is nothing more than a mixture of sandal oil, that it is impossible to lay down the plan which is adopted. The best rose-water, however, in the bazar, may be computed as bearing the proportion of one thousand roses to a seer of water; this, perhaps, may be considered as the best procurable.From one thousand roses most generally a seer and a half of rose-water is distilled, and perhaps from this even the attar has been removed. The boiler of the still will hold from eight to twelve or sixteen thousand roses. On eight thousand roses from ten to eleven seers of water will be placed, and eight seers of rose-water will be distilled. This after distillation is placed in a carboy of glass, and is exposed to the sun for several days to become pucka (ripe); it is then stopped with cotton, and has a covering of moist clay put over it; this becoming hard, effectually prevents the scent from escaping. The price of this will be from twelve to sixteen rupees. This is the best that can be procured.*Attar of Roses*.—To procure the attar, the roses are put into the still, and the water passes over gradually, as in the case of the rose-water process; after the whole has come over, the rose-water is placed in a large

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metal basin, which is covered with wetted muslin, tied over to prevent insects or dust getting into it; this vessel is let into the ground about two feet, which has been previously wetted with water, and it is allowed to remain quiet during the whole night. The attar is always made at the beginning of the season, when the nights are cool; in the morning the little film of attar which is formed upon the surface of the rose-water during the night is removed by means of a feather, and it is then carefully placed in a small phial; and, day after day, as the collection is made, it is placed for a short period in the sun, and after a sufficient quantity has been procured, it is poured off clear, and of the color of amber, into small phials. Pure attar, when it has been removed only three or four days, has a pale greenish hue; by keeping it loses this, and in a few weeks' time it becomes of a pale yellow. The first few days distillation does not produce such fine attar as comes off afterwards, in consequence of the dust or little particles of dirt in the still and the tube being mixed with it. This is readily separated, from its sinking to the bottom of the attar, which melts at a temperature of 84 degrees. From one lac of roses it is generally calculated that 180 grains, or one tolah, of attar can be procured; more than this can be obtained if the roses are full-sized, and the nights cold to allow of the congelation. The attar purchased in the bazar is generally adulterated, mixed with sandal oil, or sweet oil; not even the richest native will give the price at which the purest attar alone can be obtained, and the purest attar that is made is sold only to Europeans. During the past year it has been selling from 80 to 90 rupees the tolah; the year before it might have been purchased for 50 rupees.*General Remarks*.—Native stills are let out at so much per day or week, and it frequently occurs that the residents prepare some rose-water for their own use as a present to their friends, to secure their being provided with that which is the best. The natives never remove the calices of the rose-flowers, but place the whole into the still as it comes from the garden.The best plan appears to be to have these removed, as by this means the rose-water may be preserved a longer time, and is not spoiled by the acid smell occasionally met with in the native rose-water. It is usual to calculate 100 bottles to one lac of roses. The rose-water should always be twice distilled; over ten thousand roses water may be put to allow of sixteen or twenty bottles coming out; the following day these twenty bottles are placed over eight thousand more roses, and about eighteen bottles of rose-water are distilled. This may be considered the best to be met with. The attar is so much lighter than the rose-water, that, previous to use, it is better to expose the rose-water to the sun for a few days, to allow of its being well mixed; and rose-water that has been kept six months is always better than that which has recently been made.At the commencement of the rose season, people from all parts come to make their purchases, and very large quantities are prepared and sold. There are about thirty-six places in the city of Ghazeepore where rose-water is distilled. These people generally put a large quantity of sandal oil into the receiver, the oil is afterwards carefully removed and sold as sandal attar, and the water put into carboys and disposed of as rose-water. At the time of sale a few drops of sandal oil are placed on the neck of the carboy to give it fresh scent, and to many of the natives it appears perfectly immaterial whether the scent arises solely from the sandal oil or from the roses. Large quantities of sandal oil are every year brought up from the south and expended in this way.6. The chief use the natives appear to make of the rose water, or the sandal attar as they term it, is at the period of their festivals and weddings. It is then distributed largely to the guests as they arrive, and sprinkled with profusion in the apartments. A large quantity of rose water is sold at Benares, and many of the native Rajahs send over to Ghazipoor for its purchase. Most of the rose water, as soon as distilled, is taken away, and after six months from the termination of the manufacture there are not more than four or five places where it is to be met with.I should consider that the value of the roses sold for the manufacture of rose water may be estimated at 15,000 to 20,000 rupees a year; and from the usual price asked for the rose water, and for which it is sold, I should consider there is a profit of 40,000 rupees. The natives are very fond of using the rose water as medicine, or as a vehicle for other mixtures, and they consume a good deal of the petals for the conserve of roses, or goolcond as they call it.The roses of Ghazipoor, on the river Ganges, are cultivated in enormous fields of hundreds of acres. The delightful odor from these fields can be scented at seven miles distance on the river. The valuable article of commerce known as attar of roses is made here in the following manner:—On 40 pounds of roses are poured 60 pounds of water, and they are then distilled over a slow fire, and 30 pounds of rose water obtained. This rose water is then poured over 40 pounds of fresh roses, and from that is distilled at most 20 pounds of rose water; this is then exposed to the cold night air, and in the morning a small quantity of oil is found on the surface. From 80 pounds of roses, about 200,000, at the utmost an ounce and a-half of oil is obtained; and even at Ghazipoor it costs 40 rupees (4_l._) an ounce.Five guineas have been often paid for one ounce of attar of roses. The most approved mode of ascertaining its quality is to drop it on a piece of paper; its strength is ascertained by the quickness with which it evaporates, and its worth by its leaving no stains on the paper. The best otto is manufactured at Constantinople.

A volatile oil, erroneously called oil of spikenard, is met with in the shops, which is obtained from a plant which has been named by Dr. Royle, the *Andropogon Calamus aromaticus.*

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The true spikenard of the ancients is supposed to have been obtained from the *Nardostachys Jatamansi*, a plant of the Valerian family. Dr. Stenhouse describes rather minutely ("Journal Pharm. Soc." vol. iv. p. 276) a species of East India grass oil, said to be the produce of *Andropogon Ivaracusa*, which he believes to be what is usually called the oil of Namur. It has a very fragrant aromatic odor, slightly resembling that of otto of roses, but not nearly so rich. Its taste is sharp and agreeable, approaching that of oil of lemons. It has a deep yellow color, and contains a good deal of resinous matter.

LEMON GRASS (*Andropogon schoenanthus*).—This fragrant grass, which is now cultivated very generally throughout the West Indies, in the gardens of the planters, as an elegant and powerful diaphoratic, was doubtless introduced from the East. The active principle of the leaves seems to reside in the essential oil which they contain. Lemon grass oil forms an important article of export from Ceylon, amounting in value to nearly L7,000 annually.

The *Andropogon schoenanthus*, which may be seen covering all the Kandian hills, is the best possible pasture for cattle—at least as long as it is young. This species of grass is very hard, and grows to the height of seven feet, and sometimes higher, and has a strong but extremely pleasant acid taste. It derives its name from having, when crushed, an odor like that of the lemon, so strong, that after a time it becomes quite heavy and sickening, although grateful and refreshing at first. It covers the hills in patches—those, at least, that are not overgrown with jungle and underwood—and it is to be found nowhere but in the Kandian district. Spontaneous ignition frequently takes place, and the appearance of the burning grass is described as most magnificent. A few days after, from the midst of this parched, blackened, and apparently dead ground, lovely young green shoots begin to arise—for the roots of this extraordinary grass have not even been injured, far less destroyed, by the fire; and in a very short time the whole brow of the mountain is again overspread with tufts of beautiful green waving grass.—-("Journal of Agriculture.")

Otto of khuskhus or scented grass, from another species, *A. digitalis*, obtained at Ulwar in the States of Rajpootanah, was shown at the Great Exhibition in 1851, and Newar oil (from *A. maritima*) from Agra.

CITRONELLA OIL.—In the Southern province of Ceylon some half dozen estates about Galle are cultivated with citronella grass. The exports of this oil from Ceylon in the last three years have been as follows:—1850, 86,048 oz., valued at L3,344; 1851, 114,959 oz., valued at L3,742; in 1852, 131,780 oz., valued at L2,806.

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PATCHOULY.—Under this name are imported into this country the dried foliaceous tops of a strongly odoriferous labiate plant, growing three feet high in India and China, called in Bengalee and Hindu, *pucha pat*. About 46 cases, of from 50 to 110 lbs. each, were imported from China, by the way of New York, in 1844. The price asked was 6s. per pound. Very little is known of the plant yielding it. Mr. George Porter, late of the island of Pinang, stated that it grows wild there and on the opposite shores of the Malay peninsula. Dr. Wallich says, that it obviously belongs to the family Labiatae. Viney, in the “French Journal of Pharmacy,” suggests that it is the *Plectranthus graveolens* of R. Brown. It forms a shrub of two or three feet in height. It is the *Pogostemon patchouly*. The odor of the dried plant is strong and peculiar, and to some persons not agreeable. The dried tops imported into England are a foot or more in length. In India it is used as an ingredient in tobacco for smoking, and for scenting the hair of women. In Europe it is principally used for perfumery purposes, it being a favorite with the French, who import it largely from Bourbon. The Arabs use and export it more than any other nation. Their annual pilgrimship takes up an immense quantity of the leaf. They use it principally for stuffing mattrasses and pillows, and assert that it is very efficacious in preventing contagion and prolonging life. It requires no sort of preparation, being simply gathered and dried in the sun; too much drying, however, is hurtful, inasmuch as it renders the leaf liable to crumble to dust in packing and stowing on board. The characteristic smell of Chinese or Indian ink is owing to an admixture of this plant in its manufacture. M. de Hugel found the plant growing wild near Canton. By distillation it yields a volatile oil, on which the odor and remarkable properties depend. This oil is in common use in India for imparting the peculiar fragrance of the leaf to clothes among the superior classes of natives. The origin of its use is this:—A few years ago, real Indian shawls bore an extravagant price, and purchasers could always distinguish them by their odor; in fact, they were perfumed with Patchouly; the French manufacturers at length discovered this secret, and used to import the plant to perfume articles of their make, and thus palm off homespun shawls as real India! Some people put the dry leaves in a muslin bag, and thus use it as we do lavender, scenting drawers in which linen is kept; this is the best way to use it, as this odor, like musk, is most agreeable when very dilute.—("Gardeners’ Chronicle.”)

The root of some parasitical plant, under the name of kritz, is used in Cashmere to wash the celebrated shawls, soap is used only for white shawls.

From the flowers of the Bengal quince (*AEgle marmemolos*) a fragant liquid is distilled in Ceylon known as marmala water, which is much used as a perfume for sprinkling by the natives.

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Jasmine oil is distilled from *Jasminum sambac* and *grandiflora*.

SAPONACEOUS PLANTS.—Many plants furnish abroad useful substitutes for common soap. The aril which surrounds the seed and the roots of *Sapindus Saponaria*, an evergreen tree, I have seen used as soap in South America and the West Indies under the name of soap berries. The seed vessels are very acrid, they lather freely in water and will cleanse more linen than thirty times their weight of soap, but in time they corrode or burn the linen. Humboldt says that proceeding along the river Carenicuar, in the Gulf of Cariaco, he saw the Indian women washing their linen with the fruit of this tree, there called the parapara. Some other species of *Sapindus* and of *Gypsophila* have similar properties. The bruised leaves and roots of *Saponaria officinalis*, a British species, form a lather which much resembles that of soap, and is similarly efficacious in removing grease spots. The bark of many species of Quillaia, as *Q. saponaria*, when beaten between stones, makes a lather which can be used as a substitute for soap, in washing woollens and silk clothes, and to clean colors in dyeing, in Chili and Brazil, but it turns linen yellow. The fruit of *Bromelia Pinguin* is equally useful. A vegetable soap was prepared some years ago in Jamaica from the leaves of the American aloe (*Agave Americana*) which was found as detergent as Castile soap for washing linen, and had the superior quality of mixing and forming a lather with salt water as well as fresh. Dr. Robinson, the naturalist, thus describes the process he adopted in 1767, and for which he was awarded a grant by the House of Assembly:—"The lower leaves of the Curaca or Coratoe (*Agave karatu*) were passed between heavy rollers to express the juice, which, after being strained through a hair cloth, was merely inspissated by the action of the sun, or a slow fire, and cast into balls or casks. The only precaution necessary was to allow no mixture of any unctuous materials, which destroyed the efficacy of the soap. A vegetable soap, which has been found excellent for washing silk, &c, may be thus obtained. To one part of the skin of the Ackee add one and a half part of the *Agave karatu*, macerated in one part of boiling water for twenty-four hours, and with the extract from this decoction mix four per cent. of rosin. In Brazil, soap is made from the ashes of the bassura or broom plant (*Sidu lanceolata*) which abounds with alkali. There are also some soap barks and pods of native plants used in China. Several other plants have been employed in different countries as a substitute for soap. The bark of *Quillaia saponaria* renders water frothy and is used as a detergent by wool dyers. *Saponaria vaccana* is common in India. The pericarp of *Sapindus emarginatus* mixed with water froths like soap. Saponaceous berries are found in Java.

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The soap-worts to which the genus Sapindus belongs are tropical plants. The fruit of many species of *Sapindus* is used as a substitute for soap, as *Sapindus acuminata*, *Laurifolius emarginatus* and *detergens*, all East Indian plants.

SECTION VI.

PLANTS YIELDING DRUGS, INCLUDING NARCOTICS AND OTHER COMMON MEDICINAL SUBSTANCES.

The chief plants furnishing the drugs of commerce, and which enter largely into tropical agriculture, are the narcotic plants, especially tobacco, the poppy for opium, and the betel nut and leaf; as masticatories—but there are very many others to which the attention of the cultivator may profitably be directed. I have already trenched so largely upon my space, that I cannot do that justice to the plants coming under this section I could have wished. There are very many, however, of which I must make incidental mention. Some few medicinal plants have been already alluded to in former sections, particularly in that on dye-stuffs, &c.

THE COCA PLANT grows about four or five feet high, with pale bright green leaves, somewhat resembling in shape those of the orange tree. The leaves are picked from the trees three or four times a year, and carefully dried in the shade; they are then packed in small baskets. The greatest quantity is grown about 30 leagues from Cicacica, among the Yunnos on the frontiers of the Yunghos. Some is also cultivated near to Huacaibamba.

The natives in several parts of Peru chew these leaves as Europeans do tobacco, particularly in the mining districts, when at work in the mines or travelling; and such is the sustenance that they derive from them, that they frequently take no food for four or five days. I have often (observes Mr. Stevenson) been assured by them, that whilst they have a good supply of coca they feel neither hunger, thirst, nor fatigue, and that without impairing their health they can remain eight to ten days and nights without sleep. The leaves are almost insipid, but when a small quantity of lime is mixed with them, they have a very agreeable sweet taste. The natives generally carry with them a leather pouch containing coca, and a small calabash holding lime or the ashes of the molle to mix with them.

Cocculus indicus, or Indian berries.—This is the commercial name for the berries or fruit of the *Menispermum Cocculus* of Linnaeus, *M. heteroclitum* of Roxburgh, *Animerta paniculata* of Colebrooke, *A. Cocculus* of Wright and Arnot, and *Cocculus suberosus* of Decandolle. It is a strong climbing shrub or tree, native of Malabar, Ceylon, and the Eastern Islands. The seeds or drupes contain a bitter poisonous acid, and are used for the purpose of stupefying fish, and, in the form of a black extract, for fraudulently increasing the intoxicating power of malt liquors; one pound of the berries, it is said, will go as far in brewing as a sack of malt. The berry is kidney-shaped, with a white kernel. Whilst the imports in 1846 were but 246 bags, in 1850 they had increased to 2,359 bags of about 1 cwt. each. The price is 19s. to 24s. the cwt.

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A crystalline, poisonous, narcotic principle called picrotoxin, has been detected in these seeds, and occasionally employed externally in some cutaneous diseases. *Cocculus crispus* is used in intermittent fevers and liver complaints.

The annual imports now average 250 tons, and nearly the whole is consumed for illegal purposes by brewers. Though the practice is nominally discountenanced by the Legislature under the penalty of L200 upon the brewer and L500 upon the seller, yet under the recent tariff great encouragement is given to the introduction of these berries, the duty having been reduced from 7s. 6d. to 5s. the cwt.

The capsules and seeds of *Xanthoxylum hostile* are also employed for the same purpose as cocculus indicus. The bark of *Walseria piscidia*, a native of the Circar mountains, also intoxicates fish.

About 250 tons of *Nux vomica*, another species of dried flat seed possessing intoxicating properties, are also imported annually for the same purposes, and they fetch about 6s. to 8s. the cwt.

BETEL LEAF.—*Piper Betel*, a scandent species of the shrubby evergreen tribe of plants belonging to the pepper family, furnishes the celebrated betel leaf of the Southern Asiatics, in which they enclose a few slices of the areca nut and a little shell lime; this they chew to sweeten the breath, and to keep off the pangs of hunger, and it acts also as a narcotic.

Such is the immense consumption of this masticatory, termed Pan, in the East, that it forms nearly as extensive an article of commerce as that of tobacco in the West. The tax on the leaf forms a considerable portion of the local revenue of Pinang; in 1805, the tax yielded as much as 5,400 dollars.

Rumphius describes six species of this vine, besides several wild and cultivated varieties. It is very easily reared in the Indian islands, but in the countries of the Deccan requires manuring, frequent watering and great care, and in the northern parts of Hindostan it becomes an exotic very difficult to rear. The vine affords leaves fit for use in the second year, and continues to yield for more than thirty, the quantity diminishing as the plants grow older.

ARECA PALM (*Acacia Catechu*).—This is a fine, slender, graceful tree, rising from 20 to 30 feet high, which, being a native of the East, is found abundant in many of the forests of India, from 16 to 30 degs. of latitude. The principal places of its growth are the Burmese territories, a large province on the Malabar coast called the *Concan*, and the forests skirting the northern parts of Bengal, under the hills which divide it from Nepaul, the south and west coasts of Ceylon, the south of China, &c., the Malay Peninsula, Sumatra and the Eastern islands, it produces fruit at five years old, and continues bearing till about its twenty-fifth year, when it withers and dies. It thrives at a greater distance from the sea, and in more elevated regions than the coco-nut palm. In Prince of Wales Island some hundreds of thousands of these palms are cultivated.

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The seeds or nuts form a chief ingredient in the celebrated eastern masticatory called Pan and which seems to owe its stimulating properties to the leaves of the *Piper Betel*. When prepared for use, the nut is cut into slices and wrapped in the fresh leaves of the betel pepper vine, together with a quantity of quicklime (*Chunam*) to give it a flavor. The flavor is peculiar, between an herbaceous and an aromatic taste.

All classes, male and female, chew it; they say it sweetens the breath, strengthens the stomach, and preserves the teeth, to which it gives a reddish hue; there is probably less objection to its use than tobacco or opium, and its taste is more pleasant; but, if taken to excess, it will produce stupor like other narcotics, and even intoxication. The nuts grow in large bunches at the top, and when ripe are red and have a beautiful appearance; they resemble the nutmeg in shape and color, but are larger and harder. When gathered they are laid in heaps until the shell be somewhat rotted, and then dried in the sun, after which the process of shelling commences. The trees vary in their yield from 300 to 1,000 nuts, averaging about 14 lbs.; which the cultivators sell at about half a dollar (2s.) a picul of 133 lbs. As these palms are planted usually at the distance of 71/2 feet, it follows that the produce of an acre is about 10,841 lbs. The tree bears but once in a year generally, but there are green nuts enough to eat all the year long. Betel nut is a staple article of import into China; 25,000 piculs annually is the amount returned, but there is an immense quantity imported in Chinese junks from Hainan, of which there is no account kept. In the single port of Canton alone, 15,565 piculs were imported in 1844, and about 400 to Ningpo. 3,005 piculs of betel nuts, valued at 8,700 dollars, were imported into Canton in 1850, and as much as 4,000 tons of areca nuts are shipped annually from Ceylon.

The astringent extract obtained from the seeds of the Areca-palm constitutes two (or perhaps more) kinds of the catechu of the shops. According to Dr. Heyne ("Tracts Hist. and Statist. on India"), it is largely procured in Mysore, about Sirah, in the following manner:—

The nuts are taken as they come from the tree and boiled for some hours in an iron vessel. They are then taken out, and the remaining water is inspissated by continual boiling. This process furnishes Kassu, or most astringent terra japonica, which is black and mixed with paddy criu, husks, and other impurities. After the nuts are dried, they are put into a fresh quantity of water, boiled again; and this water being inspissated, like the former, yields the best or dearest kind of catechu, called Coony. It is yellowish brown, has an earthy fracture, and is free from the admixture of foreign bodies.

Most of the betel nuts imported into China come from Java, Singapore, and Pinang. Betel nut is not

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so generally used in the South of China as among the Southern Islands, and in the north of China it is a luxury, as the pepper does not grow freely there. Formerly there was a considerable trade in betel nuts with the Coromandel coast, from whence the natives brought back manufactured goods and other necessaries in return, but this has ceased for some time. The common price was 20,000 for a dollar. These nuts are seldom imported into England, though they might be of use as a dye in some manufactures.

The natives of the East chew the fruit of *Elate sylvestris*, (which is something like a wild plum), in the same manner as the areca nut, with the leaf of the betel pepper and quick lime.

The inner wood furnishes a kind of *Catechu* or *Cutch*, which contains much tannin and is a powerful astringent. It is obtained by the simple process of boiling the heart of the wood for a few hours, when it assumes the appearance and consistency of tar. It hardens by cooling, and when formed into small squares and dried in the sun is fit for the market.

The produce of Bombay is of uniform texture and of a dark red color. That of Concan and other parts of India is of chocolate color, and marked inside with red streaks.

The analysis of Sir H. Davy gave the following result:—

	Bombay.	Concan.
Tannin	54.5	48.5
Extractive	34.0	36.5
Mucilage	6.5	8.0
Insoluble matters, sand, lime, &c.	5.0	7.0
	-----	-----
	100.	100.

Catechu is in extensive use in India for tanning purposes, and of late years it has entirely superseded madder in the calico works of Europe for dyeing a golden coffee-brown, one pound of catechu being found equivalent to six pounds of madder.

Value of the areca nuts exported from Ceylon to the British Colonies and foreign States in the years named:—

L.

1839	22,956
1840	23,096
1841	22,428
1842	29,222
1843	27,028
1844	20,978
1845	31,836
1846	34,209
1847	35,723
1848	42,482
1849	31,746
1850	42,907
1851	54,846
1852	52,230

THE POPPY.

OPIUM is the concrete inspissated juice of the white poppy, *Papaver somniferum* and its varieties, obtained by scratching the capsules and collecting the exuding juice. The plant has been long known, and is perhaps one of the earliest described. It is a native of Western Asia and probably also of the South of Europe, but it has been distributed over various countries.

In 1826 the imports of opium into the United Kingdom were 79,829 lbs., of which 28,329 lbs. were consumed in this country. The imports and consumption in subsequent years are shown by the following figures:—

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Imports.	Consumption.	
lbs.	lbs.	
1827	113,140	17,322
1830	209,076	22,668
1833	106,846	35,407
1836	130,794	38,943
1839	196,247	41,682
1842	72,373	47,432
1845	259,644	38,229
1848	200,019	61,055
1819	105,724	44,177
1850	126,318	42,324
1851	118,024	50,682
1852	205,780	62,521

Few who have not looked into the statistics of this trade, are aware of the enormous consumption of opium all over the world, but chiefly in China and India.

In 1845, 18,792 chests of opium were sent from Calcutta to China, and nearly the same number of the Malwa opium from Bombay and Damaun. The total production of India exported to China, in 1844, was 21,526 chests from Bengal, and 18,321 from Bombay, in all 39,847 chests. The number of persons in China given to the consumption of opium was estimated, in 1837, at three millions, and the average quantity smoked by each individual is about 171/2 grains a day. The consumption of Indian opium (independent of Turkey opium) in China has gradually increased from 3,210 chests in 1817, to 9,969 chests in 1827, and about 40,000 chests in 1837, valued at 25,000,000 dollars. Now it has reached 50,000 to 60,000 chests. Notwithstanding severe penalties, imprisonment, temporary banishment, and even death, the number of those who smoke opium has multiplied exceedingly, and the contraband trade in the drug is carried on to so large an extent, that it is to be feared the practice will become general throughout the empire.

According to Mr. E. Thornton’s statistics, the production of opium in Bengal has increased cent. per cent. in the last ten years:—

Chests.	
1840-41	17,858
1841-42	18,827
1842-43	18,362
1843-44	15,104
1844-45	18,350

1845-46	21,437
1846-47	21,648
1847-48	30,515
1848-49	36,000

The chest is about 140 lbs., so that the production in 1849 was 5,040,000 lbs.

According to the statements annexed to the statistical papers relating to India, the income from the opium monopoly is obtained by two principal means, namely, by a system of allowing the cultivation of the poppy by the natives of British India on account of Government, and by the impost of a heavy duty on opium grown and manufactured in foreign states, but brought in transit to a British port for exportation. The former system obtains in Bengal, the latter in Bombay. According to the statements published, Bengal opium yields a profit of 7s. 6d. per lb., whilst the duty derived in the Bombay presidency is only equal to a surplus of 5s. 8d. per lb. By these means the total revenue realised by the opium monopoly, in Bengal and Bombay, in the year 1849-50 yielded L3,309,637.

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Lest objection should be taken to this large annual revenue derived from the cultivation of a drug, the unnatural consumption of which would be suppressed under any other European government, the Court of Directors is very anxious to show the benefit which the country derives from this monopoly; they say "that as the price of opium is almost wholly paid by foreign consumers, and the largest return is obtained with the smallest outlay, the best interests of India would, appear to be consulted." Nobody at all acquainted with the financial resources and the capabilities of any country, would hazard such an assertion. By paying cultivators for the restricted growth of the poppy a price hardly yielding more than the average rate of wages to the common laborer, I do not see in what way the best interests of India are consulted, nor is it clear that the population derives any benefit by being prohibited altogether from manufacturing a drug, which may be brought from another country *in transitu* on the payment of a heavy duty; unless indeed the Court of Directors are of opinion that in the event of the abolition of the monopoly, the people of the country would have to make up for the loss of the revenue by submitting to some other mode of direct or indirect taxation. There is an inconsistency in the statements of the Court of Directors, which is absolutely amusing. "The free cultivation of the poppy," say the Directors, "would doubtless lead to the larger outlay of capital, and to greater economy in production; but the poppy requires the richest description of land, and its extended cultivation must therefore displace other products." How very considerate on the part of the Directors, but how strongly at variance with facts, since all the fear of displacing other products, and all this appropriation of the richest description of land for other purposes has not prevented the Indian Government, within less than ten years, from more than doubling the cultivation of the poppy and the manufacture of opium. The Directors tell us that the heavy transit duty charged at Bombay is to discourage production, but they do not say whether that discouragement applies, as one would imagine, to those foreign districts which have to pay the transit duty for their production. If so, the assertion is again at variance with facts, because in a subsequent statement they say, "It is stated that neither the price of opium, nor the extent of cultivation in Malwa, has been affected by the great enhancement of the pass duty, which has taken place since 1845."

The following will show that the Company loses no opportunity of applying the screw:—

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The subjugation of Scinde afforded opportunity for the levy of a higher rate. Down to the period of that event, a large portion of the opium of Malwa had been conveyed through Scinde to Kurrachee, and thence onward to the Portuguese ports of Diu and Demaun. That route is now closed, and it was reasonably expected that an advance might be made in the charge of passes without the risk of loss to the revenue from a diminished demand for them. The rate was accordingly increased in October, 1843, from 125 to 200 rupees per chest. Upon the principle that it was desirable to fix the price at the highest amount that could be levied, without forcing the trade into other channels, a further increase was made in 1845. when it was determined that the charge should be 300 rupees per chest. Under the like views it was, in 1847, raised to 400 rupees per chest.

The company was perfectly correct, for though the quantity of opium did not increase, the revenue did; and whilst in 1840-41 16,773 chests yielded an income of only 22,046,452 rupees—16,500 chests brought in 1849-50 actually 72,094,835 rupees into the coffers of the Government of Bombay. But the people of India earned not a pice by it, and those richest descriptions of land, which it was so desirable to reserve for other produce than the poppy, remained barren.

The white variety of the poppy is that which is exclusively brought under cultivation for the production of the drug in India and Egypt. For the successful culture of opium a mild climate, plentiful irrigation, a rich soil, and diligent husbandry are indispensable. One acre of well cultivated ground will yield from 70 lbs. to 100 lbs. of “chick,” or inspissated juice, the price of which varies from 6s. to 12s. a pound, so that an acre will yield from L20 to L60 worth of opium at one crop. Three pounds of chick will produce one pound of opium, from a third to a fifth of the weight being lost in evaporation. A chief chemical feature, which distinguishes Bengal opium from that of Turkey and Egypt, is the large proportion which the narcotine in the former bears to the morphia, and this proportion is constant in all seasons. It is a matter of importance to ascertain whether the treatment which the juice receives after its collection can influence in any way the amount of alkaloids, or of the other principles in opium. In Turkey it is the custom to beat up the juice with saliva, in Malwa it is immersed as collected in linseed oil, whilst in Bengal it is brought to the required consistence by mere exposure to the air in the shade, though, at the same time, all the watery particles of the juice that will separate are drained off, and used in making *Lewah*, or inferior opium.

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The lands selected for poppy cultivation are generally situated in the vicinity of villages, where the facilities for manuring and irrigation are greatest. In such situations and when the soil is rich, it is frequently the practice with the cultivators to take a crop of Indian corn, maize, or vegetables off the ground during the rainy season, and after the removal of this in September, to dress and manure the ground for the subsequent poppy sowings. In other situations, however, and when the soil is not rich, the poppy crop is the only one taken off the ground during the year, and from the commencement of the rains in June or July, until October, the ground is dressed and cleaned by successive ploughings and weedings, and manured to the extent which the means of the cultivator will permit. In the final preparation of the land in October and November, the soil, after being well loosened and turned up by the plough, is crushed and broken down by the passage of a heavy log of wood over its surface, and it is in this state ready for sowing.

The amount of produce from various lands differs considerably. Under very favorable circumstances of soil and season, as much as twelve or even thirteen seers (26 lbs.) of standard opium may be, obtained from each biggah of 27,225 square feet. “Under less favorable conditions the turn-out may not exceed three or four seers, but the usual amount of produce varies from six to eight seers per biggah.

The chemical examination of different soils in connection with their opium-producing powers, presents a field for profitable and interesting inquiry; nor is the least important part of the investigation that which has reference to variations in the proportions of the alkaloids (especially the morphia and narcotine), which occur in opium produced in various localities. That atmospheric causes exert a certain influence in determining these variations is probable; that they influence the amount of produce, and cause alterations in the physical appearance of the drug, are facts well known to every cultivator: thus the effect of dew is to facilitate the flow of the juice from the wounded capsule, rendering it abundant in quantity, but causing it at the same time to be dark and liquid. An easterly wind (which in India is usually concomitant with a damp state of atmosphere), retards the flow of juice, and renders it dark and liquid. A moderate westerly wind, with dew at night, form the atmospheric conditions most favorable for collection, both as regards the quantity and quality of the exudation. If, however, the westerly wind (which is an extremely dry wind) blow violently, the exudation from the capsules is sparing. Whilst the effect of meteorological phenomena in producing the above results are well marked, their action in altering the relative proportions of the chemical constituents of the juice of the poppy plant is more obscure, and it is highly probable that the chemical composition of the soil plays a most

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important part in this respect. Dr. O'Shaughnessy is certainly the most accomplished chemist who had ever, in India, turned his attention to the subject, and he has published the results of his analyses of specimens of opium from the different divisions of the Behar Agency, which are worthy of much attention. In the opium from eight divisions of the agency, he found the quantity of morphia to range from 13/4 grains to 31/2 grains per cent., and the amount of the narcotine to vary from 3/4 grain to 31/2 grains per cent., the consistence of the various specimens being between 75 and 79 per cent. In the opium from the Hazareebaugh district (the consistence of the drug being 77), he found 41/2 per cent, of morphia, and 4 per cent, narcotine; whilst from a specimen of Patna-garden opium he extracted no less than 103/4 per cent. of morphia, and 6 per cent. of narcotine, the consistence of the drug being 87. With respect to the last specimen, Dr. O'Shaughnessy mentions that the poppies which produced it were irrigated three times during the season, and that no manure was employed upon the soil. It is much to be regretted that these interesting results were not coupled with an analysis of the soils from which the specimens were produced, for to chemical variations in it must be attributed the widely different results recorded above.

Opium as a medicine has been used from the earliest ages; but when it was first resorted to as a luxury, it is impossible to state, though it is not at all improbable that this was coeval with its employment in medicine, for how often do we find that, from having been first administered as a sedative for pain, it has been continued until it has taken the place of the evil. Such must have happened from the earliest ages, as it happens daily in the present; but as a national vice it was not known until the spread of Islamism, when, by the tenets of the Prophet, wine and fermented liquors being prohibited, it came in their stead along with the bang or hasch-schash (made from hemp), coffee, and tobacco. From the Arabs the inhabitants of the Eastern Archipelago most probably imbibed their predilection for opium, although their particular manner of using it has evidently been derived from the Chinese. China, where at present it is so extensively used, cannot be said to have indulged long in the vice. Previous to 1767 the number of chests imported did not exceed 200 yearly; now the average is 50,000 to 60,000. In 1773 the East India Company made their first venture in opium, and in 1796 it was declared a crime to smoke opium.

In different countries we find opium consumed in different ways. In England it is either used in a solid state, made into pills, or a tincture in the shape of laudanum. Insidiously it is given to children under a variety of quack forms, such as "Godfrey's cordial," &c. In India the pure opium is either dissolved in water and so used, or rolled into pills. It is there a common practice to give it

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to children when very young, by mothers, who require to work and cannot at the same time nurse their offspring. In China it is either smoked or swallowed in the shape of *Tye*. In Bally it is first adulterated with China paper, and then rolled up with the fibres of a particular kind of plantain. It is then inserted into a hole made at the end of a small bamboo, and smoked. In Java and Sumatra it is often mixed with sugar and the ripe fruit of the plantain. In Turkey it is usually taken in pills, and those who do so, avoid drinking any water after swallowing them, as this is said to produce violent colics; but to make it more palatable, it is sometimes mixed with syrups or thickened juices; in this form, however, it is less intoxicating, and resembles mead. It is then taken with a spoon, or is dried in small cakes, with the words "Mash Allah," or "Word of God," imprinted on them. When the dose of two or three drachms a day no longer produces the beatific intoxication, so eagerly sought by the opiophagi, they mix the opium with corrosive sublimate, increasing the quantity of the latter till it reaches ten grains a day. It then acts as a stimulant. In addition to its being used in the shape of pills, it is frequently mixed with hellebore and hemp, and forms a mixture known by the name of majoon, whose properties are different from that of opium, and may account in a great measure for the want of similitude in the effect of the drug on the Turk and the Chinese.

In Singapore and China the refuse of the chandu, the prepared extract of opium, is all used by the lower classes. This extract, when consumed, leaves a refuse, consisting of charcoal, empyreumatic oil, some of the salts of opium, and a part of the chandu not consumed. Now one ounce of chandu gives nearly half an ounce of this refuse, called Tye, or Tinco. This is smoked and swallowed by the poorer classes, who only pay half the price of chandu for it. When smoked it yields a further refuse called samshing, and this is even used by the still poorer, although it contains a very small quantity of the narcotic principle. Samshing, however, is never smoked, as it cannot furnish any smoke, but is swallowed, and that not unfrequently mixed with arrack.

Preparation.—In Asia Minor, men, women, and children, a few days after the flower falls from the poppies, proceed to the fields, and with a shell scratch the capsules, wait twenty-four hours, and collect the tears, which amount to two or three grains in weight from each capsule. These being collected and mixed with the scrapings of the shells, worked up with saliva and surrounded by dried leaves, it is then sold, but, generally speaking, not without being still more adulterated with cow's dung, sand, gravel, the petals of flowers, &c. Different kinds of opium are known in the markets of Europe and Asia.The first in point of quality is the *Smyrna*, known in commerce as the *Turkey*

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or *Levant*. It occurs in irregular, rounded, flattened masses, seldom exceeding two pounds in weight, and surrounded by leaves of a kind of sorrel; the quantity of morphia said to be derived from average specimens is eight per cent.Second, *Constantinople Opium*, two kinds of which are found in the market, one in very voluminous irregular cakes, which are flattened like the Smyrna; this is a good quality. The other kind is in small, flattened, regular cakes, from two to two and a half inches in diameter, and covered with the leaves of the poppy; the quantity of morphia is very uncertain in this description of opium, sometimes mounting as high as 15 per cent., and sometimes descending so low as six, showing the great variety in the quality of the drug.Third, *Egyptian Opium*, occurs in round flattened cakes, about 3 inches in diameter, and covered externally with the vestiges of some leaf. It is distinguished from the others by its reddish color, resembling “Socotrine Aloes.” The quantity of morphia in this is inferior to the preceding. It has one quality which, when adulterated, ought to be known, that is a musty smell. By keeping it does not blacken like the other kinds.Fourth, *English Opium*, is in flat cakes or balls enveloped in leaves. It resembles fine Egyptian opium more than any other kind. Its color is that of hepatic aloes, and in the quantity of morphia it is inferior to the preceding, but in the strength of the mass it is said by one of its most extensive cultivators to be superior.Fifth, *French*, and sixth *German Opium*, require no particular remarks. By a recent notice I find the French are cultivating the poppy in Algeria, from which they get opium giving a small per centage of morphia.

> Seventh, *Trebizond* or *Persian Opium*, is sometimes met with of a very inferior quality in the form of cylindrical sticks, which by pressure have become angular.

Eighth, *Indian Opium*, divided into four kinds, Cutch, Malwa, Patna and Benares. Of these Cutch is but little known or cultivated. It occurs in small cakes covered with leaves, and its color is much inferior to Smyrna. Malwa opium is to be met with of two kinds. The inferior is in flattened cakes, without any external covering, dull, opaque, blackish brown externally, internally somewhat darker, and soft. Its color is somewhat like the Smyrna, but less powerful, and with a slight smoky smell. Superior Malwa is in square cakes, about three inches in length and one inch thick. It has the appearance of a well prepared, shining, dry, pharmaceutical extract; its color is blackish brown, its odor less powerful than Smyrna; it is not covered by petals as the following kinds are, but smeared with oil; it is then rubbed with pounded petals.The Behar, Patna, and Benares Opium,

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being strictly in the hands of Government, no adulteration can take place, without a most extensive system of fraud; but it will not be uninteresting to trace the progress of the opium from the hands of the natives, to the condition in which it is delivered to the public by the Government.From the commencement of the hot season to the middle of the rains the Government is ready to receive opium, which is brought by the natives every morning, in batches, varying in quantities from twenty seers to a maund. The examining officer into each jar thrusts his examining rod, which consists of a slit bamboo, and, by experience, he can so judge of the qualities of the specimens before him, which are sorted into lots of No. 1 to No. 4 quality. Opium of the first quality is of a fine chesnut color, aromatic smell, and dense consistence. It is moderately ductile, and, when the mass is torn, breaks with a deeply notched fracture, with sharp needle-like fibres, translucent and ruby red at the edges. It is readily broken down under water, and the solution at first filters of a sherry color, which darkens as the process proceeds. One hundred grains of this yield an extract to cold distilled water of from 35 to 45, and at the temperature of 212 degs., leaves from 20 to 28 per cent., having a consistency of 70 to 72, the consistence of the factory.The second quality is inferior to the first, and the third quality is possessed of the following properties, black paste, of a very heavy smell, drops from the examining rod, gives off from 40 to 50 per cent, of moisture, and contains a large quantity of “Pasewa;” while the fourth or last number embraces all the kinds which are too bad to be used in the composition of the balls, comprising specimens of all varieties of color and consistence. This number is mixed with water, and only used as a paste to cement the covering of the balls.The three first qualities are emptied from their jars into large tanks, in which they are kept until the supply of the season has been obtained. The opium is then removed and exposed to the air on shallow wooden frames, until it becomes of the consistency of from 69 to 70, when it is given to the cake maker, who guesses to a drachm the exact weight, and envelops the opium in its covering of petals, cemented by a covering of quality number 4. The balls are then weighed and stored, to undergo a thorough ventilation and drying. Formerly the covering of the balls was composed of the leaves of tobacco; but the late Mr. Flemming introduced the practice of using the petals of the poppy, which was such an improvement that the Court of Directors presented him with 50,000 rupees. The balls, forty in number, are packed in a mango wood case, which consists of two stories with twenty pigeon holes in each, lined with lath and surrounded by the dried leaves of the poppy. Sometimes these balls are so soft as to burst their skins, and

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much of the liquid opium running out, is lost. In 1823, many of the chests of Patna lost five catties from this cause, and to this day we have the same thing continuing to occur. Patna chests are covered with bullock hides, Benares with gunnies.

Dr. Impey, staff surgeon at Poona, who resided in Malwa from 1843 to 1846, published at Bombay, in 1848, a valuable treatise on the cultivation, preparation, and adulteration of Malwa opium. It was some time before he obtained the permission of the East India Company to publish the result of the experience he had acquired in Malwa, and as Government inspector of opium at Bombay. It is the most practical treatise I have yet met with, although a very elaborate, useful paper, by Mr. Little, surgeon, of Singapore, appears in the 2nd vol. of the "Journal of the Indian Archipelago," from which I have quoted the preceding remarks.

Mr. Little furnishes a complete history of the drug, and the physical and mental effects resulting from its habitual use. There are also some able remarks in Dr. O'Shaughnessy's Bengal Dispensatory:—

For the successful cultivation of opium, a mild climate, plentiful irrigation, a rich soil, and diligent husbandry, are indispensable. In reference to the first of these, Malwa is placed most favorably. The country is in general from 1,300 to 2,000 feet above the level of the sea: the mean temperature is moderate, and range of the thermometer small. Opium is always cultivated in ground near a tank or running stream, so as to be insured at all times of an abundant supply of water. The rich black loam, supposed to be produced by the decomposition of trap, and known by the name of cotton soil, is that prepared for opium. Though fertile and rich enough to produce thirty successive crops of wheat without fallowing, it is not sufficiently rich for the growth of the poppy until largely supplied with manure. There is, in fact, no crop known to the agriculturist, unless sugar cane, that requires so much care and labor as the poppy. The ground is first four times ploughed on four successive days, then carefully harrowed; when manure, at the rate of from eight to ten cart loads an acre, is applied to it; this is scarcely half what is allowed a turnip crop at home. The crop is after this watered once every eight or ten days, the total number of waterings never exceeding nine in all. One beegah takes two days to soak thoroughly in the cold weather, and four as the hot season approaches. Water applied after the petals drop from the flower, causes the whole to wither and decay. When the plants are six inches high, they are weeded and thinned, leaving about a foot and a-half betwixt each plant; in three months they reach maturity, and are then about four feet in height if well cultivated. The full-grown seed-pod measures three and a-half inches vertically, and two and a-half in horizontal diameter. Early in February and March the bleeding process commences. Three small lancet-shaped

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pieces of iron are bound together with cotton, about one-twelfth of an inch of the blade alone protruding, so that no discretion as to the depth of the wound to be inflicted shall be left to the operator; and this is drawn sharply up from the top of the stalk at the base, to the summit of the pod. The sets of people are so arranged that each plant is bled all over once every three or four days, the bleedings being three or four times repeated on each plant. This operation always begins to be performed about three or four o'clock in the afternoon, the hottest part of the day. The juice appears almost immediately on the wound being inflicted, in the shape of a thick gummy milk, which is thickly covered with a brownish pellicle. The exudation is greatest over night, when the incisions are washed and kept open by the dew. The opium thus derived is scraped off next morning, with a blunt iron tool resembling a cleaver in miniature. Here the work of adulteration begins—the scraper being passed heavily over the seed-pod, so as to carry with it a considerable portion of the beard, or pubescence, which contaminates the drug and increases its apparent quantity. The work of scraping begins at dawn, and must be continued till ten o'clock; during this time a workman will collect seven or eight ounces of what is called "chick." The drug is next thrown into an earthen vessel, and covered over or drowned in linseed oil, at the rate of two parts of oil to one of chick, so as to prevent evaporation. This is the second process of adulteration—the ryot desiring to sell the drug as much drenched with oil as possible, the retailers at the same time refusing to purchase that which is thinner than half dried glue. One acre of well cultivated ground will yield from 70 to 100 pounds of chick. The price of chick varies from three to six rupees a pound, so that an acre will yield from 200 to 600 rupees worth of opium at one crop. Three pounds of chick will produce about two pounds of opium, from a third to a fifth of the weight being lost in evaporation. It now passes into the hands of the Bunniah, who prepares it and brings it to market. From twenty-five to fifty pounds having been collected, is tied up in parcels in double bags of sheeting cloth, which are suspended from the ceilings so as to avoid air and light, while the spare linseed oil is allowed to drop through. This operation is completed in a week or ten days, but the bags are allowed to remain for a month or six weeks, during which period the last of the oil that can be separated comes away; the rest probably absorbs oxygen and becomes thicker, as in paint. This process occupies from April to June or July, when the rain begins. The bags are next taken down and their contents carefully emptied into large vats from ten to fifteen feet in diameter, and six or eight inches thick. Here it is mixed together and worked up with the hands five or six hours, until it has acquired an uniform color and consistence throughout,

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become tough and capable of being formed into masses. This process is peculiar to Malwa. It is now made up into balls of from eight to ten ounces each, these being thrown, as formed, into a basket full of the chaff of the seeds pod. It is next spread out on ground previously covered with leaves and stalks of the poppy; here it remains for a week or so, when it is turned over and left further to consolidate, until hard enough to bear packing. It is ready for weighing in October or November, and is then sent to market. It is next packed in chests of 150 cakes, the total cost of the drug at the place of production being about fourteen rupees per chest, including all expenses. About 20,000 chests are annually sent from Malwa, at a prime cost charge of two lacs and 80,000 rupees. It may easily be supposed that manipulations so numerous, complex, and tedious, as those described, give the most ample opportunities for the adulteration to which the nature of the drug tempts the fraudulent dealer.In order to enable the cultivator to carry on his agricultural operations, he receives from time to time certain advances, the amount of which reaches in the aggregate to about one-half of the value of the estimated out-turn of produce. If the land has been under cultivation in previous seasons, its average produce is known; if it be new land, and considered by the Sub-Deputy Agent as eligible, then the cultivator, in addition to the usual advances, receives an advance of so much per biggah to enable him to bestow a certain amount of extra care in tilling and dressing the soil. The first advance is made on the completion of the agreement or bundobust, and this takes place in September and October. The second advance is made on the completion of the sowings in November, and the final or Chook payment is made immediately after the delivery and weighing of the produce. Nothing therefore can be fairer to the cultivator than this system of advances; he is subject to no sort of exaction, in the shape of interest or commission on the money which he receives, and it puts within his power the certain means of making a fair profit by the exercise of common care and honesty. It is an established rule in the Agency that the cultivator’s accounts of one season shall be definitively settled before the commencement of the next, and that no outstanding balances shall remain over. When a cultivator has from fraud neglected to bring produce to cover his advances, the balances due by him are at once recovered, if necessary by legal means; whereas, if he can satisfactorily show that he has become a defaulter from calamity and uncontrollable circumstances, and that the liquidation of his debt is placed entirely beyond his power, his case is then made the subject of report to the Government by the Agent, with the request that the debt may be written off to profit and loss. These provisions are most wise, for outstanding balances may be made the means of oppression,

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and to their operation may be traced a considerable amount of litigation and agrarian crime in the indigo districts of lower Bengal. It is clear that when such balances become so large that the cultivator cannot discharge them, he is no longer a free agent, but is perfectly subservient to the will of his creditor, for whom he must cultivate whether he desire it or not. Such burdens may even be handed down from father to son. The fairness of the Agency system, and the justice with which the cultivators are treated, are best evidenced by the readiness with which they come forward to cultivate, and also by the comparative rarity of agrarian crime, arising out of matters connected with the poppy cultivation.

Opium is grown to some extent in Egypt; 39,875 lbs. were produced in 1831, and sold at two dollars a pound.

At the end of October, after the withdrawal of the Nile waters the seed, mixed with a portion of pulverised earth, is sown in a strong soil, in furrows; after fifteen days the plant springs up, and in two months has the thickness of a Turkish pipe, and a height of four feet; the stalk is covered with long, oval leaves, and the fruit, which is greenish, resembles a small orange. Every morning before sunrise, in its progress to maturity, small incisions are made in the sides of the fruit, from which a white liquor distils almost immediately, which is collected in a vessel; it soon becomes black and thickish, and is rolled into balls, which are covered with the washed leaves of the plant; in this state it is sold. The seeds are crushed for lamp oil, and the plant is used for fuel.

A plant known in Jamaica under the name of bull hoof yields a narcotic which has been administered successfully in the shape of tincture and a syrup, instead of opium. This is the *Muracuja ocellata*, or *Passiflora muracuja*, of Swartz, an elegant climber, bearing bright scarlet blossoms. There is another species, *M. orbiculata*, found in Hayti and other islands, which may be expected to partake more or less of the properties of the former. The flowers are the parts most commonly employed.

THE TOBACCO PLANT.

Several species of *Nicotium* furnish tobacco; that chiefly used in Europe is procured from *N. Tabacum* and its numerous varieties, a plant naturally inhabiting the hotter parts of North and South America. The popular narcotic furnished by tobacco is probably in more extensive use than any other, and its only rivals are opium and the betel-nut and leaf of the East. The herb for smoking was brought to England from Tobago, in the West Indies, or from Tobasco, in Mexico (whence the name), by Sir Ralph Lane, in 1586. Seeds were shortly after introduced from the same quarter.

“Tobacco, as used by man,” says Du Tour, “gives pleasure to the savage and the philosopher, to the inhabitant of the burning desert and the frozen zone; in short, its use, either in powder, to chew, or to smoke, is universal; and for no other reason than a sort of convulsive motion (sneezing) produced by the first, and a degree of intoxication by the two last modes of use.”

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Tobacco is an annual plant, attaining a height of six feet, having dingy red, funnel-shaped flowers, and viscid leaves. The leaves are the officinal part, and their active properties depend on a peculiar, oily-like alkaloid, called Nicotin. The flavor and strength of tobacco depend on climate, cultivation, and the mode of manufacture. That most esteemed by the smoker is Havanna tobacco, but the Virginian is the strongest. The small Havanna cigars are prepared from the leaves of *Nicotium repanda*, Syrian and Turkish tobacco from *N. rustica*, and fine Shiraz tobacco from *N. persica*. With the exception of the Macuba tobacco, which is cultivated in Martinique in a peculiar soil, the tobacco of Cuba is considered the finest in the world. That grown in the island of Trinidad is, however, fully equal to it in quality, but all raised in the colony is generally consumed there, and is little known in the English market. This ought not to be the case, for no article would pay better.

The Maryland is a very light tobacco, in thin, yellow leaves; that of Virginia is in large brown leaves, unctuous or somewhat gluey on the surface, having a smell very like the figs of Malaga; that of Havanna is in brownish light leaves, of an agreeable and rather spicy smell,—it forms, as I have already stated, the best cigars. The Carolina tobacco is less unctuous than the Virginian, but in the United States it ranks next to the Maryland. The shag tobacco is dried to the proper point upon sheets of copper, and is cut up by knife-edged chopping stamps. There are said to be four kinds of tobacco reared in Virginia, *viz*., the sweet-scented, which is considered the best; the *big and little*, which follows next; then the Frederick; and, lastly, the *one and all*, the largest kind, and producing most in point of quantity.

According to Loudon ("Encyclo. of Plants"), there are fourteen species of this genus, besides a few varieties. Lindley, however, enumerates 31, but many of these are mere showy species, adapted to flower gardens. I shall therefore follow chiefly London's classification—

1. *N. Tabacum*, a native of several parts of America, but principally known as Virginian tobacco, having a stem rising from four to six feet or more in height, bearing pink flowers. Of this there are three chief varieties known in America by the popular names of Orinoco, Broad-leaved and Narrow-leaved. Lindley enumerates eight varieties of *N. Tabacum*.

2. *N. macrophylla*, or large-leaved tobacco, an ornamental annual, also with pink flowers, native of America, which rises to the height of six feet.

3. *N. fruticosa*, or shrubby tobacco, an ornamental evergreen shrub, native of China, with pink blossoms, which grows to about three feet.

4. *N. undulata*, or *suaveolens*, sweet-scented or New Holland tobacco, a green house perennial, native of New South Wales, with white flowers, which is only two feet high.

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5. *N. rustica*.—The common green or English tobacco, an annual plant, native of America, producing white flowers, which seldom grows higher than three feet.

6. *N. paniculata*, or panicled tobacco, an annual plant bearing greenish yellow flowers, native of Peru, rises to the height of three feet.

7. *N. glutinosa*, or clammy-leaved tobacco, also an annual plant, native of Peru, growing to the height of four feet, with bright scarlet flowers.

8. *N. plumbaginifolia*, or curled-leaved tobacco, an ornamental deciduous annual, native of America, with white blossoms, rising to the height of two feet.

9. *N. pusilla*, or primrose-leaved tobacco, an ornamental deciduous biennial, with white flowers, native of Vera Cruz, rising to three feet.

10. *N. quadrivalvis*, four-valved, or Missouri tobacco, an ornamental annual, native of North America, with white flowers, seldom growing higher than two feet.

11. *N. nana*, or rocky mount tobacco, a curious greenhouse annual, native of North America, with white blossoms, rising only three inches high.

12. *N. Langsdorffii*, or Langsdorff's tobacco, an ornamental annual, with greenish yellow flowers, native of Chili, reaching five feet high.

13. *N. cerinthoides*, or honey-wort tobacco, an ornamental annual, with greenish yellow flowers, native country unknown.

14. *N. repanda*, or Havanna tobacco, an annual with white flowers, native of Cuba, rising two feet high.

There are a few species, natives of the Province of Buenos Ayres, which may be particularised. *N. bonariensis*, having white flowers; *N. glauca*, yellowish green flowers; *N. longiflora*, white flowers; and *N. viscosa*, pink flowers.

The important mineral substances presented in Havanna tobacco, examined by Hertung, are in 100 parts of ashes,

Salts of potash	34.15
Salts of lime	51.38
Magnesia	4.09
Phosphates	9.04

These substances were for the most part insoluble in earth, and must have been dissolved during the growth of the crop.

ANALYSIS OF FIVE SAMPLES OF TOBACCO.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
	Grown on argillaceous soil		Grown in calcareous soil.		
Potash	29.08	30.67	9.68	9.36	10.37
Soda	2.26	—	—	—	.36
Lime	27.67	24.79	49.28	49.44	39.58
Magnesia	7.22	8.57	14.58	15.59	15.04
Chloride of sodium	.91	5.95	4.61	3.20	6.39
Chloride of potassium	—	—	4.44	3.27	2.99

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Phosphate of iron	8.78	6.03	5.19	6.72	7.56
Sulphate of lime	6.43	5.60	6.68	6.14	9.42
Silica	17.65	18.39	5.54	6.28	8.34
	-----	-----	-----	-----	-----
	100.00	100.00	100.00	100.00	100.00

From the above it will be seen that on the argillaceous soil the tobacco contained a large quantity of alkalies and silica, while on the other hand, the lime, magnesia and chlorides were high in proportion, in the tobacco grown on calcareous soil.

There is no doubt that the manure which contains the largest proportion of alkaline carbonate, magnesia, lime and gypsum, is that best adapted for tobacco.

I give an analysis taken from Prof. Johnston's "Lectures," (2nd edition) of the ash of the tobacco leaf and the composition of a special manure for tobacco:—

Potash 12.14
Soda 0.07
Lime 45.90
Magnesia 13.09
Chloride of sodium 3.49
Chloride of potassium 3.98
Phosphate of iron 5.48
Phosphate of lime 1.49
Sulphate of lime 6.35
Silica 8.01

100.00

All the ingredients which are necessary to replace 100 lbs. of the ash of tobacco leaves are present in the following mixture:—

Bone dust, sulphuric acid 23 lbs.
Carbonate of potash (dry) 31 "
Carbonate of soda (dry) 5 "
Carbonate of Magnesia 25 "
Carbonate of lime (chalk) 60 "
------
144 "

The following is the result of an analysis of the fresh leaves of tobacco, by Posselt and Reimann ("Mag. Pharm.” xxiv. xxv.):—

Nicotine	0.06
Nicotianine	0.01
Extractive matter, slightly bitter	2.37
Gum, with a little malate of lime	1.74
Green resin	0.26
Vegetable albumen	0.26
Substance analogous to gluten	1.04
Malic acid	0.51
Malate of ammonia	0.12
Sulphate of potash	0.04
Chloride of potassium	0.06
Potash combined with malic and nitric acids	0.90
Phosphate of lime	0.16
Lime in union with malic acid	0.24
Silica	0.08
Woody fibre	4.96
Water (traces of starch)	87.21

100.10	

Dr. Covell, in “Silliman’s American Journal,” vol. vii., shows its components to have been but imperfectly represented in the above German analysis. He found in tobacco by chemical examination—1, gum; 2, a viscid slime, equally soluble in water and alcohol, and precipitable from both by subacetate

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of lead; 3, tannin; 4, gallic acid; 5, chlorophyle (leaf green); 6, a green pulverulent matter, which dissolves in boiling water, but falls down again when the water cools; 7, a yellow oil, possessing the smell, taste and poisonous qualities of tobacco; 8, a large quantity of a pale yellow resin; 9, nicotine; 10, a white substance, analogous to morphia, soluble in hot, but hardly in cold alcohol; 11, a beautiful orange red dye stuff, soluble only in acids; it deflagrates in the fire, and seems to possess neutral properties; 12, nicotianine. According to Buchner, the seeds of tobacco yield a pale yellow extract to alcohol, which contains a compound of nicotine and sugar.

M.M. Henry and Boutron Charlard found in 100 parts of

Cuba tobacco 8.64 of nicotine.
Maryland 5.28
Virginia 10.00
Ile et Vilaine 11.20
Lot et Garonne 8.20

quantities from 12 to 19 times more than were obtained by Posselt and Reimann.—-“Ure’s Dictionary of Arts and Manufactures.”

The following are the results of a series of experiments made by Messrs. Cooper and Brande, for the purpose of ascertaining the quantity of soluble matter in eight samples of tobacco, of detecting the presence and quantity of sugar contained in them, and the nature and relative proportions of their inorganic constituents. An important paper on the state in which *Nicotine* exists in tobacco, and on the relative proportion of it furnished by different varieties of the plant, has been furnished by Schloessing ("Ann. Ch. et Ph.” 3ieme Ser. XIX. 230).

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|P s |P & |P t o |P s a|P s a|P m t|P o i|P m o|
|e o |e c |e r f |e o s|e o c|e a h|e b n|e a b|
|r l |r . |r e   |r l h|r l i|r t e|r t f|r t t|
| u  |    | a a | u .| u d|  t | a u|  t a|
|c b |c i |c t m |c b  |c b  |c e a|c i s|c e i|
|e l |e n |e m o |e l  |e l i|e r s|e e i|e r n|
|n e |n s |n e n |n e  |n e n|n , h|n n o|n   e|
|t   |t o |t n i |t    |t    |t   .|t e n|t d d|
|. i |. l |. t a |. i  |. i t|. a  |. d .|. e  |
| n  | u  |    . | n   | n h| s   |     | d a|
Tobacco dried |o  |o b |o w  |o    |o   e|o    |o f  |o u l|
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at 212 degs.  |f w |f l |f i   |f w  |f h  |f s  |f r  |f c c|
|  a |  e |  t   |  a  |  y a|  i  |  o  |  e o|
|e t |w   |a h   |m t  |m d s|i l  |a m  |s d h|
|x e |o i |s     |a e  |a r h|n i  |l    |a   o|
|t r |o n |h c   |t r  |t o .|s c  |c f  |c f l|
|r . |d   |  a   |t    |t c  |o a  |o e  |c r .|
|a   |y w |a r   |e i  |e h  |l ,  |h r  |h o  |
|c   |  a |f b   |r n  |r l  |u    |o m  |a m  |
|t   |f t |t n   |     |  o  |b &  |l e  |r    |
|,   |i e |e a   |  t  |  r  |l c  |  n  |i t  |
|    |b r |r t   |  h  |  i  |e .  |  t  |n h  |
|&   |r . |  e   |  e  |  c  |     |  e  |e e  |
|c   |e   |      |     |     |  i  |  d  |     |
|.   |    |      |     |     |  n  |     |     |
|    |    |      |     |     |     |     |     |
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1. Light Missouri}	49	54.9	20.97	2.17	11.73	5.9	--	--
leaf and stalk}			white					
2. Light Missouri}	50	47.7	19.7	1.77	12.83	5.1	0.75	1.50
leaf only }			white					
3. Dark Missouri }	50	52.4	16.47	4.2	10.14	2.13	--	--
leaf and stalk}			white					
4. Dark Missouri}	51	50.6	13.8	2.17	8.73	2.9	0.35	0.71
leaf only }			white					
5. Light Virginia}	51.5	53.1	16.4	2.53	8.54	5.33	--	--
leaf and stalk}			gray-					
			white					
6. Light Virginia}	54	46.1	11.97	2.0	6.86	3.11	1.045	2.09
leaf only }			green-					
			gray					
7. Dark Virginia }	48.5	51.8	14.7	4.8	8.40	1.5	--	--
leaf and stalk}			gray					
8. Dark Virginia}	52	49.8	12.53	2.63	8.20	1.7	1.46	2.93
leaf only }			gray					

1. The samples were dried and the woody fibre and extract were also dried at 212 degs. The watery infusions of all contained ammoniacal salts. The salts from the ash, which were soluble in water, consisted of sulphates, carbonates, phosphates, and chlorides; the bases being potassa and lime. The solution by hydrochloric acid contained lime, alumina, phosphate of lime, and oxide of iron.

3. Contained oxide of manganese in small quantity; sulphates in watery solution of ash abundant. Hydrochloric solution contained an abundance of lime.

4. A trace of manganese; a trace only of phosphoric acid in watery solution.

5. Contained abundance of oxide of manganese.

6. Abundance of oxide of manganese.

7. A mere trace of oxide of manganese, and a trace of oxide of iron; only a trace of alumina.

8. A trace of oxide of manganese; quantity of oxide of iron very great; only a trace of alumina.

In rich loams, where the solution of the minerals of the soil is rapid, and where 10 to 20 per cent, of vegetable matter is incorporated in the earth, tobacco may be obtained for many years, but it is always an exhausting crop. It has been stated that 170 Lbs. of mineral matter are removed in less than three months from one acre of land, by a crop of tobacco. This is very much more than wheat or other grains abstract from the soil in eight or nine months.

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Tobacco is now very extensively cultivated in France and other European countries, in the Levant, the East and West Indies; and a little is grown at the Cape and in the Australian Settlements.

A good deal of tobacco is raised in Mexico, but only for home consumption, as its export is prohibited. It forms an article of culture in Brazil and some of the South American republics, and is grown to a small extent along the Western shores of Africa. It is from North America, however, that we derive the bulk of our supplies of this great article of commerce, which, with cotton, forms the chief agricultural wealth of the United States.

In 1821, the tobacco exported from the Brazils amounted to 29,192,000 Lbs., but its cultivation was greatly injured by the siege of the capital in 1822-23. Fresh seed was subsequently obtained from Cuba, and in 1835 the exports were 6,051,040 Lbs.

131 cases of Princeza snuff were shipped from Bahia to Lisbon, in 1835; about 60,000 Lbs. per annum of this snuff being now manufactured at Bahia, with the aid of two steam-engines. The exports of tobacco from Bahia increased from 2,048,000 Lbs. in 1833, to 6,051,040 Lbs. in 1835. The average shipments are about 21,000 bales and rolls.

The army of smokers in Great Britain and Ireland consume yearly about six millions of pounds worth of tobacco. The duty alone paid upon snuff and tobacco for the people of Great Britain, averages four-and-a-half millions sterling a year! The quantity consumed —smoked, snuffed, or chewed—during the same period, is about 28 millions of pounds weight, or about four pounds weight per annum for every male adult. Ireland annually pays not less than L800,000 of duty on tobacco and snuff, and only about L30,000 on coffee. For every pound of coffee that the Irish people use, they smoke away about *four pounds of tobacco*.

North America produces annually upwards of 200 million pounds. The combustion of the mass of vegetable material used in this kingdom would yield about 340 million pounds of carbonic acid gas; so that the yearly produce of carbonic acid gas from tobacco smoking alone cannot be less than 1,000,000,000 lbs.—a large contribution to the annual demand for this gas made upon the atmosphere for the vegetation of the world. Henceforth let no one twit the smoker with idleness and unimportance. Every pipe is an agricultural furnace,—every smoker a manufacturer of vegetation,—the consumer of a weed that he may rear more largely his own provisions.

In the year 1842, 605,000,000 of cigars were made in the German Commercial Union.

In 1839, the revenue on tobacco in this country was about L3,600,000. Of this it has been estimated eleven-twelfths are drawn from the working classes, and one-twelfth from the richer classes. The following is a calculation of the consumption of tobacco per

head of the population, estimated from the number of pounds on which duty was paid:
—

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Consumption per head.
Rate of duty. ozs.
1801 {1s. 7 3-10d. England } 17
{1s. 0 7-10d. Ireland.}
1811 2s. 2 13-20d. 191/2
1821 4s. 0d. 11 45
1831 3s. 0d. 12 35
1841 3s. 1 8-10d. 12 4-5
1851 3s. 1 4-5d. 21

Thus it will be seen the consumption is materially affected by the rate of duty.

A memorial presented to the First Lord of the Treasury a few years ago, by the American Chamber of Commerce, and signed by Mr. Thomas Todd, the chairman, furnishes some valuable information, and I am therefore tempted to give it entire:—

The American Chamber of Commerce of Liverpool desire respectfully to bring under the consideration of her Majesty's Government the impolicy of the present high rate of duty on foreign tobacco, and the benefit to commerce, as well as to the revenue, which would arise from such a reduction as would remove the temptation now held out to the smuggler.The cost of tobacco, including freight and all charges, is from 3d. to 4d. per lb., and the duty is 3s. per lb., being 900 per cent, on the value. A duty so enormously disproportioned to the cost offers an irresistible premium to the illicit trader; for the expense of smuggling tobacco by the cargo, including the first cost, does not exceed 91/2d. per lb., and it has been ascertained that the smuggler receives 6d. per lb. less than the duty, or 2s. 6d. per lb., which yields him a clear profit of 1s. 81/2d. per lb., to the injury not only of the revenue, but of the fair trader.The effect of this heavy duty in diminishing the consumption of duty-paid tobacco is further exemplified by the fact that, while all other articles of general consumption have progressively increased with the increase of the population, tobacco alone forms an exception, as will appear from the following:—

COMPARATIVE SCALE OF POPULATION AND CONSUMPTION OF TEA, COFFEE, AND TOBACCO, IN GREAT BRITAIN AND IRELAND, COMPILED FROM PARLIAMENTARY
PAPERS.

Population Tea Coffee Tobacco
1801 16,338,102
Duty, 65 a 95 per ct 19d. per lb. 19d. per lb.
& 121/2 per ct. & 121/2 per ct.
Lbs., 23,163,999 871,846 16,895,752
1811 18,547,720
Duty 96 per cent. 8d. per lb. 261/2d. per lb.

Lbs., 24,461,308 6,895,619 21,376,370
1821 21,193,458
Duty, 96 a 100 per ct. 12d. per lb. 4s. per lb.
Lbs., 26,043,257 7,593,001 1,823,365
1831 24,271,763
Duty 96a 100 per ct. 6d. per lb. 3s. per lb.
Lbs., 30,648,348 22,740,627 19,418,941
1841 26,855,928
Duty, 261/4d. per lb. 6d. per lb. 3s. per lb.
Lbs., 36,396,073 28,420,980 22,094,772

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The consumption of tobacco in the island of Great Britain, excluding Ireland, and the duty thereon, were in

	Consumption.	Duty.
1801	10,514,998 lbs.	1s. 7d.
1811	14,923,243 "	2s. 21/2d.
1821	12,983,198 "	4s. 0d.
1831	15,350,018 "	3s. 0d.
1841	16,083,593 "	3s. 0d.
1851	28,062,841 "	3s. 0d.

In the last two periods five per cent is added to all the duties.

Thus, while the consumption of tea and coffee has increased even beyond the ratio of the population, the consumption of tobacco has decreased.

This table also exemplifies the greater productiveness of a low duty compared with a high one; for instance, coffee in 1801, at 1s. 7d. per lb., yielded L77,654; in 1821, at 1s. per lb., L379,650; and, in 1841, at 6d. per lb., L710,524; tobacco in 1821, at 4s. per lb., yielded L3,164,673, and 1841, at 3s. per lb., L3,314,215. But the difference in duty in the latter case was not sufficient to curtail the profits of the smuggler to any material extent.Cigars afford a remarkable example of the amount of duty being increased by diminishing the rate. In 1828, when the duty was 18s. per lb., duty was paid on 8,600 lbs. only, yielding L7,740. In 1830, when the duty was reduced to 9s. per lb., duty was paid on 66,000 lbs., yielding L29,700; and such has been the increase of consumption, that, in 1841, duty was paid on 213,613 lbs., yielding L100,899.

We would further illustrate the position by the following facts:

In 1798, Ireland, with a population of 4,000,000, consumed 8,000,000 lbs. of tobacco, and now, with more than double the population, she consumes about 3,000,000 lbs. of tobacco less than at the former period. The reason is obvious: in 1789 the duty was 8d. per lb; now it is 3s. In 1798, England and Scotland, with a population of 10,000,000, consumed 10,000,000 lbs. of tobacco, being one half of the relative consumption of Ireland at the same period; the duty in England and Scotland being then 1s. 7d. per lb., and in Ireland only 8d.But the quantity of tobacco on which duty is paid does not even approximately show the quantity consumed. If the duty now paid on tobacco in the United Kingdom retained the same relative proportion to the population that it held in Ireland in 1798, the duty in 1841 would have been actually levied upon 53,711,856 lbs., instead of 22,094,772 lbs.; and such we believe to be about the actual amount of consumption, the great bulk of the supply being furnished by the illicit trader.In Prussia, it appears that the consumption of tobacco is at the rate of three pounds per head; while, in England, if we were to judge from the amount on which duty is paid, it is considerably less than one pound per head.Assuming the actual consumption at only 45,000,000 lbs., or two pounds per head, we believe

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that a reduction of duty to 1s. per pound would so effectually destroy the illicit trader, that the revenue would gain by the change, not only by bringing upwards of 30,000,000 lbs. under duty, which at present escape, but by the great increase of the consumption consequent upon the encouragement given to the fair trader.We would not, however, treat the question merely as a matter of revenue. We would strongly represent the injustice which this exorbitant duty inflicts upon those who pursue a legitimate trade, by enabling the smuggler to lessen the extent of their transactions by more than half what they would otherwise be; and we would further earnestly urge upon your consideration the demoralising tendency of such a systematic and extended violation of the law, not only upon those engaged in the illicit trade, also upon those parties who are found to connive at the practice from a sense of the gross injustice and impolicy of a duty so disproportioned to the value of an article of such extensive consumption.We would refer to the opinion of a committee of the House of Commons on the growth of tobacco in Ireland, in 1840, as follows:—'That it further appears, from the evidence, that smuggling of foreign tobacco is at present carried on to a great extent, and that all the measures now adopted, at great expense to the country, are and will be ineffectual to repress it so long as the temptation of evading a duty equal to twelve times the value of the article on which it is imposed, remains."We beg, therefore, respectfully to express our opinion, that if the duty on tobacco were reduced to one shilling per pound, it would be alike beneficial to the interests of legitimate commerce; to the consumers, who consist almost entirely of the poorer classes; to the revenue, by increasing the productiveness of the duty, and by greatly diminishing the expenditure so ineffectually incurred to suppress the illicit trade; and to the general morals of society by removing a powerful inducement to infringe the laws.

The imports of all kinds of tobacco for the last five years have been as follows:—

	1848.	1849.	1850.	1851.	1852.
	lbs.	lbs.	lbs.	lbs.	lbs.
Unmanufactured	34,090,360	41,546,848	35,166,358	31,061,953	33,205,635
Manufactured and snuff	1,512,714	1,905,306	1,557,618	2,331,886	2,930,299
	35,603,074	43,452,154	36,723,876	33,393,839	36,135,934

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Gross duty received:—

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	1848.	1849.	1850.	1851.	1852.
	L	L	L	L	L
On raw tobacco	4,267,579	4,328,217	4,337,258	4,386,910	4,466,533
Cigars, snuff, &c.	97,655	96,814	92,873	98,858	94,298
	4,365,234	4,425,031	4,430,131	4,485,768	4,569,831

The amount of tobacco consumed is so limited that the trade will not admit of an excessive growth. In the two most thickly populated countries in Europe—France and England—not more than a certain quantity finds its way there. In France the trade is monopolised by Government, which gives out contracts to deliver a stipulated quantity at certain prices; in England the duty imposed is so enormous that only a limited quantity of certain descriptions can be imported without risk of loss. In Germany and Holland, where the trade is more extensively carried on than elsewhere, the duty imposed is almost nominal, and all classes of their citizens are enabled to use the weed at prices very little higher than its first prime cost. The tobacco trade constitutes so large a staple of American produce that it is singular greater efforts are not made upon the part of that Government to cause a reciprocal duty to be imposed, that more favor may be shown by European Governments to this particular article. England, from the duty imposed upon it alone, derives a revenue of L4,500,000, being about L160 to the hogshead, or from ten to sixteen times its original cost. France makes the trade a monopoly, from which she derives an income of L3,000,000 sterling.

STATEMENT OF IMPORTS, SALES, AND STOCKS OF TOBACCO AND STEMS, IN BREMEN, FROM 1840 TO 1850.

	MARYLAND				VIRGINIAN			
Year	Stock 1st January	Imports	Sales	Stock last December	Stock 1st January	Imports	Sales	Stock last December
1840	4,890	14,570	18,399	1,061	245	3492	3422	285
1841	1,061	19,629	18,321	2,369	285	3466	3025	726

1842	2,369	20,821	19,067	4,123	726	6729	5898	1557
1843	4,123	18,483	15,004	7,602	1557	5541	4242	2856
1844	7,602	16,978	18,338	6,242	2856	5092	4282	3666
1845	6,242	24,251	24,571	5,922	3666	1588	3099	

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1846	5,922	26,785	23,788	8,919	2155	2386	2456	2085
1847	8,919	21,743	20,681	9,981	2085	911	2079	917
1848	9,981	12,084	9,935	12,130	917	847	1054	710
1849	12,130	19,285	22,112	9,303	710	1173	1734	149

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	KENTUCKY				STEMS			
Year	Stock 1st January	Imports	Sales	Stock last December	Stock 1st January	Imports	Sales	Stock last December
1840	181	3,803	3,699	285	2853	3362	4564	1651
1841	285	5,206	4,941	550	1651	7085	7054	1682
1842	550	9,407	8,939	1018	1682	4151	5386	447
1843	1018	7,485	6,441	2062	447	3969	3447	969
1844	2062	9,736	9,569	2229	969	4753	5513	209
1845	2269	11,439	10,328	3340	209	5273	4152	1330
1846	3340	5,028	6,099	2269	1330	6092	4716	2706
1847	2269	3,816	5,013	1072	2706	6788	8038	1456
1848	1072	4,448	4,980	540	1456	4912	4473	1895
1849	540	4,620	4,746	414	1895	5188	5083	1000

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Culture and Statistics in the United States.—Tobacco has been the great staple of the States of Virginia and Maryland from their first settlement. About the year 1642 it became a royal monopoly, and afterwards, in order to encourage its growth in the colonies, and thereby increase the revenue of the Crown, Parliament prohibited the planting of it in England. The average quantity shipped from the North American colonies to the parent country, for ten years preceding the year 1709, was about twenty-nine millions of pounds. For some years prior to the American revolution, about 85,000 hhds. were exported, then valued at little more than four millions of dollars, and constituting nearly one-third the value of all the exports of the British North American colonies. From 1820 to 1830 tobacco constituted about one-ninth in value of all the domestic exports of the United States. It finds a market principally in Great Britain, France, Holland, and the north of Europe.[55] The crop of tobacco produced in the four principal States, was in—

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	1838.	1839.
	hhds.	hhds.
Virginia	26,000	45,000
Kentucky	27,000	35,000
Maryland	16,000	16,000
Ohio	3,000	4,000
	------	-------
	72,000	100,000

The whole crop of 1840 was 219,163,319 lbs., which, at the estimate of 1,200 lbs. to the hhd., would be equal to 182,636 hhds., and at the average price of that year, 81 dollars 5 cents. per hhd., would make the value of the crop of the United States 14,802,647 dollars 80 cents. The average annual export for the ten years ending with 1840, was 96,775 hhds. The actual exportation of 1840 was 119,484 hhds. The principal exports are formed of the produce of Virginia, Kentucky, Tennessee, Maryland, and North Carolina. The exports are chiefly to the following countries—about 30,000 hhds. annually to England, 15,000 hhds. to France, 20,000 hhds. to Holland, 25,000 hhds. Germany, and about 22,000 hhds. to other countries. The whole crop for 1845 was put down at 187,422,000 lbs. In 1839, it was ascertained that one and a half million persons were engaged in the cultivation and manufacture of tobacco in the United States, one million of whom were so occupied in the States of Virginia, Maryland, Kentucky, and Missouri. In the city of New York the consumption of cigars is computed at 10,000 dollars a day, a sum greater than that which the inhabitants pay for their daily bread; and in the whole country the annual consumption of tobacco is estimated at 120 million pounds, being 7 lbs. for every man, woman, and child, at an annual cost to the consumers of 20 million dollars (more than four million pounds sterling).

It is estimated that the manufacture of tobacco in the United States is increasing at the rate of 2,000 hhds. per annum.

hhds.
The quantity manufactured in 1851, was stated at
 55,000
Exportations for the year estimated at
 120,000

175,000

The production for 1852 is supposed to be as follows:—

hhds.
Virginia
  27,000
Maryland
  33,000
Western States, including frosted
  65,000

Total production
 125,000
Deficiency in the year's crop
        50,000

The quantity produced in the United States, in 1847, was 220,164,000 lbs., worth, at 5 cents per lb., nearly 11 million dollars (more than two million sterling). The principal producing States were—Kentucky, 65 million lbs.; Virginia, 50 millions; Tennessee, 35 millions; North Carolina, 14 millions; Ohio, 9 millions; Indiana, 4 millions; Illinois, Connecticut, and a few others in smaller proportions.

The production in 1848 was 218,909,000 lbs., which, valued at four cents per lb., would be worth nine million dollars. From persons largely interested in the tobacco trade, and well informed in relation thereto, I have gathered the following general statements:—

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The crops of tobacco to come to market in the year 1851, were estimated as follows—

	hhds.
Virginia	30,000
Kentucky, Tennessee, and Missouri, about	50,000
Maryland, about	22,000
Ohio, about	14,000

From the above estimate it will be seen that the quantity produced in 1850 is less than two-thirds of the usual production in the States named. The entire crop of Virginia will be required for home consumption. About 15,000 hhds. Kentucky, and 5,000 hhds. Maryland will also be wanted for home use. Owing to the increase of population by immigration and otherwise, the domestic consumption, which was a few years ago so small as not to be considered worthy of notice, has now increased to a very important item, and affords a steady home market for a large portion of the production.

The quantity of Maryland tobacco left for export to Bremen and Holland, in 1851, will only be about 17,000 hhds., which is not more than half the amount usually shipped to these countries every year.

Of the Kentucky tobacco contracted for last year by France and Spain, through their agents in this country, less than one third has yet been purchased, and those governments will this year require the deficiency to be made up, in addition to their annual average supply, which, with the quantity required for England, will take the entire crop, leaving nothing for the rest of Europe, Africa, South America, the West Indies, &c. The tobacco markets throughout the world are in a much more healthy condition than has ever been known, and it is thought prices will rule very high the coming season. In Maryland, while the production has been not more than half an average crop, the price is nearly three times as high as usual; so that the planter will receive more for his diminished crops than in ordinary seasons of plenty.

QUANTITY OF TOBACCO EXPORTED ANNUALLY FROM 1821 TO 1850.

Exports for Year ending hhds.|Stocks in Europe, year ending hhds.

September 30th, 1821	66,850	December 31st, 1821	—
" " 1822	83,169	" " 1822	—
" " 1823	99,000	" " 1823	—
" " 1824	77,889	" " 1824	—
" " 1825	75,986	" " 1825	—
" " 1826	64,099	" " 1826	—
" " 1827	100,020	" " 1827	—
" " 1828	96,279	" " 1828	69,485
" " 1829	77,136	" " 1829	63,670
" " 1830	83,810	" " 1830	50,672
" " 1831	86,718	" " 1831	54,690
" " 1832	106,800	" " 1832	61,868

It is a curious fact that, notwithstanding the variety of climate and soil in the northern State;, every State and territory in the Union produces some tobacco. In many of the States its cultivation is, of course, a secondary object, and perhaps in several it is attended to as a mere matter of curiosity; but in most of the States, probably a sufficient quantity has been grown, to show that with attention to this object, it might, in case of necessity, be resorted to as a profitable crop. The States in which the great bulk of the crop is grown lie between the latitudes of about 34 and 40 degrees.There is a considerable increase of consumption of American tobacco in Europe, as well as in the United States, which should encourage the planters of Virginia and North Carolina to cultivate this article more abundantly than they have done for several years past; and, since the home manufacture has increased so much, and the Virginia tobacco is preferred in many parts of the European markets, they may safely count on getting good prices for many years to come.

It is not in the power of Virginia to make any three years together more than 56,000 hhds., even with good seasons, and 30,000 hhds. annually of this will be wanted by our manufacturers.

The planters, then, should enrich their lands, and aim to make full crops.

The increased consumption in Europe is three per cent., and in the United States four per cent. per annum.

The crop of the United States from 1840 to 1850 inclusive—say 11 years—averaged about 160,000 hhds.; this embraces the large crops of 1842-43-44.

The consumption of Europe from 1829 to 1838 was 96,826 hhds.—it is now 130,000.

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An account of the quantities of unmanufactured tobacco, manufactured called negro-head, and cigars, imported into the United Kingdom in 1850:—

Countries from whence imported.	Unmanufactured	Manufactured
United States of America	30,173,444	1,191,001
Venezuela, New Granada and Ecuador	895,523	527
Brazil	12,138	56,802
Peru	8,649	6
Cuba	589,627	153,819
British West Indies, including Demerara and Honduras	26,169	3,242
British Territories in the East Indies	14,500	25,332
Philippine Islands	12,233	51,210
Hongkong and China	2,706	2,340
Turkey, Syria, and Egypt	140,361	2,882
Malta	13,028	7,818
Italy, Sardinian Territories	431,939	17
Gibraltar	7	3,063
Spain	307,641	1,100
France	29,950	1,521
Channel Islands	149	1,342
Belgium	29,922	6,579

Holland	2,418,732	9,078
Hanseatic Towns	50,610	36,680
Other parts	8,930	1,980
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Total unmanufactured	35,166,358	1,556,321
Ditto manfactured	1,556,321	
Snuff		1,197

Total	36,723,876	

From the tobacco circulars of Messrs. Clagett, Son, and Co., leading brokers of London, dated Feb., 1st, 1850, I take the following extracts:—

The exhaustion of the stock has resulted from the concurrence of a gradually decreasing supply and increasing consumption, which may be very clearly perceived by a reference, first to the official returns from New Orleans of the yearly receipts of the western crops in each of the last seven years; and secondly, to the consumption of American tobacco in Great Britain and Ireland in the years 1847, 1848, and 1849, as compared with that of 1840, 1841, and 1842. We have no means of exhibiting with similar accuracy the relative consumption of Continental Europe in the latter as compared with the former part of these last ten years, but it is quite reasonable to assume that the increase,

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where there has been little or no duty, must have gone on more rapidly than it has done here, under the restraining force of a duty of 800 to 900 per cent.The deliveries from London and Liverpool, independently of those from Scotland, Bristol, and Newcastle, for the use of Great Britain and Ireland, have been as follows:—In 1840, 15,037 hhds.; 1841, 15,019 hhds.; 1842, 15,468 hhds.; 1847, 18,091 hhds.; 1848, 18,595 hhds.; 1849, 18,738 hhds.The highest estimates we have seen of the whole of the crops of the United Slates in 1849, do not exceed 140,000 hhds., of which it is not doubted that fully 45,000 hhds. will be required for consumption there, and we estimate the supply required for the consumption of Europe, South America, the West Indies, and Africa, at certainly not less than 125,000 hhds.; if these estimates be realised in fact, it will follow that the stocks at the close of this year must be 30,000 hhds. less than at the close of 1849.

We estimate the present consumption of American tobacco in Great Britain and Ireland as follows:—

The deliveries in London and Liverpool in 1849, were 18,738 hhds.; do. do. Bristol 1,400 hhds.; do. do. Scotland we assume at 2,800 hhds. Total 22,939.

Of Stripts, the deliveries in Liverpool last year were 8,544 hhds., of which about 300 were for exportation; the deliveries, therefore, were—For the use of Great Britain and Ireland, 8,250 hhds. In London we have no account of the deliveries of stripts, as distinguished from leaf, for the whole of last year; it is doubtless less than that in Liverpool, and we assume it at 7,000 hhds.; in Bristol it was about 900 hhds.; in Scotland we assume it at 2,400 hhds. Total 18,550 hhds.Now, assuming 1,500 hhds. of the deliveries in Scotland and Bristol to be included in the coastwise returns in London and Liverpool, then the consumption of Great Britain and Ireland would appear to be about 21,500 hhds. of American tobacco, and 17,000 for these to be stripts. The progressive increase which we have shown in the returns of 1849, as compared with those of 1840, must still go on.Without troubling you with any detail of the stocks in each of the several markets, it may be sufficient to show that the summary of the whole in all the markets of Europe, other than Great Britain, consisted on the 31st December, 1849, of about 22,000 hhds.; of which about 18,000 were Maryland and 2,000 stalks; and it is important to notice especially the fact, that the stocks of the manufacturers and dealers in Germany, Holland and Belgium are unusually small. We have taken very considerable care to inform ourselves on this point, and are fully satisfied that the usual stocks in second or dealers' hands do not exist. The whole demand of the year must, therefore, be supplied from those stocks in importers'

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hands, from England or from the United States.The following were the prices current in London in the spring of 1853:—Virginia Leaf, common, per pound, 31/4d. to 33/4d.; middling, 5d. to 6d.; good and fine 61/2d. to 71/2d. Stripts, 51/2d. to 10d. Kentucky Leaf: common 3d., to 31/2d.; middling, 33/4d. to 41/2d.; good and fine, 5d. to 6d. Stripts, 5d. to 7d. Maryland, 31/2d. to 9d. Negrohead and Cavendish: common and heated, 4d. to 6d.; middling to good, 6d. to 8d. and 9d.; fine, 10d., 12d., 16d.; Barret's none. Columbian, 7d. to 1s. 8d.; Brazil, 3d. to 6d.; flat, 5d. to 1s. 1d.; Manilla, 7d. to 2s. 6d.; Havana, 10d. to 5s.; Yara, 11d. to 3s.; Cuba, 9d. to 1s. 1d.; ingars, 3s. to 16s.; cheroots, Manilla, 7s. 6d., nominal; German and Amersfoort 4d. to 1s. 3d.; stalks, duty paid, 2s. 6d. to 3s. 4d.; smalls, 2s. 9d to 2s.The shipments to Europe were 76,516 hhds. against 40,652 hhds. the previous year, and 43,576 hhds. in 1850. The rapidity of sales, the diminished stocks even now held in first hands, were taken as an infallible index of the progressive rate of consumption; and of a truth the quantity of hogsheads received in the principal markets of Belgium, Holland, Germany, and the North, and as speedily relieved from the control of the importers, was enough to control even those who were alive to the existing necessities of Europe, and to give a color to the rumour of almost inexhaustible consumption.This extraordinary demand for tobacco on the continent has been occasioned by three distinct causes; the first of which was the pressing wants which, for the last two years, were well known to have existed, and the constant willingness of consumers to act at the very moderate rates which prevailed some time last spring. The second was the compulsory purchases by the Austrian Government, amounting, it is estimated, to 20,000 hhds., by reason that the discontented Hungarians, for political considerations, abandoned altogether the cultivation of tobacco, and which deficiency was obliged to be replaced by American growths. The third cause also had a political origin: the anticipation of the extension of the Zollverein or German Customs League to the Kingdoms of Hanover and Oldenburg, whereby the duties on tobacco in those countries would be greatly increased, was a natural incentive to the dealers and manufacturers there to lay in heavy stocks, to reap the benefit thereon; and these last two causes, therefore, may be viewed in the light of fortuitous circumstances, which have fostered a speculation originally founded on the cheapness of money alone.It has been shown, and the statistics of the past year fully confirm the statement, that a plethora of money and prosperity among the middle classes of society, while it induces to the consumption of tobacco in general, rather curtails than otherwise the demand for American growths. A poor man addicted to smoking takes

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his pipe not from choice, but necessity; as he grows independent, the humble pipe is abandoned and the more costly cigar assumed. We have frequently heard this matter noticed, more especially after the disasters which followed the railway speculations of 1846, when the demand for English cigars sensibly declined; and we have now a further verification of the assertion in the opposite sense, the sales of cigar materials in Bremen having been extended more than 40 per cent, in three years, *viz*., from 94,750 bales and cases in 1850 to 135,650 during last season.From New Orleans we learn that the arrivals from the interior since the 1st September had amounted to 18,043 hhds. against 5,165 hhds. last season, and the stock on hand was 24,128 hhds. against 7,927 hhds. only.

The shipments from Virginia during the past year exceeded 13,700 hhds. In 1851 they were under 4,000 casks.

From Baltimore 54,272 hhds. have been exported. The official figures for the previous year gave 35,967 as the total.

The aggregate stock of tobacco on the 1st of January last, in the principal ports of America, was taken at 52,982 hhds. against 45,292 the year before and the growth of the Western States, Virginia, and Maryland during 1852, to come forward for our supply the present season, is estimated at 185,000 hhds., notwithstanding all the unfavorable influences and curtailing causes which were said to have prevailed.

The method adopted of cultivating tobacco in Virginia is thus described:

Several rich, moist, but not too wet spots of ground are chosen out in the fall, each containing about a quarter of an acre or more, according to the magnitude of the crop, and the number of plants it may require.These spots, which are generally in the woods, are cleared, and covered with brush or timber, for five or six feet thick and upwards; this is suffered to remain upon it until the time when the tobacco seed must be sowed, which is within twelve days after Christmas. The evening is commonly chosen to set these places on fire, and when everything thereon is consumed to ashes, the ground is dug up, mixed with the ashes, and broken very fine. The tobacco seed, which is exceedingly small, being mixed with ashes also, is then sown and just raked in lightly; the whole is immediately covered with brushwood for shelter to keep it warm, and a slight fence thrown around it. In this condition it remains until the frosts are all gone, when the brush is taken off, and the young plants are exposed to the nutritive and genial warmth of the sun, which quickly invigorates them in an astonishing degree, and soon renders them strong and large enough to be removed for planting, especially if they be not sown too thick. Every tobacco planter, assiduous to secure a sufficient quantity of plants, generally has several of these plant beds in different

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situations, so that if one should fail, another may succeed; and an experienced planter commonly takes care to have ten times as many plants, as he can make use of.

In these beds, along with the tobacco, they generally sow kale, colewort, and cabbage seed, &c., at the same time.

There are seven different kinds of tobacco, particularly adapted to the different qualities of the soil on which they are cultivated, and each varying from the other. They are named Hudson, Frederick, Thick-joint, Shoe-string, Thickset, Sweet-scented, and Oronoko. But although these are the principal, yet there are a great many different species besides, with names peculiar to the situations, settlements and neighbourhoods wherein they are produced; which it would be too tedious here to specify and particularise. The soil for tobacco must be rich and strong; the ground is prepared in the following manner:—after being well broke up and by repeated working, either with the plough or hand hoes, rendered soft, light, and mellow, the whole field is made into hills, each to take up the space of three feet, and flattened at the top.In the first rains, which are here called seasons, after the vernal equinox, the tobacco plants are carefully drawn while the ground is soft; carried to the field where they are to be planted, and one dropped upon every hill, which is done by the negro children. The most skilful slaves then begin planting them, by making a hole with their finger in each hill, inserting the plant with the taproot carefully placed straight down, and pressing the earth on each side of it. This is continued as long as the ground is wet enough to enable the plants sufficiently grown to draw and set; and it requires several different seasons, or periods of rain, to enable them to complete planting their crop, which operation is frequently not finished until July.After the plants have taken root, and begin to grow, the ground is carefully weeded and worked, either with hand hoes or the plough, according as it will admit. After the plants have considerably increased in bulk, and begin to shoot up, the tops are pinched off, and only ten, twelve, or sixteen leaves left, according to the quality of the tobacco and the soil. The worms, also, are carefully picked off and destroyed, of which there are two species that prey upon tobacco. One is the ground worm, which cuts it off just beneath the surface of the earth; this must be carefully looked for and trodden to death; it is of a dark brown color, and short. The other is a horn worm, some inches in length, as thick as your little finger, of a vivid green color, with a number of pointed excrescences or feelers from his head like horns. These devour the leaf, and are always upon the plant. As it would be endless labor to keep their hands constantly in search of them, it would be almost impossible to prevent their eating up more than half the crop

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had it not been discovered that turkeys are particularly dexterous at finding them, eat them up voraciously, and prefer them to every other food. For this purpose every planter keeps a flock of turkeys, which he has driven into the tobacco grounds every day by a little negro that can do nothing else; these keep his tobacco more clear from horn worms than all the hands he has got could do were they employed solely for that end. When the tops are nipped off, a few plants are left untouched for seed. On the plants that have been topped, young shoots are apt to spring out, which are termed suckers, and are carefully and constantly broken off lest they should draw too much of the nourishment and substance from the leaves of the plant. This operation is also performed from time to time, and is called “suckering tobacco.” For some time before it is ripe, or ready for cutting, the ground is perfectly covered with leaves, which have increased to a prodigious size, and then the plants are generally about three feet high. When it is ripe, a clammy moisture or exudation comes forth upon the leaves, which appear, as it were, ready to become spotted, and they are then of a great weight and substance. The tobacco is cut when the sun is powerful, but not in the morning and evening. The plant, if large, is split down the middle, and cut off two or three inches below the extremity of the split; it is then turned directly bottom upwards, for the sun to kill it more speedily, to enable the laborers to carry it out of the field, else the leaves would break off in transporting it to the scaffold. The plants are cut only as they become ripe, for a field never ripens altogether. There is generally a second cutting likewise, for the stalk vegetates and shoots forth again, and in good land, with favorable seasons, there is a third cutting also procured, notwithstanding acts of the Legislature to prevent cutting tobacco even a second time.When the tobacco plants are cut and brought to the scaffolds, which are generally erected all around the tobacco houses, they are placed with the split across a small oak stick, an inch and better in diameter and four feet and a half long, so close as each plant just to touch the other without bruising or pressing. These sticks are then placed on the scaffolds, with the tobacco thus suspended in the middle, to dry or cure, and are called tobacco sticks. As the plants advance in curing, the sticks are removed from the scaffolds out of doors into the tobacco house, on to other scaffolds erected therein in successive regular gradations from the bottom to the top of the roof, being placed higher as the tobacco approaches to a perfect cure, until the house is all filled and the tobacco quite cured, and this cure is frequently promoted by making fires on the floor below. When the tobacco house is quite full, and there is still more tobacco to bring in, all that is within the house is struck, and taken down, and

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carefully placed in bulks, or regular rows, one upon another, and the whole covered with trash tobacco, or straw, to preserve it in a proper condition, that is moist, which prevents its wasting and crumbling to pieces. But, to enable them to strike the cured tobacco, they must wait for what is there called a season, that is rainy or moist weather, when the plants will better bear handling, for in dry weather the leaves would all crumble to pieces in the attempt. By this means a tobacco house may be filled two, three, or four times in the year. Every night the negroes are sent to the tobacco house to strip, that is to pull off the leaves from the stalk, and tie them up in hands or bundles. This is also their daily occupation in rainy weather. In stripping, they are careful to throw away all the ground leaves and faulty tobacco, binding up none but what is merchantable. The hands or bundles thus tied up are also laid in what are called a bulk, and covered with the refuse tobacco or straw to preserve their moisture. After this, the tobacco is carefully packed in hogsheads, and pressed down with a large beam laid over it, on the ends of which prodigious weights are suspended, the other end being inserted with a mortice in a tree, close to which the hogshead is placed. This vast pressure is continued for some days, and then the cask is filled up again with tobacco until it will contain no more, after which it is headed up and carried to the pubic warehouses for inspection. At these warehouses two skilful planters constantly attend, and receive a salary from the public for that purpose. They are sworn to inspect with honesty, care, and impartiality, all the tobacco that comes to the warehouse, and none is allowed to be shipped that is not regularly inspected. The head of the cask is taken off, and the tobacco is opened by means of large, long iron wedges, and great labour, in such places as the inspectors direct. After this strict attentive examination, if they find it good and merchantable, it is replaced in the cask, weighed at the public scales, the weight of the tobacco and of the cask also cut in the wood on the cask, stowed away in the public warehouses, and a note given to the proprietor, which he disposes of to the merchant, and he neither sees nor has any trouble with his tobacco more. The weight of each hogshead must be 950 lbs. nett, exclusive of the cask—for less a note will not be given. Under the name of a crop hogshead, however, the general weight is from 1,000 to 1,200 or 1,300 lbs. nett, but if the tobacco is found to be totally bad, and refused as unmerchantable, the whole is publicly burnt in a place set apart for that purpose. However, if it be judged that there is some merchantable tobacco in the hogshead, the owner must unpack the whole publicly on the spot, for he is not permitted to take any of it away again, and must select and separate the good from the bad; the last is immediately committed to the flames, and for the first he receives a transfer

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note, specifying the weight, quality, &c. This great and very laudable care was taken by the public to prevent frauds, which, however, was not always effectual, for, even with all these precautions, many acts of iniquity and imposition were committed.
So little is this crop cultivated in the States north of Maryland, that scarcely any notice has been taken of it in the agricultural or other public journals.

In Connecticut, in some few towns of Hartford county, considerable attention has been directed to it for a number of years past. A ton and a-half the acre is said to be no uncommon yield. The tobacco is planted very thick, two feet and a half each way. The seed came originally from Virginia. It is cured in houses, without having been yellowed in the sun, and without the use of fire. It is said that the best Havana cigars (as they are termed) are often manufactured from mixed Cuba and American tobacco, and sold under that name in Connecticut.

In the Connecticut Valley is produced about 500 tons of tobacco annually, the average quantity, 1,500 lbs. per acre, value from seven to ten cents per pound.

Culture.—Seed bed made rich and sown as cabbage early in April as possible.

Land well ploughed and manured and harrowed as for corn, laid out in rows three feet apart, and slight hills in the row about two and a-half feet apart; begin to plant about 10th of June, the ground to be kept clean with hoe and cultivator, and examine the plants and keep clear of worms.

“When in blossom and before seed is formed, the plants must be topped about thirty-two inches from the ground, having from sixteen to twenty leaves on each stalk, after this the suckers are broken off, and the plants kept clean till cut. When ripe the leaves are spotted, thick, and will crack when pressed between the fingers and thumb. It is cut at any time of the day, after the dew is off, left in the row till wilted, then turned, and if there is a hot sun, it is often turned to prevent burning; after wilting it is put into small heaps of six or eight plants, then carried to the tobacco house for hanging, usually on poles twelve feet long; hung with twine about forty plants to a pole, twenty on each side, crossing the pole with a hitch knot to the stump end of the plants; when perfectly cured, which is known by the stems of the leaves being completely dry, it is then taken in a damp time, when the leaves will not crumble, from the poles and placed in large piles, by letting the tops of the plants lap each other, leaving the butts out; it remains in these heaps from three to ten days before it is stripped, depending on the state of weather, but it must not be allowed to heat. When stripped it is made into small hands, the small and broken leaves to be kept by themselves; it is then packed in boxes of about 400 lbs. and marked "Seed Leaf Tobacco."

One acre of tobacco will require as much labor as two of corn that produce 60 bags to the acre, and requires about the same quantity of manure. If the tobacco can be cured without fire heat the quality will be improved, and if dried in the open air, should have shades of boards to keep off rain and excess of sun. The chief market for Connecticut tobacco is Bremen.

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In a number of the “Charleston Southern Planter,” a remedy is described for preventing the destruction of plants by the fly. The writer says: “I had a bushel or two of dry ashes put into a large tub, and added train oil enough (say one gallon of oil to the bushel of ashes) to damp and flavor the ashes completely: this was well stirred and mixed with the hand, and sown broadcast over certain patches, and proved thoroughly effectual for several years, while parts left without the remedy were destroyed.”

The best ground for raising the plant, according to Capt. Carver ("Treatise on Culture of Tobacco,” &c.), is a warm rich soil, not subject to be overrun with weeds. The soil in which it grows in Virginia is inclining to sandy, consequently warm and light; the nearer, therefore, the nature of the land approaches to that, the greater probability there is of its flourishing. The situation most preferable for a plantation is the southern declivity of a hill, or a spot sheltered from the blighting north winds. But at the same time the plants must enjoy a free current of air; for if that be obstructed they will not prosper.

The different sorts of seed not being distinguishable from each other, nor the goodness to be ascertained by its appearance, great caution should be used in obtaining the seed through some responsible mercantile house, or individual of character.

Each capsule contains about a thousand seeds, and the whole produce of a single plant has been estimated at 350,000. The seeds are usually ripe in the month of September, and when perfectly dry may be rubbed out and preserved in bags till the following season.

There is a large quantity of tobacco raised in the southern part of Indiana annually, equal in quality to the tobacco raised in Kentucky. In some counties the article is extensively cultivated, and generally pays the producer a handsome profit on the labor bestowed on it. The cultivation of it is becoming more extensive every year. Nearly all this crop is taken to Louisville for sale, very little being shipped south on account of the producer.

Heretofore, owing to the heaviness of tobacco and bad roads, the producer has encountered great difficulties in getting his crop to market. The hauling of a few hogsheads fifty or sixty miles, or even forty, is no light job, even over good roads. Hence, tobacco has not been as extensively cultivated as it would have been under different circumstances. But, with the facilities afforded by the railroads in carrying their crops to market, I doubt not the farmers of the interior will more generally engage in the cultivation of tobacco, and those who have been in the habit of raising small crops will extend their operations.

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In Maryland the seed is sown in beds of fine mould, and the plants arising therefrom are transplanted in the beginning of May. They are set at the distance of three or four feet apart, and are hilled, and kept continually free from weeds. When as many leaves have shot out as the soil will nourish to advantage, the top of the plant is broken off, which of course prevents its growing higher. It is carefully kept clear from worms, and the suckers which put out between the leaves are taken off at proper times, till the plant arrives at perfection, which is in August. When the leaves turn of a brownish color, and begin to be spotted, the plants are cut down and hung up to dry, after having sweated in heaps one night. When the leaves can be handled without crumbling, which is always in moist weather, they are stripped from the stalks, tied up in bundles, and packed for exportation in hogsheads. No suckers nor ground leaves are allowed to be merchantable. An industrious person may manage 6,000 plants of tobacco, which will yield 1,000 lbs. of dried leaves, and also four acres of Indian corn.

Miller, an American author, thus describes the mode of culture:—

When a regular plantation of tobacco is intended, the beds being prepared and well turned up with the hoe, the seed, on account of its smallness and to prevent the ravages of ants, is mixed with ashes and sown upon them, a little before the rainy season. The beds are raked, or trampled with the foot, to make the seed take the sooner. The plants appear in two or three weeks. As soon as they have acquired four leaves, the strongest are carefully drawn up and planted in the field by a line, at a distance of about three feet from each other. If no rain fall, they should be watered two or three times. Every morning and evening the plants must he looked over in order to destroy a worm which sometimes invades the bud. When they are about four or five inches high, they are to be cleaned from weeds and moulded up. As soon as they have eight or nine leaves, and are ready to put forth a stalk, the top is nipped off in order to make the leaves longer and thicker. After this the buds which sprout at the joints of the leaves are also plucked off, and not a day is suffered to pass without examining the leaves to destroy the large caterpillar, which is often most destructive to them. When they are fit for cutting, which is known by the brittleness of the leaves, they are cut off with a knife close to the ground, and, after lying some time, are carried to the drying-shed or house, where the plants are hung up by pairs upon lines, leaving a space between, that they may not touch one another. When perfectly dry, the leaves are stripped from the stalks and made into small bundles, tied with one of the leaves. These bundles are laid in heaps and covered with blankets; care is taken not to overheat them, for which reason the heaps are laid open to the air from time to time,

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and spread abroad. This operation is repeated till no more heat is perceived in the heaps, and the tobacco is then ready for packing and shipping.

I have been favored by Mr. J. M. Hernandez, a Cuba planter, with some valuable instructions for the cultivation of Cuba tobacco, which I subjoin. These remarks apply principally to America, but most of the advice and information will be found generally applicable to other localities:—

The first thing to be considered in this, as in every other culture, is the soil, which for this kind of tobacco (*N. repanda*) ought to be a rich, sandy, loam, neither too high nor too low—that is, ground capable of retaining moisture, the more level the better, and, if possible, well protected by margins. The next should be the selection of a spot of ground to make the necessary beds. It would be preferable to make those on land newly cleared, or, at all events, when the land has not been seeded with grass; for grass seeds springing up together with the tobacco would injure it materially, as the grass cannot be removed without disturbing the tobacco plants. In preparing the ground for the nurseries, break it up properly, grub up all the small stumps, dig out the roots, and carefully remove them with the hand. This being done, make the beds from three to four inches high, of a reasonable length, and from three to three and a-half feet broad, so as to enable the hand, at arm’s length, to weed out the tender young plants with the fingers from both sides of the bed, and keep them perfectly clean.The months of December and January are the most proper for sowing the seed in Florida. Some persons speak of planting it as early as the month of November, I am, however, of opinion, that about the latter part of December is the best time to sow tobacco seed; any sooner would expose the plants to suffer from the inclemency of the most severe part of the winter season. Before the seed is sown take some dry trash and burn it off upon the nursery beds, to destroy insects and grass seeds; then take one ounce of tobacco seed and mix it with about a quart of dry ashes, so as to separate the seed as much; as possible, and sow it broadcast. After the seed has been thus sown, the surface of the bed ought to be raked over slightly, and trodden upon by the foot, carrying the weight of the body with it, that the ground may at once adhere closely to the seed, and then water it. Should the nursery-beds apparently become dry from blighting winds or other causes, watering will be absolutely necessary, for the ground ought to be kept in a moist state from the time the seed is planted until the young plants are large enough to be set out.The nurseries being made, proceed to prepare the land where the tobacco is to be set out. If the land is newly cleared—and new land is probably more favorable to the production of this plant than it is to that of any other,

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both as respects quality and quantity—remove as many of the stumps and roots as possible, and dig up the ground in such a manner as to render the surface perfectly loose; then level the ground, and in this state leave it until the nursery plants have acquired about one-half the growth necessary to admit of their being set out; then break up the ground a second time in the same manner as at first, as in this way all the small fibres of roots and their rooted parts will be more or less separated, and thus obviate much of that degree of sponginess so common to new land, and which is in a great measure the cause of new land seldom producing well the first year, as the soil does not lay close enough to the roots of the plants growing in it, so that a shower of rain produces no other effect than that of removing the earth still more from them.The ground having been prepared and properly levelled off, and the plants, sufficiently grown to be taken up—say of the size of good cabbage plants—take advantage of the first wet or cloudy weather to commence setting them out. This should be done with great care, and the plants put single at equal distances, that is, about three feet north and south, and two and a-half, or two and three-fourths feet east and west. They are placed thus close to each other to prevent the leaves growing too large. The direction of the rows, however, should alter according to the situation of the land; where it has any inclination, the widest space should run across it, as the bed will have to be made so as to prevent the soil from being washed from the roots by rain when bedded; but where the land is rather level, the three feet rows should be north and south, so as to give to the plants a more full effect on them by passing across the beds, than by crossing them in an oblique direction. To set the plants out regularly, take a task line of 105 feet in length, with a pointed stick three feet long attached to each end of it, then insert a small piece of rag or something else through the line at the distance of two feet and three-fourths from each other; place it north and south (or as the land may require), at full length, and then set a plant at every division, carefully keeping the bud of the plant above the surface of the ground. Then remove the line three feet from the first row, and so on, until the planting is completed. Care ought to be taken to prevent the stretching of the line from misplacing the plants. In this way the plants can be easily set out, and a proper direction given to them both ways. In taking the plants up from the nursery, the ground should be first loosened with a flat piece of wood or iron, about an inch broad; then carefully holding the leaves close towards each other between the fingers, draw them up, and place them in a basket or some other convenient thing to receive them for planting. After taking up those that can be planted during the day, water the nursery that the earth may again

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adhere to the remaining ones. The evening is the best time for setting out the plants, but where a large field has to be cultivated it will be well to plant both morning and evening. The plants set out in the morning, unless in rainy or cloudy weather, should be covered immediately, and the same should be done with those planted the evening previous, should the day open with a clear sunshine,—the palmetto leaf answers the purpose very well. There should be water convenient to the plants, so as to have them watered morning and evening, but more particularly in the evening, until they have taken root. They should also be closely examined when watered, so as to replace such plants as happen to die, that the ground may be properly occupied, and that all the plants may open as nearly together as possible.From the time the plants are set out, the earth around them should be occasionally stirred, both with the hand and hoe. At first hoe flat, but as soon as the leaves assume a growing disposition, begin gradually to draw a slight heel towards the plant. The plants must be closely examined, even while in the nursery, to destroy the numerous worms that feed upon them—some, by cutting the stalk and gnawing the leaves when first set out; these resemble the grub-worm, and are to be found near the injured plant, under ground; others, which come from the eggs deposited on the plant by the butterfly, and feed on the leaf, grow to a very large size, and look very ugly, and are commonly called the tobacco-worm. There is also a small worm which attacks the bud of the plant, and which is sure destruction to its further growth; and some again, though less destructive, are to be seen within the two coats of the leaf, feeding as it were on its juices alone. The worming should be strictly attended to every morning and evening, until the plants are pretty well grown, when every other day will be sufficient. The most proper persons for worming are either boys or girls from ten to fourteen years of age. They should be made to come to the tobacco ground early in the morning, and be led by inducements, such as giving a trifling reward to those who will bring the most worms, to clear it thoroughly. Grown persons would find it rather too tedious to stoop to examine the under part of every leaf, and seek the worm under ground: nor would they be so much alive to the value of a spoonful of sugar, or other light reward. Beside, where the former would make the search a matter of profit and pleasure, it would to the latter prove only a tedious and irksome occupation. Here I will observe, that it is for similar reasons that the culture of the Cuba tobacco plant more properly belongs to a white population, for there are few plants requiring more attention and tender treatment than it does. Indeed it will present a sorry appearance, unless the eye of its legitimate proprietor is constantly watching over it.When the plants have acquired from twelve

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to fourteen good leaves, and are about knee high, it may be well to begin to top them, by nipping off the bud with the aid of the finger and thumb nail (washing the hands after this in water is necessary, as the acid juices of the plants, otherwise, soon produce a soreness on the fingers), taking care not to destroy the small leaves immediately near the bud: for if the land is good and the season favorable, those very small top leaves will in a short time be nearly as large, and ripen quite as soon as the lower ones, whereby two or more leaves may be saved; thus obtaining from 16 to 18 leaves, in the place of 12 or 14, which is the general average. As the topping of the tobacco plant is all essential in order to promote the growth, and to equalise the ripening of the leaves, I would observe that this operation should at all events commence the instant that the bud of the plant shows a disposition to go to seed, and be immediately followed by removing the suckers, which it will now put out at every leaf. Indeed, the suckers should be removed from the plant as often as they appear. The tobacco plant ought never to be cut before it comes to full maturity, which is known by the leaves becoming mottled, coarse, and of a thick texture, and gummy to the touch, at which time the end of the leaf, by being doubled, will break short, which it will not do to the same extent when green. It ought not to be out in wet weather, when the leaves lose their natural gummy substance, so necessary to be preserved. About this period, the cultivator is apt to be rendered anxious by the fear of allowing the plants to remain in the field longer than necessary; until experience removes those apprehensions, he should be on his guard, however, not to destroy the quality of his tobacco, by cutting it too soon. When the cutting is to commence, there should be procured a quantity of forked stakes, set upright, with a pole or rider setting on each fork ready to support the tobacco, and to keep it from the ground. The plant is then cut obliquely, even with the surface of the ground, and the person thus employed should strike the lower end of the stalk, two or three times with the blunt side of his knife, so as to cause as much of the sand or soil to fall from it as possible, then tying two stalks together, they are gently placed across the riders or poles prepared to receive them. In this state they are allowed to remain in the sun or open air until the leaves have somewhat withered, whereby they will not be liable to the injury which they would otherwise receive, if they came suddenly in contact with other bodies when fresh cut. Then place as many plants on each pole or rider as may be conveniently carried, and take them in the drying house, where the tobacco is strung off upon the frames prepared for it, leaving a small space between the two plants, that air may circulate freely among them, and promote their drying. As the drying advances, the stalks are brought closer to each other, so as

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to make room for those which yet remain to be housed.In drying the tobacco, all damp air should be excluded, nor ought the drying of it to be precipitated by the admission of high drying winds. The process is to be promoted in the most moderate manner, except in the rainy season, when the sooner the drying is effected the better; for it is a plant easily affected by the changes of the weather, after the drying commences. It is then liable to mildew in damp weather, which is when the leaf changes from its original color to a pale yellow cast, and from this, by parts, to an even brown. When the middle stem is perfectly dry, it can be taken down, and the leaves stripped from the stalk and put in bulk to sweat, that is, to make tobacco of them; for before this process, when a concentration of its better qualities takes place, the leaves are always liable to be affected by the weather, and cannot well be considered as being anything else than common dry leaves, partaking of the nature of tobacco, but not actually tobacco. The leaves are to be stripped from the stalks in damp or cloudy weather, when they are more easily handled, and the separation of the different qualities rendered also more easy. The good leaves are at this time kept by themselves as wrappers, or caps, and the most defective ones for fillings, or *tripa*. When the tobacco is put in *bulk*, the stem of the leaves should all be kept in one direction, to facilitate the tying of them in hanks: afterwards make the bulk two of three feet high, and of a proportionate circumference. To guard against the leaves becoming over-heated, and to equalise the fermentation or sweating, after the first twenty-four hours, place the outside leaves in the centre, and those of the centre to the outside of the *bulk*. By doing this once or twice, and taking care to cover the *bulk* either with sheets or blankets, so as to exclude all air from it, and leaving it in this state for about forty days, it acquires an odor strong enough to produce sneezing, and the other qualities of cured tobacco. The process of curing may then be considered as completed. Then take some of the most injured leaves, but of the best quality, and in proportion to the quantity of tobacco made, and place them in clean water, there let them remain until they rot, which they will do in about eight days; then break open your *bulks*, spread the tobacco with their stems in one direction, and damp them with this water in a gentle manner, that it may not soak through the leaf, for in this case the leaf would rot. Sponge is used in Cuba for this operation. Then tie them in hanks of from, twenty-five to thirty leaves; this being done, spread the hanks in the tobacco house for about twelve hours, to air them, that the dampness may be removed, and afterwards pack them in casks or barrels, and head them tight, until you wish to manufacture them.The object of damping the tobacco with

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this water, is to give it elasticity, to promote its burning free, to increase its fragrance; to give it an aromatic smell, and to keep it always soft. This is the great secret of curing tobacco for cigars properly, and for which we are indebted to the people of Cuba, who certainly understand the mode of curing this kind of tobacco better than other people. It is to them a source of great wealth, and may be made equally so to others. We have here three cuttings from the original plants; the last cutting will be of rather a weak quality, but which, nevertheless, will be agreeable to those who confine their smoking to weak tobacco.

In ratooning the plant, only one sprout ought to be allowed to grow, and this from those most deeply rooted; all other sprouts ought to be destroyed.

The houses necessary for the curing of tobacco ought to be roomy, with a passage way running through the centre, from one extremity of the building to the other, and pierced on both sides with a sufficient number of doors and windows to make them perfectly airy.In addition to what I have said respecting the mode of cultivating and treating the tobacco plant, I have further to state, that when once the plant is allowed to be checked in its growth, it never again recovers it. That in promoting the drying of the leaf, fire should not be resorted to, because the smoke would impart to it a flavor that would injure that of the tobacco itself.In order to obtain vigorous plants, the seed ought to be procured from the original stalk, and not from the ratoons, by allowing some of them to go to seed for that express purpose. In Cuba, the seed is most generally saved from the ratoon plants, but we should consider that that climate and soil are probably more favorable to the production of the plant than America, and consequently we ought to confide in the best seed, which is had from the original stalk.All plants have their peculiar empire: nevertheless, we should not be deterred from planting Cuba tobacco here; for even if we should be compelled to import the seed every third year, which would be as often as necessary, it would still prove a profitable culture. Taking 600 lbs., which is the average product per acre, it would yield, if well cured, at 50 cents, per lb., 300 dollars in the leaf.

The following exhibits the profit to be derived from it when manufactured into cigars:—

	Dls.	Dls.
Six hundred pounds, allowing eight pounds to the 1.000, would produce 75,000 cigars, which at ten dollars per thousand	750.00	

Cost of the leaf 300.00
Worth of manufacture, at two dollars fifty cents per thousand 187.50 487.50

Difference in favor of manufacturer 262.50

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This amount being the profits of the manufacturer alone, the profit to him who could combine both pursuits would be more than doubled.

As to the quantity of land which can be cultivated to the hand, there is some difference in the practice of planters; however, I think that I am within the usual calculation in saying, that an acre and a half would not exceed the quantity that an able hand can easily cultivate and manage properly.

"With reference to the cultivation of Spanish tobacco from the seed, the following remarks are also made by a gentleman residing in Maryland:—

My experience for some years in the cultivation and manufacture of Spanish tobacco into cigars, convinces me that the first-rate variety of Spanish tobacco—that is, the most odorous and fine—will bear reproduction in our climate twice, without much deterioration; by that time it becomes acidulated and worthless as Spanish tobacco. For seven years I have imported annually first seed from Cuba, but have occasionally made experiments with reproduced seed, and I have arrived at the conclusion above stated. I have obtained, annually, a cigar maker from Baltimore, who has made for me on my farm, and from Spanish tobacco. These produced about the average of 70,000 cigars, per year; they have been sold in Baltimore and Philadelphia for five dollars the half box, that is ten dollars the thousand. The tobacco has been uniformly admired, but in former years they have been very badly made; for the last two years, (writing in 1843,) my crops were destroyed by the unfavorable weather. This growth and manufacture do not interfere with my cultivation of other crops; in fact they are wholly unconnected with the other operations of the farmer." He mentions having obtained a premium from an agricultural society, for having produced on one and a half acres, growth and manufacture included, of Spanish tobacco 504 dollars net profit.

The following letter from Mr. Clarke, to the Hon. H. L. Ellsworth, Washington, speaks favorably of a new variety of tobacco:—

Willow Grove, Orange County, Virginia,

Feb. 13, 1844.

Dear Sir,—Agreeably to my promise I enclose you the Californian tobacco seed. It grew from the small parcel given to me by Mr. Wm. Smith, in your office in March last. On getting home, although late, I prepared a bed, and sowed the small parcel, the first week in April, and not having seed enough to finish the bed, sowed the balance of the bed in Oronoko tobacco seed, and to my astonishment the Californian plants were soon ready to set out, as soon as the other kinds of tobacco sown in the month of January;

and the Oronoko seed, that was sown with the Californian, did not arrive to sufficient size until it was too late to set out. The Californian tobacco, if it continues to ripen and grow for the time to come, as it did for me on the first trial, must come

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into general use—first, because the plants are much earlier in the spring (say ten days at least), than any kind we have; secondly, when transplanted, the growth is remarkably quick, matures and ripens at least from ten to fifteen days earlier than any kind of tobacco we have in use amongst us. It is a large broad, silky leaf, of fine texture, and of a beautiful color, and some plants grow as large as seven feet across, from point to point; upon the whole, I consider it a valuable acquisition to the planting community.
Tobacco is one of the chief staples of Cuba. There are many qualities, but it is usually classed into two kinds. That which is raised on the western end of the island and is unequalled for smoking, is called "Vuelta abajo." That which is raised east of Havana, is called "Vuelta arriba," and is far inferior to the former.

The best Havana tobacco farms are confined to a very narrow area on the south west part of Cuba. This district, twenty-seven leagues long and only seven broad, is bounded on the north by mountains, on the south and west by the ocean, whilst eastward, though there is no natural limit, the tobacco sensibly degenerates in quality. A light sandy soil and rather low situation suit the best.

The "Vuelta abajo" is usually divided into five classes.

Calidad or Libra.
Ynjuriado Principal or Firsts.
Segundas or Seconds.
Terceiras or Thirds.
Cuartas or Fourths.

Calidad is the best tobacco, selected for its good color, flavor, elasticity and entireness of the leaves. The bales contain sixty hands of four gabillas, or fingers of twenty-five leaves each, and are marked L.60. Ynjuriado Principal has less flavor, and is usually of a lighter color. The leaves should be whole and somewhat elastic. The bales contain eighty hands of four gabillas, or thirty leaves each, and are marked B. 80. Segundas is the most inferior class of wrapper. There are many good leaves in it, but the hands are usually made up of those which are stained, have a bad color, or have been slightly touched by the worm. The bales contain eighty hands of four gabillas of thirty-six to forty leaves each, and are marked Y. 2a. 80.

Terceiras is the best tilling, and much wrapper can usually be selected from it when new. The bales contain eighty hands of four gabillas of more than forty leaves each, and are marked 3a. 80.

Cuartas is the most inferior class, fit only for filling. The bales contain eighty hands of four gabillas of no determined number of leaves, and are marked 4a. 80.

The Vuelta arriba tobacco is prepared in a similar manner, but neither its color or flavor is good, and it does not burn well.

The crop is gathered in the spring, and usually begins to appear at market in July. Good tobacco should be aromatic, of a rich brown color, without stains, and the leaf thin and elastic. It should burn well and the taste should be neither bitter nor biting. The best is grown on the margins of rivers which are periodically overflowed, and is called “De rio.” It is distinguished from other tobacco by a fine sand, which is found in the creases of the leaves.

The tobacco plantations in Cuba increased in number from 5,534 in 1827, to 9,102 in 1846. The production of tobacco has nearly doubled in the province, of which St. Jago is the port, in the last ten years.

The following figures show the exports from the Havana:—

	Leaf tobacco.	Cigars.
1840	1,031,136 lbs.	147,818 thousand.
1841	1,460,302 "	161,928 "
1842	1,053,161 "	135,127 "
1843	2,125,805 "	153,227 "
1844	1,197,136 "	147,825 "
1845	1,621,889 "	120,352 "
1846	4,066,262 "	158,841 "
1847	1,936,829 "	1,982,267 "
1848	1,350,815 "	150,729 "
1849	1,158,265 "	111,572 "

The class of tobacco shipped at the port of Havana, is not the same as that gathered in the districts from which the manufacturers of cigars there receive their supplies—it would cost too dear. However, it is not a rare occurrence to find among a number of bales a few of a quality about equal to that employed there, and this happens in years when the crop has been very abundant, as in 1846 and 1848. The various classes are paid in proportion to the capa, or outside leaves, which are found in an assortment; the three first classes are employed as covers, and often, if the tobacco is new, they may be found in the fourth and even in the fifth. In parcels well assorted, one-fourth is composed of capa—say, first, second, and third, and the rest is composed of tripa, or interior of the cigar. In the first-named, there generally comes more of the *capa* than is necessary to use; the remaining bales, which contain the inferior class, are fit only for fillings.

The following is an analysis of the ashes of Havana tobacco:—

Salts of potash	24.30
Salts of lime and magnesia	67.40
Silica	8.30

	100.00

Hayti exported in 1836	1,222,716 lbs.
Porto Rico, in 1839	43,203 cwt.

The French have been so successful in cultivating tobacco, in their possessions in Northern Africa, that they hope soon to be independent of the foreign grown article. The mode of preparing it, however, is not very well understood by the colonists. In 1851, the number of planters in Algeria was only 137, whereas in 1852, it was 1,073. The number of hectares under culture with the tobacco plant was 446 in 1851, and 1,095 in 1852. The total of the present year's crop is estimated at 1,780,000 kilogrammes, of which 700,000 kilogrammes have been grown by the natives, and the rest by Europeans.

In the province of Algiers alone, the quantity of tobacco sold will amount to 550,000 kilogrammes, which is nearly three times as much as in 1851, and an equal progression has taken place in the provinces of Oran, and Constantina.

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The cultivation of tobacco in Algeria has proved most successful; in 1851, only 264,912 kilogrammes were produced; in 1852, the quantity had risen to 735,199 kilogrammes. There are two crops in the year, the first being the best, but even this is capable of almost indefinite augmentation.

CULTURE OF TOBACCO IN THE EAST.

Having touched upon the practice of culture in the western world, we will now bend our steps towards the east, and it may be curious to notice the method pursued in cultivating and curing the celebrated Shiraz tobacco of Persia (*Nicotiana Persica*), which is so much esteemed for the delicacy of its flavor, and its aromatic quality. It is thus described by an intelligent traveller. The culture of the plant, it will be seen, is nearly the same; it is only the preparation of the tobacco that forms the difference:—

In December the seed is sown in a dark soil, which, has been slightly manured (red clayey soils will not do). To protect the seed, and to keep it warm, the ground is covered with light, thorny bushes, which are removed when the plants are three or four inches high; and during this period, the plants are watered every four or five days, only however in the event of sufficient rain to keep the soil well moistened not falling. The ground must be kept wet until the plants are six to eight inches high, when they are transplanted into a well moistened soil, which has been made into trenches for them; the plants being put on the top of the ridges ten or twelve inches apart, while the trenched plots are made, so as to retain the water given. The day they are transplanted, water must be given to them, and also every five or six days subsequently, unless rain enough falls to render this unnecessary. When the plants have become from thirty to forty inches high, the leaves will be from three to fifteen inches long. At this period, or when the flowers are forming, all the flower capsules are pinched or twisted off. After this operation and watering being continued, the leaves increase in size and thickness until the month of August or September, when each plant is cut off close to the root, and again stuck firmly into the ground. At this season of the year, heavy dews fall during the night; when exposed to these the color of the leaves change from green to the desired yellow. During this stage, of course no water is given to the soil. When the leaves are sufficiently yellow, the plants are taken from the earth early in the morning, and while they are yet wet from the dew, are heaped on each other in a high shed, the walls of which are made with light thorny bushes, where they are freely exposed to the wind. While there, and generally in four or five days, those leaves which are still green become of the desired pale yellow color. The stalks and centre stem of each leaf are now removed, and thrown away, the leaves are heaped together in the drying house for three or four days more, when they are in a fit state for packing. For this operation the leaves are carefully spread on each other and formed into sorts of cakes, the circumference from four to five feet, and three to four inches thick, great care being taken not to break or injure the leaves.Bags made of strong cloth, but thin and very open at the sides, are filled with these cakes, and pressed very strongly down on each other; the leaves would be broken if this were not attended to. When the bags are filled, they are placed separately in a drying house, and turned daily. If the leaves were so dry that there would be a risk of their breaking during the operation of packing, a very slight sprinkling of water is given them to enable them to withstand it without injury. The leaf is valued for being thick, tough, and of a uniform light yellow color, and of an agreeable aromatic smell.

In India, the Surat, Bilsah, and Sandoway (Arracan) varieties of tobacco are the most celebrated. The two first are found to be good for cultivation in the district about Calcutta, but the Cabool is still more to be preferred. Tobacco requires in the East, for its growth, a soil as fertile and as well manured as for the production of the poppy or opium. It is, therefore, often planted in the spaces enriched by animal and vegetable exuviae, among the huts of the natives. I have tried seed in different soils, says Capt. C. Cowles,—namely a light garden mould with a large portion of old house rubbish, dug to a good depth, which had a top dressing of the sweepings of the farm-yard and cow-houses; a rather heavy loam, highly manured with burnt and decayed vegetables, and old cow dung; the third was a patch of ground, which was originally an unwholesome swamp, from being eighteen inches to two feet, lower than the surrounding land; the soil appeared to be a hard sterile clay, and covered with long coarse grass and rushes. As there was a tank near it, I cut away one side of it, and threw the soil over the ground, bringing it rather above the level. Such was its appearance, (a hard compost marly clay,) that I expected no other good from it than that of raising the land so as to throw the water off; contrary, however, to my expectations, it produced a much finer crop of tobacco than either of the other soils, and with somewhat less manure. The agricultural process is limited to some practical laws founded on experience, and these are subject to two principal agents; *viz*., the soil and climate. With respect to the former, it is the practice amongst the growers in tobacco countries, such as Cuba, the States of Virginia, North and South Carolina, and the Philippine Islands, to select a high and dry piece of land, of a siliceous nature, and combined with iron, if possible; and with respect to the latter, there are seasons of the year too well known to the planters to need any explanation. The only difference (if there is any) depends on the geographical situation of the place, with respect to its temperature, or in the backwardness or advancement of seasons, and even on the duration of the same—in which circumstances the planter takes advantage of the one for the other.

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The influence of a burning climate may be modified by choosing the coolest month of the year, whereas the soil cannot be altered without incurring great expense. I have seen tobacco lose its natural quality and degenerate by transplanting from one soil to another, although of the same temperature, and *vice versa*.

Mr. Piddington has analysed several Indian soils, distinguished for the production of superior tobacco. These are the table soils from Arracan, (Sandoway,) a soil from Singour, in Burdwan, near Chandernagore, the tobacco of which, though of the same species as that of the surrounding country, sells at the price of the Arracan sort; and the soil of the best Bengal tobacco, which is grown at, and about Hingalee, in the Kishnagur district.

The best tobacco soils of Cuba and Manila, are for the most part red soils. Now, the red and reddish soils contain most of their iron in the state of peroxide, or the reddish brown oxide of iron; while the lighter grey soils contain it only in the state of protoxide, or the black oxide of iron. Mr. Piddington believes the quality of the tobacco to depend mainly on the state and quantity of the iron of the soil, while it is indifferent about the lime, which is so essential to cotton. None of the tobacco soils contain any lime. Their analysis show them to contain:—

	Arracan soil.	Singour soil.	Hingalee soil.
Oxide or iron, (peroxide)	15,65	10,60	6,00
Water and saline matter	1,10	75	1,50
Vegetable matter and fibre	3,75	1,10	75
Silex	76,90	80,65	87,25
Alumina	2,00	4,50	1,50
	-------	-------	-------
	99,40	97,60	97,00
Water and loss	60	2,40	3,00
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	100	100	100

From which it will be seen that the best tobacco soil hitherto found in India contains about sixteen per cent., or nearly one-sixth, of iron, which is mostly in a state of peroxide; and that the inferior sort of tobacco grows in a soil containing only six per cent., or one-sixteenth of iron, which is, moreover, mostly in the state of protoxide, or black oxide.
Mr. Piddington thought it worth examining what the quantity of iron in the different sorts of tobacco would be, and found that while the ashes of one ounce, or 480 grains of Havana and Sandoway cheroots gave exactly 1.94 grains, or 0.40 per cent., of peroxide of iron the ashes of the same quantity of the Hingalee, or best Bengal tobacco, only gave 1.50 grains, or 0.32 per cent.; and it appears to exist in the first two in a state of peroxide, and in the last as a protoxide of iron; rendering it highly probable that the flavor of the tobacco to the smoker depends on the state and quantity of the iron it contains! Green copperas water, which is a solution of sulphate of iron, is

often used by the American and English tobacconists and planters, to colour and flavor their tobacco; and this would be decomposed by the potass of the tobacco, and sulphate of potass and carbonate of iron is formed. Carbonate of iron is of an ochre-yellow color. Mr. Piddington says he took care to ascertain that this process had not been performed with the tobacco used for this experiment; and adds that Bengal cheroot makers do not know of this method. Mr. Laidley, of Gonitea, dissents from the idea suggested by Mr. Piddington that ferruginous matter in the soil is essential to the successful growth of tobacco. He observes that if we attend only to the iron contained, why every plant will be found to require a ferruginous soil; but tobacco contains a notable quantity of nitrate of potass and muriate of ammonia (the latter a most rare ingredient in plants), and these two salts are infinitely more likely to affect the flavor of the leaf than a small portion of oxide of iron, an inert body. Now as neither of these can be supplied by the atmosphere, we must search for them in the soil, and accordingly he imagined that a compost similar to the saltpetre beds which Napoleon employed so extensively in France, would be a good manure for tobacco lands; namely, calcareous matter, such as old mortar, dung, and the ashes of weeds or wood. He was aware that good tobacco might be grown in Beerbhoom, having raised some himself several years ago from American seed. The plants grew most vigorously, and he further observed, in confirmation of his opinion about the proper manure, that in other districts in which he had resided the natives always grew the tobacco (each for his own use) upon the heap of rubbish at his door, consisting of ashes, cow-dung, and offal of all kinds. While the soil of the Gangetic diluvium almost always contains carbonate of lime, the Beerbhoom soil does not, as far at least as Mr. Laidley had examined it.

The following is the mode of culture pursued about the city of Coimbetore. Between the middle of

August and the same time in September, a plot of ground is hoed and embanked into small squares; in these the seed is sown, and covered by hand three times at intervals of ten days. To secure a succession of seedlings water is then given, and the sun's rays moderated by a covering of bushes. Watering is repeated every day for a month, and then only every fifth day. The field in which the seedlings are transplanted, is manured and ploughed at the end of August. Cattle are also folded upon the ground. Four or five ploughings are given between mid September and the middle of October, when the field is divided as above into small squares. These are watered until the soil is rendered a mud. Plants of the first sowing are then inserted at the end of September, about a cubit apart, the transplanting being done in the afternoon. At intervals of ten days the seedlings of the other two sowings are removed. A month after being transplanted the field is hoed, and after another month the leading shoot of each plant is pinched off, so as to leave them not more than a cubit high. Three times during the next month all side shoots thrown out are removed. When four months old, the crop is ready for cutting. To render the leaves sweet the field is watered, and the plants cut down close to the surface, being allowed to remain when cut until next morning. Their roots are tied to a rope and suspended round the hedges. In fine weather the leaves are dry in ten days, but if cloudy they require five more days. They are then heaped up under a roof, which is covered with bushes and pressed with stones for five days. After this the leaves are removed from the stems, tied in bunches, heaped again, and pressed for four days longer. They are now tied in bundles, partly of the small leaf and partly of the large leaf bundles, and again put in heaps for ten days—once during the time the heaps being opened and piled afresh. This completes the drying. A thousand bundles, weighing about 570 lbs., is a good produce for an acre.

In 1760, Ceylon produced a considerable quantity of tobacco, principally about Jaffna, a demand having sprung up for it in Travancore, and on the Malay coast. The cultivation spread to other districts of the island, Negombo, Chilaw, and Matura. Not long after the possession of the island by the British, a monopoly was created by an import duty of 25 per cent., *ad valorem*, and in 1811 the growers were compelled to deliver their tobacco into the Government stores at certain fixed rates. The culture and demand thereupon decreased. In 1853, the duty on the exports of tobacco from this island amounted to L8,386, and in 1836 to L9,514.

Ceylon now exports a considerable quantity of tobacco. The value of that exported in 1844 was nearly L18,000: it went exclusively to British colonies. The shipments since have been as follows:—

1848 L17,992 —— 1849 22,300 —— 1850 20,721 22,184 cwts. 1851 21,422 22,523 "
1852 20,531 21,955 "

About 96,000 piculs of cigars, of five different qualities, are exported annually from Siam. A good deal of very fine tobacco is grown in the Philippines, and the Manila cheroots are celebrated all over the globe. The quantity of raw tobacco shipped from Manila in 1847 was 92,106 arrobas (each about a quarter of a cwt.); manufactured tobacco, 12,054 arrobas; and 1,933 cases of cigars. 5,220 boxes of cigars were shipped from Manila in 1844. 73,439 millions of cigars were shipped in 1850, and 42,629 quintals of leaf tobacco.

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The manufacture of cigars in Manila is a monopoly of the government, and not only is this the case, but it is a monopoly of the closest description, and any infringement of the assumed rights of the Spanish Indian government is visited by the most severe penalties. Public enterprise, however little of that commodity there now exists in the Spanish character, is thus kept down; and this is not only detrimental to the nation itself, but is also unjust towards those persons who are the purchasers of the article, enhanced in price, as is always the case, by monopoly. The cheroot, which now costs, free of duty, about one halfpenny, could be rendered for half that sum, according to well-authenticated opinions. To protect itself from illicit manufacturers, or smuggling of any kind in connection with cigars, the government is compelled to maintain an army of gendarmes, in order to adopt the most stringent means which despotic states alone tolerate. No person is, therefore, permitted to have even the tobacco leaf in its raw state on his premises, and gendarmes pay, at stated intervals, domiciliary visits to the habitations of the people, in search of any contraband materials. There are several extensive manufactories of cigars and cheroots belonging to the government in and near Manila. Mr. Mac Micking, in his recent work on the Philippines, thus describes the mode of manufacture by those employed by the government:—

In making cheroots women only are employed, the number of those so engaged in the factory at Manila being generally about 4,000. Beside these, a large body of men are employed at another place in the composition of cigarillos, or small cigars, kept together by an envelope of white paper in place of tobacco; these being the description most smoked by the Indians. The flavor of Manila cheroots is peculiar to themselves, being quite different from that made of any other sort of tobacco; the greatest characteristic probably being its slightly soporific tendency, which has caused many persons in the habit of using it to imagine that opium is employed in the preparatory treatment of the tobacco, which, however, is not the case.The cigars are made up by the hands of women in large rooms of the factory, each of them containing from 800 to 1,000 souls. These are all seated, or squatted, Indian like, on their haunches, upon the floor, round tables, at each of which there is an old woman presiding to keep the young ones in order, about a dozen of them being the complement of a table. All of them are supplied with a certain weight of tobacco, of the first, second, or third qualities used in composing a cigar, and are obliged to account for a proportionate number of cheroots, the weight and size of which are by these means kept equal. As they use stones for beating out the leaf on the wooden tables before which they are seated, the noise produced by them while making them up is deafening, and generally

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sufficient to make no one desirous of protracting a visit to the place. The workers are well recompensed by the government, as very many of them earn from six to ten dollars a month for their labor; and as that amount is amply sufficient to provide them with all their comforts, and to leave a large balance for their expenses in dress, &c., they are seldom very constant laborers, and never enter the factory on Sundays, or, at least, on as great an annual number of feast days as there are Sundays in a year.

The Japanese grow a good deal of tobacco for their own consumption, which is very considerable. They consider that from Sasma as the best, then that from Nangasakay, Sinday, &c. The worst comes from the province of Tzyngaru; it is strong, of a black color, and has a disgusting taste and smell. The tobacco from Sasma is, indeed, also strong, but it has an agreeable taste and smell, and is of a bright yellow color. The tobacco from Nangasakay is very weak, in taste and smell perhaps the best, and of a bright brown color. The tobacco from Sinday is very good. The Japanese manufacture the tobacco so well, says Capt. Golownin, (Recollections of Japan,) that though I was before no friend to smoking, and even when I was at Jamaica could but seldom persuade myself to smoke an Havana cigar, yet I smoked the Japanese tobacco very frequently, and with great pleasure.

The culture of tobacco is a very profitable article for the laborers, seeing that the produce is obtained from grounds which have already given the first crop. The qualities of Java tobacco are more and more prized in the European markets, the preparation and assortment are not yet all that could be desired, but they have progressed in this branch, and the contracts made with the new adventurers assure them of a considerable benefit. But before the Java tobaccos can find an assured opening in the European markets, it is necessary that the cultivators should make use of seed from the Havana or Manila. The residencies of Rembang, Sourabaya, Samarang, Chinbou, and Tagal, present districts suited for its culture; it has been carried on with success for a good many years in the residencies of Treanger, Pakalongan, and Kedu, but only for the consumption of the interior, and of the Archipelago.

Tobacco is cultivated in Celebes, but merely in sufficient quantity for local consumption. It is exclusively grown by the Bantik population—the mode of preparation is the same as in Java; it is chopped very fine and mostly flavored with arrack. When bought in large quantities, it may be had for thirty cents the pound; but in smaller quantities it costs double that price.

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Tobacco is cultivated in New South Wales with much success. Australia produces a leaf equal to Virginia, or the most fertile parts of Kentucky, but the great difficulty is to extract the superabundant “nitre.” The first crop in New South Wales exceeds one ton per acre, and the second crop off the same plants, yields about half the weight of the first. In 1844 there were about 871 acres in cultivation in New South Wales with tobacco, and the produce was returned at 6,382 cwts. In New England, New South Wales, as fine a “fig” as could be wished for is manufactured under the superintendence of a thorough-bred Virginia tobacco manufacturer—but the impossibility of extracting the nitre by the heating, or any other process, renders the flavor rank and disagreeable. Perhaps cheroots, or the lower numbers of cigars, manufactured from the Australian leaf, might prove more successful.

In Sydney the time for sowing tobacco seed is September, but in Van Diemen’s Land it should be a month later, as tobacco plants cannot stand the frost. The ground should be made fine, and in narrow beds three feet wide from path to path, to allow for weeding without stepping on the beds. The seed, being small, should not be raked in; but after the ground is raked fine, and perfectly clean, and well pulverised, mix the seed with wood ashes, and sow over the beds, and pat in with the spade, or tread in with the naked feet, which is preferable. The ground should be moist, but not much watered, or it moulds the plants. When about as large as moderate sized cabbage plants, they should be put out—three feet or three feet six in the rows, and five feet apart between the rows. When the plant rises to about two feet high, it will throw out suckers at each leaf, which must be carefully taken off with the finger and thumb, and all bottom and decayed leaves that touch the ground taken off. When the tobacco plant throws out flower, it must be topped off, leaving about twelve leaves in the stalk to ripen and come to maturity.

When the leaves feel thick between the finger and thumb, and assume a mottled appearance, they are fit to cut.

In “Tegg’s New South Wales Almanac” it is stated that the end of July is the usual time for sowing the seed. In order, however, to prevent the plants from being subsequently destroyed by frost, care must be taken not to sow the seed until the frost has ceased in any respective locality (unless raised in a frame). Tobacco requires a rich light soil, and well manured.

By the instructions for cultivating it, the plant must be three feet apart each way, which would give 4,840 plants to an acre; assuming that each plant would yield half a pound for the first crop, this would give 2,420 lbs. to an acre, which is only 180 lbs. in excess of a ton. In New South Wales several parties use the tobacco stems for sheep wash. One pound of tobacco is sufficient to wash five sheep on an average (one washing), which would give 12,100 sheep to one acre.

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Assuming that only one crop was grown in New Zealand in one year, of 2,420 lbs. to an acre, at 3d. per pound, (which is about half the market price of a fair sample of tobacco in bond,) it would amount to L30 5s. per acre.

Three rows of Indian corn are planted outside the tobacco plants to shelter them from the wind. In order to save seed, a few plants are allowed to flower. The Virginian tobacco is the largest; it is known by a pink flower; the *Nicotiana rustica* (common green) has a yellow flower.

A planter in Northern Australia furnishes the following directions:—
The land selected for the growth of tobacco ought to be of the most fertile description, of a friable description, and upon which no water can rest within eighteen inches of the surface. Newly cleared brush lands of this nature are the most prolific; upon such, after good tillage, put the plants about four feet or more apart, in rows, and five feet six inches asunder. In interior or old ground, plant proportionately closer. Before topping or nipping off the head, all the lower leaves (that is such as may touch the ground) ought to be broken off, leaving only from five to seven for the crop, which will yield a greater weight and be of a superior quality than if double that number were left. When ripe, a dry and cloudy day should be selected to cut it, as the sun destroys its quality after cutting. It ought then to lie sufficiently long upon the ground so as to welt before carting to the sheds, hanging up each stalk next morning so as not to touch its fellow.The drying sheds ought to be built upon an elevated or dry spot, with a hoarded flour of rough split stuff, fifteen or eighteen inches from the ground, with apertures as windows to admit or to exclude the external atmosphere. In damp weather close all the doors and windows, also every night; in contrary weather open all.In these drying houses the stalks should remain suspended until the vegetable moisture is entirely evaporated, so that on a dry day the stems of the leaves will break like a glass pipe, and the finer parts crumble into snuff upon compression; after which, in humid weather, they will become quite pliable; then strip the leaves off the stems, make them up into hands, and pack them tightly into a close bin: when full, cover it with boards and old bagged stuff, upon which place heavy weights. In this state it undergoes the sweating process, which, in this colony, is little understood or not properly attended to, and yet, upon the skill displayed thereon, the quality of the tobacco greatly depends. I will therefore give some general directions upon this portion of the planter’s office. If the tobacco happen to be too damp when put into the bin, it will attain either an injurious or a destructive degree of

heat; it must therefore he watched for some days after it is packed. To an experienced operator I would say, if the heat

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exceed 80 degrees of temperature, immediately unpack and re-hang the whole, waiting its condition as before explained, before it is again put into the sweating bin. Should the degree of heat be below that stated, it may remain for weeks or until the heat has subsided. I have generally removed it from the sweating process in about fourteen or twenty days, sometimes considerably longer, regulating that act by the odor and color of the leaf. If, however, it appears to be attaining a very dark brown color and its heat not subsided, it should be taken out and closely pressed into large cases or casks, when it will again attain a gentle heat called the “second sweating,” as is invariably the case with the hogsheads of the American leaf tobacco: this again improves its quality. Here the grower’s operations terminate.It may be necessary to remark, that how skilful and experienced soever the grower may be, it is hardly possible for him to produce a good article upon a small scale; for with a less quantity than one ton to place in the sweating bin at a time, the requisite heat to insure success will not be generated. I would further observe, that the practice of the colonists in growing what they term a “second crop” is most injurious to their interests, their lands, and the quality and character of the colonial tobacco. The American planter never attempts it. I would therefore strongly recommend its discontinuance, and also never to crop one piece of land with tobacco more than two or three years in succession. The Americans rarely take more than two crops unless the land be new; after which they sow it down with grasses, in which state it remains for two or three years until it is again planted with tobacco. I would recommend this plan to the growers.The character of the American tobacco has been greatly advanced in the mercantile world by an ordinance regulating that source of national wealth. The planters are thereby obligated to deposit their crops in warehouses, over which sworn inspectors preside, who rigidly examine every hogshead, and if found to be of mercantile quality, grant the owner a certificate, by which instrument only he sells his produce. The purchaser is hereby safe in buying these certificates. The tobacco to which they refer is delivered to the holder on presentation to the inspector. I mention this not as applicable here at present, but it most probably may hereafter.When the colony is suffering severely for the want of labor, it may by some be deemed inopportune in offering remarks upon this article of commerce. To such dissentients I will remark, that a great portion of the work can be performed by women and children. A moiety of our anticipated increase of population will be available for this hitherto mismanaged source of wealth. At present the quantity grown in the colony is equal to three-fourths of its consumption, and which production is of

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a very inferior quality to the imported. These facts tend to show that my notice of the subject is not inopportune, and particularly so when the object is to point out those errors so generally adopted by the tobacco growers here. Years of practical experience, of personal observation upon the plantations of North America, and my having been, I believe, the grower of the greatest quantity of tobacco in the colony, qualify me to afford instructions thereon; whereby, if attended to, our tobacco will become fully equal to the American, as was proved to be the case by the crops I grew here (upwards of 40 tons), [56] which were sold in Sydney by the Commissariat Department at public auction, at an advance of twenty per cent. more than the imported leaf. As the duty on tobacco is about to be reduced, the present production may fall off, unless an immediate improvement in its quality take place. Instead of being importers of tobacco, we should, if it was grown here to perfection, be exporters of it to all our sister colonies; and in its raw state, also to the European markets. At present, for home consumption, there is a greater profit to be made by its cultivation, if skilfully managed, than in any part of the world; for the duty upon imported is a positive bonus to the grower.

In 1849-50 there were fifteen manufactories of tobacco on a small scale in New South Wales, but these were reduced in 1851 to six.

Many samples of tobacco grown in the colony have been pronounced by competent judges equal to Virginian, but a very considerable prejudice exists against it. There is, however, no doubt that the dealers dispose of a great deal as American tobacco, and get a best price for it. The reduction of the import duties on foreign tobacco, recently made by the Legislative Council, will probably retard the progress of the colonial production and manufacture of this article; but with an abundance of labor there is no question that this branch of industry will be again profitably resorted to. The quantity of tobacco manufactured in New South Wales, in 1847, was 1,321 cwt.; in 1848, 714 cwt.; in 1849, 2,758 cwt.; in 1850, 3,833 cwt.; in 1851, 4,841 cwt.

A correspondent of the *Adelaide Observer* recommends its culture in South Australia, and supplies the following useful information:—

Without entering into botanical details, I will simply state that the plant is of a shrubby nature, about five feet high, and ought not to be planted nearer than four feet from each other, in rows five feet apart—thus allowing for each plant a space of ground four feet by five, or 20 square feet. An acre will consequently furnish sufficient room for 2,178 plants.The tobacco plant will thrive in almost any climate, from the torrid zone to the temperature of Great Britain. It luxuriates in rich alluvial valleys, where the soil is either of a *loamy* or a *peaty* nature.

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Maiden soil is not recommended. The ground should be trenched, worked as fine as possible, and well manured. Tobacco will not answer unless the subsoil is thoroughly broken. The best manure is that obtained from the bullock-yard, and bark from the tan yard; and by two or three ploughings the earth can be brought to a proper consistency, and fit for the reception of the plants.The usual method adopted in New South Wales, is to raise the plants in a warm, sheltered bed, neither exposed to wind nor to the sun's rays; but if the weather is dry, they should be well watered night and morning. The time of sowing is the end of August or the beginning of September in the latitude of Sydney, according to the state of the weather; and they may be transplanted when they have attained their sixth leaf, which is generally about a month or five weeks after they are up.The period is rather later in this colony, and care should be taken that the plants have gained sufficient strength in the ground after transplanting to withstand the effect of the hot winds, and, if practicable, the aspect should be either N.E. or N.W., and the rows should incline towards either of these points.

The most suitable spots in
this colony for the cultivation of
tobacco, are Lyndoch Valley
and the districts round the town of
Willunga and Morphett Vale.

The greatest care is required from the cultivator to prevent the destruction of the plant from its greatest enemy, the black grub. Daily search should be made for it, and not a plant should be left unexamined; they make their appearance about the beginning of November, when the plants have scarcely had time to take root. The soil between the rows should be kept constantly stirred with a three-pronged fork, that air and the sun's rays may be admitted, which latter are as indispensable to the growing plant as injurious to the seedling. The labor is great, and from first to last requires the constant attention of one man throughout the year, with an additional hand for about six weeks during the process of curing.The profits even in bad seasons are considerable; but when the season and soil are favorable, they average upwards of 100 per cent. The consumption of tobacco is great in this colony, not only for personal use, but for sheep-wash; and the profits may be considerably greater for the lower leaves, which, owing to their gritty nature, cannot be manufactured, but may be advantageously cured for wash.It is not my office to argue the point as to the advantages which may accrue from a free trade in tobacco; but this I know, and confidently assert it, from actual experiments made in this province, that a more lucrative article cannot be grown.

The consumption in South America,
in 1850, was 147,178 lbs.; and the
annual increase since 1840 has been a higher percentage
than the
increase of population, chiefly owing to extension
in sheep-farming.

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The probable expense of cultivation per acre may be as under:—

	L	s.	d.
Rent	0	10	0
Labor, 12 months	52	0	0
Ditto, 2 months	8	10	0
Ploughing three times	2	2	0
Harrowing twice	1	0	0
Manure, say	2	10	0
Seed, say	0	10	0

	L67	2	0

The Sydney average quantity is said to be 11-1/3 cwt. per acre, say 10 cwt.; and the cost price per lb. will be 141/2d., or L6 15s. 4d. per cwt. The profit will at once be seen on this article of consumption.

* * * * *

Miscellaneous Drugs.—The blood tree (*Croton gossypifolia*), an evergreen shrub, native of the Trinidad mountains, is remarkable for yielding, when wounded, a thick juice resembling blood in color, which is one of the most powerful astringents I know of, and as such would be valuable to medical science. The bark of *Croton Cascarilla* is, as we have seen in a former section, aromatic, and the seeds of *C. Tiglium*, the physic nut, are purgative; so are those of the purging nut (*Jatropha multifida*), and another species (*J. gossypifolia*).

The pods of cow-itch (*Mucuna pruriens*) act as a vermifuge; the roots of the *Ruellia tuberosa*, or manyroot, and the bulbs of the white lily (*Pancratium Carribaeum* and *maritimum*), are emetic. The Indian root or bastard ipecacuan (*Asclepias curassavica*) has medicinal properties. *A. tuberosa* is used as a mild cathartic, and a remedy for a variety of disorders. *Hydrastis canadensis*, or Canadian yellow root, is a valuable bitter, and furnishes a useful yellow dye. *Knowltonia vesicatoria* is used commonly as a blister in the Cape Colony. *Ranunculus saleratus* (the *R. indicus* of Roxburgh, and *B. camosus* of Wallich), common in India, is also used by the natives for blistering purposes.

A kind of sedge rush, common in swampy places in the West India islands, the *Adme cyperus*, enjoys a reputation for the cure of yellow fever. It is also stated to be cordial, diuretic and cephalic, serviceable in the first stages of the dropsy, good in vomitings, fluxes, &c.

Dr. Impey, the residentiary surgeon of Malwa, has just confidence in the indigenous drugs in use by the natives of the East, many of which are quite unknown in European practice. He believes that, in the Indian bazaars and the jungle, drugs having precisely the same effect as those of Europe may be discovered, and has recently drawn up a list of ninety substances, which are perfect substitutes for an equal number of European medicines. The class of tonics, in particular, is most amply supplied, and the Englishman is not the only animal who suffers from disorders of the digestive organs.

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My friend Dr. Hamilton, of Plymouth, recently brought under the notice of the profession the medical properties of the prickly poppy or Mexican thistle (*Argemone Mexicana*). It is indigenous to and grows wild in the greatest profusion throughout the whole of the Caribbean islands, and may be found at every season of the year covered with its bright golden blossoms, and bearing its prickly capsules in all their several stages of maturity. It is an annual plant, attaining a height of about two feet, growing abundantly in low and hot uncultivated spots. Its stem is round and prickly, furnished with alternate branches and thorny leaves. The seeds possess an emetic quality. The whole plant abounds in a yellow milky juice, resembling gamboge in color, and not improbably possessing properties similar to the seeds. In Nevis the oil is obtained from the bruised seeds by boiling, and sold by the negroes in small phials, containing about an ounce each, under the name of "thistle oil," at the price of a quarter of a dollar each. The usual dose for dry bellyache is thirty drops upon a lump of sugar, and its effect is perfectly magical, relieving the pain instantaneously, throwing the patient into a profound and refreshing sleep, and in a few hours relieving the bowels gently of the contents. This oil seems fitted to compete in utility with the far more costly and less agreeable oil of the croton.

The seeds of the sandbox (*Hura crepitans*) when bruised, operate powerfully as emetico-cathartic. It is probable that an oil might be obtained from them similar in its operation to the thistle oil.

A cucurbitaceous fruit, one of the Luffas (called by Von Martius *Luffa purgans*), a tribe closely allied to the colocynth and mornordicas, growing in South America, is a powerful purgative, and is used in the province of Pernambuco, where it is called Cabacinha. The fruit is about the size of a small pear and resembles the wild cucumber. An infusion of a fourth part

of one of these fruits is administered chiefly in
the form of an injection.

Another species (*Luffa drastica*, of Martius)
is also employed for the same purpose.

The *Luffa purgans* grows spontaneously in the
suburbs of Recieffe, the capital of the province of
Pernambuco, and flowers in November and December.
The fruit is a drastic purgative, and an infusion of
it is used either internally or in the form of clyster.
The tincture is prepared by macerating, for twenty-eight
hours or more, four of the fruit deprived of the seeds
in a bottle of spirit 21 degrees. The dose is
three or four ounces daily, which occasions much sickness.

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Poisons.—The vegetable kingdom (observes Mr. Simple), to which man is largely indebted for the materials of food, clothing, and shelter, produces also some of the most deadly poisons with which science, experience, or accident, has made him acquainted. In examining the poisonous productions of the vegetable kingdom, we find that their properties are generally due to the presence of some acid or alkali contained in the plant from which they are derived. Oil of bitter almonds and cherry laurel water are poisonous in consequence of containing prussic acid. Opium owes its activity to the alkaloid morphia. The Upas-tiente derives its energetic powers from the alkaloid strychnia; conia is the active principle of hemlock; veratria of hellebore; aconita of monk's hood; and although there are several poisonous plants in which the active principle has not yet been detected, there can be little doubt that such a principle exists, although it has hitherto eluded the researches of the chemist.—("Pharmaceutical Journal," vol. 2, p. 17.)

The bark taken from the roots of the Jamaica dogwood (*Piscidia erythrina*), which is extensively distributed throughout the Archipelago of the Antilles, is used for stupefying fish. The pounded root is mixed with slaked lime and the low wines or lees of the distillery, and the mixture is put into small baskets or sacks, and so suffered to wash out gradually, coloring the water to a reddish hue. The fish rise to the surface in a few minutes, when they float as if dead.

The expressed juice of the root of *Maranta Arundinacea* is stated to be a valuable antidote to some vegetable poisons, and also serviceable in cases of bites or stings of venomous insects or reptiles. One of the most popular remedies for the bites of snakes is a decoction of the leaves of the Guaco, or snake plant, of South America, a species of willow which flourishes along the banks of the streams in the sultry regions shaded by other trees. It is said to be both a preventive and cure.

Mr. Edward Otto, writing from Cuba to the “Gardener’s Magazine” for May, 1842, p. 286, describes the guaco as a tree growing from four to eight feet in height, with beautiful dark green leaves, having a brown tinge round the margin. The blossoms are small, of a bluish brown, and hang like loose bunches of grapes at the points of the shoots, or even on the stem itself, as it has seldom branches. The milky sap is said to have poisonous effects.
“I was told (he adds) that this plant is used efficiently in cholera and yellow fever.”
This tree is said to be the *Camaeladia ilicifolia* of Swartz, common in Antigua and Hayti, being known in Antigua by the popular name of the holly-leaved maiden plum.

* * * * *

ALOES.—The drug called aloes is the bitter, resinous, inspissated juice of the leaves of various species of an arborescent plant of the lily family, with a developed stem and large succulent leaves, growing principally in tropical and sub-tropical regions, and having a wide extent of range, being produced in Borneo and the East, Africa, Arabia, and the West Indies; many are also natives of the Cape of Good Hope. The plant will thrive in almost any soil, and, when once established, it is extremely difficult to eradicate.

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The cultivation and manufacture are of the most simple kind. The usual mode of propagating the plants is by suckers; and all the care required is to keep them free from weeds.

From the high price which the best Barbados aloes fetches in the market, L7 per cwt., its culture might be profitably extended to many of the other islands. The aloes plant is indigenous to the soil of Jamaica, and although handled by thousands of the peasantry and others, there is not perhaps one in five thousand who understands its properties or the value of the plant. With the Jamaicans it is commonly used in fever cases, by slicing the leaves, permitting the juice to escape partially, and then applying them to the head with bandages;—this is the only generally known property which it possesses there.

A series of trials made recently in Paris proved that cordage manufactured from the fibre of this plant grown in Algiers, was far preferable in comparative strength to that manufactured from hemp. Cables, of equal size, showed that that made of the aloe raised a weight of one-fifth more than that of hemp.

The drug is imported into this country under the names of Socotrine, East Indian or Hepatic, Barbados, Cape and Caballine aloes. It contains a substance called Aloetine, which some regard as its active principle. The various species now defined are—*Aloe spicata*, *vulgaris*, *Socotrina*, *Indica*, *rubescens*, *Arabica*, *linguae-formis* and *Commelina*. The average imports in 1841 and 1842 were only about 170,780 cwts.; it is now much larger, and a great portion of the supply is drawn from the Cape colony.

The mode of preparing the drug, which I have myself seen in the West Indies, is exceedingly simple. When the plant has arrived at proper maturity, the laborers go into the field with tubs and knives, and cut the largest and most succulent leaves close to the stalk; these are placed upright in the tubs, side by side, so that the sap may flow out of the wound. Sometimes a longitudinal incision is made from top to bottom of the leaf, to facilitate the discharge. The crude juice thus obtained is placed in shallow flat-bottomed receivers, and exposed to the sun until it has acquired sufficient consistency to be packed in gourds for exportation. In preparing the coarser kind, or horse aloes, the leaves are cut into junks and thrown into the tubs, there to lie till the juice is pretty well drained out; they are then squeezed by the hand, and water, in the proportion of one quart to ten of juice, is added, after which it is boiled to a due consistence and emptied into large shallow coolers.

The following analysis by M. Edmond Robiquet of a specimen of Socotrine aloes, obtained from M. Chevallier, is given in the sixth volume of the "Pharmaceutical Journal," p. 277. The constituents in 100 parts were:—

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Pure aloes (Aloetine) 85.00 Ulmate of potash 2.00 Sulphate of lime 2.00 Carbonate of potash } -------------lime } traces. Phosphate of lime } Gallic acid .25 Albumen 8.

The true Socotrine aloes is the produce of *A. Socotrina*, which grows abundantly in the island of Socotra in the Indian Ocean. Lieutenant Wellstead says, the hills on the west side of the island are covered for an extent of miles with aloe plants. The aloe grows spontaneously on the limestone mountains of Socotra, from 500 to 3,000 feet above the level of the sea. The produce is brought to Tamarida and Colliseah, the principal town and harbor for exports. In 1833, the best quality sold for 2s. a pound, while for the more indifferent the price was 13d. The value is much impaired by the careless manner in which the aloes is gathered and packed. Aloes once formed the staple of its traffic, for which it was chiefly resorted to; but only small quantities are now exported. It was formerly shipped by the way of Smyrna and Alexandria, but is usually now brought by the way of Bombay; Melinda, on the Zanzibar coast, and Maccula on the Arabian shore, furnish the greater part of that sold in Europe as Socotrine aloes. It comes home in chests or packages of 150 to 200 lbs. wrapt in skins of the gazelle, sometimes in casks holding half a ton or more. It is somewhat transparent, of a garnet or yellowish red color. The smell is not very unpleasant, approaching to myrrh. Socotrine aloes, although long considered the best kind, is now below Barbados aloes in commercial value.

About two tons were imported from Socotra in 1833, but a much larger quantity could be obtained if required.

The price of Socotrine aloes in the Liverpool market, in the early part of 1853, was 30s. to L6 the cwt.; of Cape, 30s. to 32s.

East Indian, or *Hepatic aloes*.—
The real hepatic aloes, so called from its liver color, is believed to be the produce of *A. Arabica*, or *perfoliala*, which grows in Yemen in Arabia, from whence it is exported by the way of Bombay to Europe. According to Dr. Thomson and the "Materia

Medica," it is duller in its color than the other kinds, is bitterer, and has a less pleasant aroma than the Socotrine aloes. It should not be liquid, which deteriorates the quality.

A. Indica—a species with reddish flowers, common in dry situations, in the north-west provinces of India, is that from which an inferior sort of the drug is produced. It is obtained in Guzerat, Salem, and Trichinopoly, and fetches a local price of 2d. to 3d. a pound. In the Bombay market, Socotrine aloes fetches wholesale 16s. to 20s. the Surat maund of 41 lbs., and Maccula aloes only 9s.

Barbados aloes, is the produce of *A. vulgaris*, or *A. barbadensis*, a native of the Cape colony, and is often passed off for the Hepatic. It is brought home in calabashes, or large gourd shells, containing from 60 to 70 lbs. each, or more. It is duskier in hue than the East Indian species, being a darkish brown or black, and the taste is more nauseous and intensely bitter.

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In 1786 one hogshead and 409 gourds of aloes were exported from Barbados. In 1827, there were about 96,000 packages shipped from the island. In 1844, there were 4,600 packages exported. The exports have fallen off considerably, only about 850 gourds having been shipped in the season of 1849-50; but in 1851 it increased to 2,505 gourds.

Caballine, or *Horse-aloes*, is the coarsest species or refuse of the Barbados aloes, and from its rank fetid smell is only useful for veterinary medicine. It is also obtained from Spain and Senegal.

A very good description of the mode of cultivating and preparing the aloes in Barbados is given in the 8th vol. of the “London Medical Journal":—
The lands in the vicinity of the sea, that is from two to three miles, which are rather subject to drought than otherwise, and are so strong and shallow as not to admit of the planting of sugar-canes with any prospect of success, are generally found to answer best for the aloe-plant. The stones, at least the larger ones, are first picked up, and either packed in heaps upon the most shallow barren spots, or laid round the field as a dry wall. The land is then lightly ploughed and very carefully cleared of all noxious weeds, lined at one foot distance from row to row, and the young plants set like cabbages, at about five or six inches from each other. This regular mode of lining and setting the plants is practised only by the most exact planters, in order to facilitate the frequent weeding by hand; because if the ground be not kept perfectly clean and free from weeds, the produce will be very small. Aloes will bear being planted in any season of the year, even in the dryest, as they will live on the surface of the earth for many weeks without a drop of rain. The most general time of planting them, however, is from April to June.In the March following, the laborers carry a parcel of tubs and jars into the field, and each takes a slip or breadth of it, and begins by laying hold of a bunch of the blades, as much as he can conveniently grasp with one hand, whilst with the other he cuts it just above the surface of the earth as quickly as possible (that the juice may not be wasted), and then places the branches in the tub bunch by bunch or handful by handful. When the first tub is thus packed quite full, a second is begun (each laborer having two); and by the time the second is filled, all the juice is generally drained out of the blades in the first tub. The blades are then lightly taken out and thrown over the land by way of manure, and the juice is poured out into a jar. The tub is then filled again with blades, and so alternately, till the laborer has produced his jar full, or about four gallons and a half of juice, which is often done in six or seven hours, and he has then

the remainder of the day to himself, it being his employer's interest to get each day's operation as quickly

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done as possible. It may be observed that although aloes are often cut in nine, ten, or twelve months after being planted, they are not in perfection till the second or third year, and that they will be productive for a length of time, say ten or twelve years, or even for a longer time, if good dung or manure of any kind is stirred over the field once in three or four years, or oftener if convenient.The aloe juice will keep for several weeks without injury. It is therefore not boiled till a sufficient quantity is procured to make it an object for the boiling house. In the large way, three boilers, or coppers are placed to one fire, though some have but two, and the small planters only one boiler. The boilers are filled with the juice, and as it ripens or becomes more inspissated by a constant but regular fire, it is ladled from boiler to boiler, and fresh juice is added to that farthest from the fire, till the juice in that nearest the fire (by much the smallest of the three) becomes of a proper consistency, to be skipped or ladled out into gourds or other small vessels used for its final reception. The proper time to skip or ladle it out of the last boiler is when it has arrived at what is termed a resin height, or when it cuts freely or in thin flakes from the edges of a small wooden slice that is dipped from time to time into the boiler for that purpose. A little lime water is used by some aloe boilers during the process, when the ebullition is too great.

CAPE ALOES is the produce chiefly of *A. spicata*, and *A. Commelini*, which are found growing wild in great abundance in the interior of the Cape Colony. It has not the dark opaque appearance of the other species. About fifty miles from Cape Town is a mountainous tract, almost entirely covered with numerous species and varieties of the plant, and some of the extensive arid plains in the interior of the colony are crowded with it. The settlers go forth and pitch their waggous and campa on these spots to obtain the produce. The shipments from Table Bay and the eastern port of Algoa Bay are very considerable. The odor of the Cape aloes is stronger and more disagreeable than that of the Socotrine or Barbados, and the color is more like gamboge. It is brought over in chests and skins, the latter being preferred.

Mr. George Dunsterville, surgeon of Algoa Bay, gives the following description of the manufacture of Cape aloes:—

A shallow pit is dug, in which is spread a bullock's hide or sheep's skin. The leaves of the aloe plants in the immediate vicinity of this pit are stripped off and piled up on the skin to variable heights. These are left for a few days. The juice exudes from the leaves, and is received by the skin beneath. The Hottentot then collects in a basket or other convenient article the produce of many heaps, which is then put into an iron pot capable of holding eighteen or twenty gallons. Fire is applied to effect evaporation,

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during which the contents of the pot are constantly stirred to prevent burning. The cooled liquor is then poured into wooden cases of about three feet square by one foot deep, or into goat or sheep skins, and thus is filled for the market. In the colony aloes realises about 21/4 d. to 31/2 d. per pound. The Hottentots and Dutch boors employ indiscriminately different species of aloe in the preparation of the drug.The Cape aloes, which *is* usually prized the highest in the English market, is that made at the Missionary institution of Bethelsdorp (a small village about nine miles from Algoa Bay, and chiefly inhabited by Hottentots and their missionary teachers). Its superiority arises not from the employment of a particular species of aloe, for all species are used, but from the greater care and attention paid to what is technically called the cooking of the aloes; that is, the evaporation, and to the absence of all adulterating substances (fragments of limestone, sand, earth, &c.), often introduced by manufacturers. Mr. Moodie, in his "Ten Years' Residence in Southern Africa," gives a somewhat similar account.

Mr. Bunbury states that, about the neighbourhood of Graham's Town, three large kinds of aloe are very abundant, which form striking and characteristic features of the scenery; they grow irregularly scattered over the parched and naked faces of the hills, but most abundantly among the low broken ledges and knolls of sandstone rock, and are often seen spiring up above the evergreen bushes in the ravines, and crowning the cliffs. One kind grows to the height of a man. They are plants of a strange, rigid, and ungraceful appearance, but with very handsome flowers, which form tall and dense spikes, of a fine coral-red color in two of the species *(A. arborescens* and *lineata?*), and of an orange scarlet in the third *(A. glaucescens?*). When in blossom they are conspicuous at a great distance, and might easily be mistaken, when seen from far off, for soldiers in red uniforms.

The importance of this indigenous plant to the Cape Colony, may be estimated from the following figures:—

AMOUNT OF ALOES, THE PRODUCE OF THE COLONY, AND VALUE THEREOF,
EXPORTED IN THE YEARS ENDING 5TH JANUARY 1841, 1842, AND 1846.
lbs L

1841	485,574	8,821
1842	602,620	11,877
1846	266,725	3,018

EXPORTS AND VALUE FROM THE EASTERN PROVINCE.

	lbs.	L
1835	68,042	474
1836	30,808	285
1837	13,400	115
1838	28,867	306
1839	75,500	918
1840	82,478	1,145
1841	220,214	4,271
1842	283,305	5,003
1844	318,035	3,225

EXPORTS AND VALUE FROM THE WESTERN PROVINCE.

	lbs.	L
1841	242,860	4,175
1842	379,315	6,874

ASAFOETIDA.——This drug of commerce is procured from the milky juice of *Ferula asafoetida*, a plant recently described by Dr. Falconer, under the name of *Narthex asafoetida*. It is found in Persia, the mountains of Chorasan, the central table land of Affghanistan, and some seeds of it, sent to this country by Dr. Falconer, germinated in the Botanical Garden at Edinburgh, and are now vigorous thriving plants of six years growth. Its leaves have a resemblance to those of a paeony; the fruit is distinguished by divided and interrupted vittae, which form a network on the surface. The perennial roots grow to a very large size, and are seldom of any use until after four or five years' growth. The asafoetida is procured by taking successive slices off the top of the root and collecting the milky juice., which is allowed to concrete into masses of a fetid resinous gummy matter, with a sulphur oil, similar to that of garlic, which is probably its active ingredient.

An inferior sort is obtained from *F. persica*, another species with very much divided leaves, growing chiefly in the southern provinces of Persia. It comes over usually in casks and cases. The British consumption of the drug is about 10,000 lbs. a year. A little is procured from Scinde.

In 1825 the quantity imported was 106,770 lbs., in 1839 only 24 cwts.

The wholesale price in the Liverpool market, in January 1853, was L1 to L3 10s. the cwt.

CAMPHOR.—The Camphor tree (*Camphora officinarum*, *Laurus Camphora*) is a native of China, Japan, and Cochin China, of the laurel tribe, with black and purple veins. Camphor is procured from all parts of the tree, but it is obtained principally from the wood by distillation, and subsequent sublimation.

Many plants, such as the cinnamon tree, supply a kind of camphor, but the common camphor of the shops is the produce chiefly of *C. officinarum*.
Two kinds of unrefined camphor are known in commerce.—1. The Dutch, which is brought from Batavia, and is said to be the produce of Japan. This is imported in tubs covered by matting and each surrounded by a second tub, secured on the outside by hoops of twisted cane. Each tub contains about one cwt. Most of this goes to the continent. 2. Ordinary crude camphor is imported from Singapore and Bombay, in square chests lined with lead-foil, and containing 11/4 to 11/2 cwts. It is chiefly produced in the island of Formosa, and is brought by the Chin Chew junks in very large quantities to Canton, whence foreign markets get supplied.—("Pereira's Materia Medica.")

In the southern part of Japan the tree grows in such abundance that, notwithstanding the great consumption of it in the country, large quantities are exported. Koempfer says, that the Japanese camphor is made by a simple decoction of the wood and roots, but bears no proportion in value to that of Borneo. There is also an imitation of camphor in Japan, but every body can distinguish it from the genuine.

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The camphor of Sumatra is procured from the stem of a large tree, *Dryobalanops Camphora*, Colebrook; *D. aromatica*, Graertner. It is secreted in crystalline masses naturally into cavities of the wood. It supplies this camphor only after attaining a considerable age. In its young state it yields, however, by incision, a pale yellow liquid, called the liquid camphor of Borneo and Sumatra, which consists of resin and a volatile oil having a camphorated odor.

An account of this tree, and of the mode of procuring the peculiar and high-priced camphor which it yields, is given by Dr. Junghuhn, who has travelled lately in Sumatra, and Prof. De Vriese, of Leyden, in the "Nederlandsch Kruidkundig Archief" for 1851. An abstract of the memoir, translated into English by Miss De Vriese, is published in "Hooker's Journal of Botany " for February and March 1852:—
The Dryobalanops is a gigantic tree, rising for fifty or even a hundred feet above those which compose the chief mass of the forests where they grow, just as the steeples of the churches appear above the roofs of the houses in a town. The trunks of the full-grown trees are from 7 to 10 feet in diameter at the very base, and from 5 to 8 feet higher up; they rise to the height of 100 or 130 feet, and their ample crown is from 50 to 70 feet in diameter. The tree has a limited range, being confined to the seaward slope of the mountains of southwestern Sumatra, most abundant on the lower slopes and the outlying hills of the alluvial plain, and extending in latitude from 1deg. 10m. to 2deg. 20m. N., and perhaps further to the north. Camphor oil occurs in all the trees, and is most abundant in the younger branches and leaves. The solid camphor is found only on the trunks of older trees, especially in fissures of the wood, and in smaller quantity than is generally supposed. Colebrooke, and authors who have copied from him, assert that camphor is found in the heart of the tree in such a quantity as to fill a cavity of the thickness of a man's arm, and that a single tree yields about eleven pounds. The price of this camphor, which at Padang sells for about 340 dollars per hundred weight, suffices to show that the account is much exaggerated. The camphor occurs only in small fissures, from which the natives, having felled the trees and split up the wood, scrape it off with small splinters or with their nails. From the oldest and richest trees they rarely collect more than two ounces. After a long stay in the woods, frequently of three months, during which they may fell a hundred trees, a party of thirty persons rarely bring away more than 15 or 20 pounds of solid camphor, worth from 200 to 250 dollars. The variety and price of this costly substance are enhanced by a custom which has immemorially prevailed among the Battas, of delaying the burial of every person who

during his life had a claim to the title of Rajah (of which each village has one) until some rice, sown on the

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day of his death, has sprung up, grown and borne fruit. The corpse, till then kept above ground among the living, is now, with these ears of rice, committed to the earth, like the grain six months before; and thus the hope is emblematically expressed that, as a new life arises from the seed, so another life shall begin for man after his death. During this time the corpse is kept in the house, enclosed in a coffin made of the hollowed trunk of a Durion, and the whole space between the coffin and the body is filled with pounded camphor, for the purchase of which the family of the deceased Rajah frequently impoverish themselves. The camphor oil is collected by incisions at the base of the trunk, from which the clear balsamic juice is very slowly discharged.

In Sumatra the best camphor is obtained in a district called Barus, and all good camphor bears that local name. It appears that the tree is cut down to obtain the gum and that not in one tenth of the trees is it found. Barus camphor is getting scarce, as the tree must be destroyed before it is ascertained whether it is productive or not. About 800 piculs are annually sent to China. The proportion between Malay and Chinese camphor is as eighteen to one; the former is more fragrant and not so pungent as the latter.

Nine hundred and eighty-three tubs of camphor were exported from Java in 1843; 625 bales were imported in 1843, the produce of the Japanese empire; and 559 piculs exported from Canton in 1844.

The price of unrefined camphor in the Liverpool market in July, 1853, was L4 to L4 10s. the cwt. There have been no imports there direct in the last two years.

Camphor (says Dr. Ure) is found in a great many plants and is secreted in parity by several laurels; it occurs combined with the essential oils of many of the *labiacae*; but it is extracted for manufacturing purposes only from the *Laurus Camphora*, which abounds in China and Japan, as well as from a tree which grows in Sumatra and Borneo, called in the country *kapur barus*, from the name of the place where it is most common. The camphor exists, ready formed, in these vegetables between the wood and the bark; but it does not exude spontaneously. On cleaving the tree *Laurus Sumatrensis (Qy. Dryobalanops Camphora)*, masses of camphor are found in the pith. The wood of the Laurus is cut into small pieces and put, with plenty of water, into large iron boilers, which are covered with an earthen capital or dome, lined within with rice straw. As the water boils, the camphor rises with the steam, and attaches itself as a sublimate to the stalks, under the form of granulations of a grey color. In this state it is picked off the straw and packed up for exportation to Europe.”—(” Dictionary of Arts and Manufactures.”)

The price of camphor at Canton in July, 1850, was from fourteen to fifteen dollars per picul.

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Cinchona.—Peruvian or Jesuit's Bark—One of the most valuable and powerful astringents and tonics used in medicine, is the produce of several species of cinchona, natives of the Andes, from 11 north latitude to 20 south latitude, at elevations varying from 1,200 to 10,000 feet above the level of the sea, and in a dry rocky soil. There are at least twelve trees which are supposed to furnish the barks of commerce, and great obscurity prevails as to the species whence the various kinds of cinchona bark are derived. The names of yellow, red, and pale bark have been very vaguely applied, and are by no means well defined. Dr. Lindley mentions twenty-six varieties; of which twenty-one are well known. The barks are met with either in thick, large, flat pieces, or in thinner pieces, which curl inwards during drying, and are called quilled.

Quinine is one of the most important of the vegetable alkaline bitters. It was first discovered by Vauquelin, in 1811, and its preparation on a large scale pointed out by Pelletier and Caventon in 1820. It is obtained by boiling the yellow bark (*Cinchona*) in water and sulphuric acid, and then treating it with lime and alcohol, when the quinine is precipitated in the form of a white powder. Upwards of 120,000 ounces are made annually in Paris.

Cinchona, or the Peruvian bark, was gathered to the amount of two million dollars in one year recently, and the demand is constantly increasing.

Peruvian bark is cut in the eastern Provinces of Bolivia, skirting the river Paraguay, and now conveyed an immense distance by mules over a mountainous region to El Puerto, the only port of Bolivia on the Pacific. It is thence brought by Cape Horn to the cities of the United States and Europe. Now that Government has been successful in opening the South American rivers, this important article of commerce will be furnished in market by the Paraguay and La Plata rivers, at a much reduced price.

A species of bark from Colombia, known as Malambo or Matias bark, has been frequently administered by Dr. Alexander Ure as a substitute for cinchona with good effect. It offers the useful combination of a tonic and aromatic. It is supposed to be the produce of a species of *Drimys*. It is stated that in New Granada, and other districts of Central America, where the tree is indigenous, incisions are made in the bark, and there exudes an aromatic oil which sinks in water.

Cinchona bark contains two alkaloids, cinchonia and quina, to which its active properties are due; the former is best obtained from gray bark, the latter from yellow bark. In combination with these there exists an acid called kinic acid.

The imports of cinchona bark to this country are from 225,000 to 556,000 lbs. annually, and about 120,000 lbs. are retained for home consumption. It comes over in chests and serons, or ox-hides, varying from 90 to 200 lbs. We imported from France, in 1850, 489 cwt. of Peruvian bark, of the value of L6,840; and in 1851, 1,128 cwt., of the value of L15,787; also the following quantities of sulphate of quinine, on which there is a duty of 6d. and 3-10ths per ounce.

oz.	L	
1848	3,856	5,898
1849	1,114	1,560
1850	8,976	12,566
1851	7,605	10,647

The following is the arrangement of these barks adopted by Pereira, who has gone very fully into the subject:—

A. True cinchonas, with a brown epidermis.

I. Pale barks 1. Crown or Loxa bark. *C. Condaminea*. 2. Gray or silver or Huanuco bark. *C. micrantha*. 3. Ash or Jaen bark. *C. ovata*. 4. Rusty or Huamalies bark. *C. pubescens*.

II. Yellow barks. 5. Royal, yellow or Calisaya bark. *C. sp ?*
III. Red barks. 6. Red bark. *C. sp ?*
B. True cinchonas, with a white epidermis.

I. Pale barks. 7. White Loxa bark.

II. Yellow barks. 8. Hard Carthagena bark. *C. cordifolia*. 9. Fibrous ditto. Perhaps *C. cordifolia*. 10. Cuzco bark. *C. sp.?* 11. Orange bark of Santa Fe. *C. lancifolia*.

III. Red barks. 12. Bed bark of Santa Fe. *C. oblongifolia*.

The genus Exostemma yields various kinds of false cinchona bark, which do not contain the cinchona alkalies.

The following are some of the kinds noticed by Pereira:—

1. St. Lucia or Piton bark. *Exostemma floribundum*. 2. Jamaica bark. *E. caribaeum*. 3. Pitaya bark. *E. sp?* 4. False Peruvian bark. *E. peruvianum*. 5. Brazilian bark. *E. souzianum*.

The mode adopted by the bark-peelers of obtaining cinchona varies somewhat in different districts. The Indians (says Mr. Stevenson, "Twenty Years' Residence in South America") discover from the eminences where a cluster of trees grow in the woods, for they are easily discernable by the rose-colored tinge of their leaves, which appear at a distance like bunches of flowers amid the deep-green foliage of other trees. They then hunt for the spot, and having found it out, cut down all the trees, and take the bark from the branches, and after they have stripped off the bark, they carry it in bundles out of the wood, for the purpose of drying it. The peelers commence their operation about May, when the dry season sets in. Some writers state that the trees are barked without felling.

In a letter published in one of the Calcutta papers not long ago, from the pen, I believe, of Mr. Piddington, he strongly urged the introduction of the cinchona tree into British India:—

There is (he observes) one tree, the introduction and the copious distribution of which within certain appropriate points of the sub-Himalayan range, "would confer a greater blessing on the great body of natives, than any effort the Government has made or can make, and that is the cinchona bark tree.Without any reference to the greater or less force of medical theories as to the efficacy of cinchona bark, I now only take an experienced

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and practical view, well knowing that the sufferings of many millions of poor and rich natives, especially in the jungle districts, are yearly very great, and the mortality quite enormous from remittent and intermittent fevers, by far the greater part of which would be immensely relieved, or wholly cured, by the free use of cinchona bark.

If by abundance the price
be once brought within the poor native's
reach, he will readily take
to it, having no objection whatever on
account of caste to anything
of the nature of the bark of a tree.

If the cinchona tree were
once growing in abundance, quinine could
be easily prepared in India,
from the facility of procuring, and
cheapness of spirits of wine
used in the process of its elimination.

I take it that every hundred Sepahees sick of fevers remaining in hospital off duty for thirty days, drawing an average pay of eight rupees each, form a full monthly loss to Government of eight hundred rupees; while a free use of quinine and bark would cure them in ten days on the average, costing at present about forty rupees; thus by the twenty days' services gained, Government would save nearly five hundred rupees.

But the cinchona tree once
glowing abundantly, quinine would of
course become infinitely cheaper.

Under a proper system of culture,
quill bark only need be taken
without destroying the trees,
and an earlier return be obtained.

There never yet has been a
substitute found for cinchona bark and
its salts, as an antiperiodic
and tonic.

It yet remains for some one
to find an equally efficacious
substitute, and thus make
a fortune. In the mean time the importance
of the cinchona is paramount.

The cinchona tree, like the pimento, deteriorates under cultivation, and in moist, warm, rich valleys the bark becomes inert. The best bark is from trees growing on mountain tops or steep declivities.

From the full accounts of Condamine, Mutis, and Humboldt, a soil and climate like that of the north west sub-Himalayan range is admirably adapted to the planting and prospering of cinchona trees.

In Lord W. Bentinck's time, before there were steamers in or to India, seeing the immense benefit to be derived, I sent in a proposition to procure young cinchona plants from Vera Cruz, begging to be then permitted to proceed there on that account, and my proposition was civilly and even favorably received; but these were not the days to act on it.Of about the twenty species of cinchona trees the following would of course be the best to bring—the *Cinchona bineifolia*, the *cinchona cordifolia*, the *cinchona oblongifolia*, the *cinchona micrantha*, and the *cinchona condaminea*.

The Calumba plant (*Cocculus palmatus*, Decandolle,

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or *Minispermum palmatum*) furnishes the medicinal Colombo root, which is one of the most useful stomachics and tonics in cases of dyspepsia. It is scarcely ever cultivated, the spontaneous produce of thick forests on the shores of Oibo and Mozambique and many miles inland on the eastern shores of Africa, Madagascar and Bombay, proving sufficient. The supplies principally go to Ceylon. The roots are perennial, and consist of several fasciculated, fusiform, branched, fleshy, curved and descending tubers, from one to two inches thick, with a brown warty epidermis; internally deep yellow, odorless, very bitter.

The main roots are dug up by the natives in March (the hot season). The offsets are cut in slices and hung up on cords to dry in the shade. It is deemed fit to ship when, on exposure to the sun, it breaks short, and of a bad quality when it is soft and black.—("Pereira's Materia Medica.")

It contains a bitter crystallizable principle called Calumbin.

The commercial parcels are often adulterated with the roots of *Costus indicus, C. speciosus*, and *C. Arabicus* (Kusmus, Putckuk, &c.). It is imported into this country in bags and chests of from one to three cwt., and ranges in price from L1 to L2 the cwt. The imports in 1846 to London were 82 packages, and in 1850, 214 packages, but the stock held in London is always large, being nearly 2,500 packages.

Colocynth, furnished by *Cucumis colocynthis* and *C. pseudocolocynthis*, is the dried medullary part of a wild species of gourd which is cultivated in Spain. It also grows wild in Japan, the sandy lands of Coromandel, Cape of Good Hope, Syria, Nubia, Egypt, Turkey, and the islands of the Grecian Archipelago. It may be obtained in the jungles of India in cart loads. The fruit, which is about the size of an orange, with a thin but solid rind, is gathered in autumn, when ripe and yellow, and in most countries is peeled and dried either in the sun or by stoves. It comes over from Cadiz, Trieste, Mogadore, &c., in cases, casks, &c., and duty was paid on about 11,000 lbs. in 1839.

CUBEBS.—The dried unripe fruit of *P. Cubebi*, or *Cubeba qfficinalia*, a climbing plant of the pepper tribe, native of Prince of Wales' Island, Java, and the Indian islands furnishes the medicinal cubebs, which is used extensively in arresting discharges from mucous membranes. In appearance cubebs resemble black pepper, except that they are higher colored and are each furnished with a stalk two or three lines long. Dr. Blume says, that the cubebs of the shops are the fruit of *P. caninum*. This species of pepper, when fresh and good, contains nearly 10 per cent. of essential oil.

In 1842 the quantity entered for home consumption was 67,093 lbs. The average imports are about 40 to 50 tons annually. 3 cases were imported into Liverpool in 1851. The price in the Liverpool market, in January 1853, was L3 10s. to L4 10s. the cwt.

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GAMBOGE.—This resinous juice, which is a most important article of commerce, is furnished by some of the plants of Gambogia, natives principally of South America. It is a powerful irritant, and is employed medicinally as a drastic and hydragogue cathartic. From its bright yellow color it is also used as a pigment.

Gamboge fetches in the London market from L5 to L11 per cwt.

Some of the species of *Stalagmites* (Murray), natives of Ceylon and the East, yield a similar yellow viscid juice, hardly distinguishable from gamboge, and used for the same purpose by painters. They are a genus of fine ornamental trees, thriving well in soils partaking of a mixture of loam and peat.

According to Koenig, the juice is collected by breaking off the leaves or young branches. From the fracture the gamboge exudes in drops, and is therefore called *gum gutta*. It is received on leaves, coco-nut shells, earthen pots, or in bamboos; it gradually hardens by age, and is then wrapped up in leaves prior to sale.

The common gamboge of Ceylon is produced by a plant which Dr. Graham was led to view as a species of a new genus under the name of *Hebradendron Gambogoides*. A very different species, the *Garcinia Gambogia*, of Roxburgh, once supposed to produce gamboge, and indeed actually confounded by Linnaeus with the true gamboge tree of Ceylon, he has proved not to produce gamboge at all.

This substance is also obtained from several other plants, as the *Mangostana Gambogia* (Gaertner), *Hypericwm bacciferum* and *Cayanense*, natives of the East Indies, Siam and Ceylon, whence it is imported in small cakes and rolls or cylindrical twisted masses. Its composition is as follows:

number 1 being an analysis by Professor Christison of a commercial specimen from Ceylon; number 2 of a fine sample of common ditto:—

	1	2
Resin, or fatty acid	78.84	74.8
Coloring matter	4.03	3.5
Gum	12.59	16.5
Residue	4.54	5.2
	-----	-----
	100.	100.

The average imports of gamboge into the port of London, during the past five or six years, have been from 400 to 500 chests of one to two cwt. each.

Gentian.—The yellow gentian root (*Gentiana lutea*) is the officinal species, and a native of the Alps of Austria and Switzerland.

The stems and roots of *G. amarella* and *campestris*, British species, and *G. cruciata, purpurea, punctata*, &c., are similar in their effects, having tonic, stomachic, and febrifugal properties. So has *G. kurroo* of the Himalayas. The root is generally taken up in autumn, when the plant is a year old. It is cut longitudinally into pieces of a foot or a foot and a half long. They are imported into this country in bales from Havre, Marseilles, &c., and a good deal comes from Germany. In 1839, 470 cwts. were entered for home consumption.

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Chiretta is the herb and root of *Agathotes Chirayta*, Don; *Gentiana Chirayta*, Fleming; or *Ophelia chirayta*, a herbaceous plant, growing in the Himalaya mountains about Nepaul and the Morungs.

Ipecacuan.— *Cephaelis Ipecacuanhae*, Richard, yields the ipecacuan of the shops. The plant is met with in the woods of several Brazilian provinces, as Pernambuco, Bahia and Rio Janeiro. It is found growing in moist shady situations, from 8 to 20 degs. south latitude. The roots, which are the officinal part, are contorted, knotty and annulated, and about the thickness of a goose quill.

Besides this brown or gray annulated ipecacuan, there are spurious kinds, such as the striated or black Peruvian, the produce of *Pyschotria elliptica*, and other species; and white or amylaceous ipecacuan, furnished by *Richardsonia scabra*, an herbaceous perennial, native of the provinces of Rio Janeiro and Minas Geraes. *Manettia glabra* or *cordifolia*, also furnishes ipecacuan in Buenos Ayres. It is imported into this country from Rio in bales, barrels, bags, and serons, and the average annual imports in the eight years ending in 1841 were 10,000 lbs. In 1840, the shipments from Rio were as much as 20,000 lbs.

Castelnau states, that one expert hand can gather 15 lbs. of the ipecacuan root in a day, which will fetch in Rio one dollar per pound. He estimates that, from 1830 to 1837, not less than 800,000 lbs. of this drug were exported from the province of Matto Grosso to Rio.

Jalap.—This drug is obtained from the dried tubers or root-stock of *Ipomoea Jalapa* or *Convolvulus Jalapa*, a perennial plant, native of America. Some suppose it takes its specific name from Xalapa, in Mexico, whence we chiefly import it. It grows in the woods near Chicanquiaco, at an altitude of

6,000 feet above the level of the sea. Large quantities might be gathered and exported in Jamaica. The root is of a roundish tuberous form, black externally, and of a deep, yellowish grey within, and varies in size from that of a walnut to that of a moderate sized turnip. It contains a resin in which its active properties reside. It is brought to this country in thin transverse slices, and the amount entered for home consumption is about 45,000 lbs. a year. It is imported in bales, from Vera Cruz direct, or indirectly by way of New York, and other places.

Two sorts of jalap root occur in commerce. The one which was first introduced into the market, and which is even at the present day most frequently met with, is obtained from the *Ipomoea Schiedeana* of Zuccarini, a plant growing on the eastern declivity of the Mexican Andes, and discovered by Von Schiedes. The root, as met with in commerce, consists of pieces varying from the size of a nut to that of the fist, sometimes whole, sometimes cut into disks, and at other times divided into two or three portions. The external surface is of a more or less dark gray brown color, corrugated and rough. It is very hard, presents a shining resinous even surface when broken, and is difficult to reduce to powder. The powder is of a brownish color, has a faint peculiar odor and irritant taste.

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The second quality, which was introduced into commerce is great quantities a few years ago, by the name of stalk jalap, is now more scarce, and obtained from the *Ipomoea orazabensis* of Pelletan, a plant growing without cultivation in the neighbourhood of the Mexican town of Orizaba. The root, as met with in the trade, consists of pieces varying from one to three inches in length, and 11/2 to two inches in diameter. They are of a higher color than the first-named root, and of decidedly fibrous structure. The chief constituents of both varieties is a peculiar resin, of which they contain about 10 per cent.

Scammony.—The root of *Convolvulus Scammonia*, another plant of the same family, affords, when cut, a gummy resinous exudation or milky juice, which soon concretes and forms scammony. The plant grows abundantly in Greece, the Grecian Islands, and various parts of the Levant. It is imported from Aleppo in drums, weighing from 75 to 125 lbs. each, and from Smyrna in compact cakes like wax packed in chests. In 1839, the quantity on which duty (2s. 6d. per lb.) was paid amounted to 8,581 lbs. The duty received for scammony, in 1842, was L607. A spurious kind is prepared from *Calystegia (Convolvulus) sepium*, a native of Australia, and several plants of the Asclepiadacae order.

Dr. Russell ("Med. Obs. and Inqui.”) thus describes the mode of procuring scammony:—

Having cleared away the earth from the upper part of the root, the peasants cut off the top in an oblique direction, about two inches below where the stalks spring from it. Under the most depending part of the slope they affix a shell, or some other convenient receptacle, into which the milky juice flows. It is then left about twelve hours, which time is sufficient for the drawing off of the whole juice; this, however, is in small quantities, each root affording but a few drachms. This milky juice from the several roots is put together, often into the leg of an old boot, for want of some more proper vessel, when in a little time it grows hard, and is the genuine scammony. Various substances are often added to scammony while yet soft. Those with which it is most usually adulterated are wheat flour, ashes, or fine sand and chalk.

Liquorice.—The plant which yields the liquorice root of commerce is *Glycirrhiza glabra* or *Liquiritia officinalis*. It is a native of Italy and the southern parts of Europe, but has been occasionally cultivated with success in Britain, especially at Pontefract, in Yorkshire, and at Mitcham, in Surrey. The plant is a perennial, with pale blue flowers. It grows well in a deep, light, sandy loam, and is readily increased by slips from the roots with eyes. The root, which is the only valuable part, is long, slender, fibrous, of a yellow color, and when grown in England is fit for use at the end of three years. The sweet, subacid, mucilaginous juice is much esteemed as a pectoral. It owes its sweetness to a peculiar principle called glycrin or glycirrhiza, which appears also to be present in the root and leaves of other papilionaceous plants, as *G. echinata* and *glandulifera, Trifoliwm alpinum*, and the wild liquorice of the West Indies, *Abrus precatorius*, a pretty climber.

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The greatest portion of our supplies of the extract, which amount to 7,000 or 8,000 cwts. a year, are obtained from Spain and Sicily. The juice, obtained by crushing the roots in a mill, and subjecting them to the press, is slowly boiled, till it becomes of a proper consistency, when it is formed into rolls of a considerable thickness, which are usually covered with bay leaves. It is afterwards usually re-dissolved, purified, and, when formed into small quills, is known as refined liquorice.

In 1839, 1,166 tons of liquorice paste were exported from Naples, valued at L45 per ton. Mr. Poole, in his Statistics of Commerce, states that the consumption of liquorice root and paste in this country averages 500 tons per annum. 110 cwt. of the juice and 100 cwt. of the root are annually brought into Hull from the continent.

Matico—the Peruvian styptic, a powerful vegetable astringent, was first made known to the medical profession of England by Dr. Jeffreys, of Liverpool, in the *Lancet*, as far back as January 5th, 1839. A paper on its history and power was published in May, 1843, in the “Transactions of the Provincial Medical and Surgical Association,” vol. 10. It is stated to be the *Piper angustifolium* of Ruiz and Parsons. Dr. Martin believes it to be a species of *Phlomis*. The leaves are covered with a fine hair.

The powdered leaves of the *Eupatorium glutinosum*, under the name of Matico, are used about Quito for stanching blood and healing wounds. A good article on the pharmaceutical and chemical character of matico, by Dr. J.F. Hodges, appeared in the “Proceedings of the Chemical Society of London,” in 1845. It is stated, by Dr. Martin, that, like the gunjah, which the East Indians prepare, from the *Cannabis Indica*, the leaves and flowers of the matico have been long employed by the sensual Indians of the interior of Peru to prepare a drink which they administer to produce a state of aphrodisia. The leaves and flowering tops of the plant are the parts imported and introduced to notice as a styptic, which property seems to depend on their structure and not on their chemical composition.

Quassia.—The quassia wood of the pharmacopoeia was originally the product of *Quassia amara*, a tall shrub, never above fifteen feet high, native of Guiana, but also inhabiting Surinam and Colombia. It is a very ornamental plant, and has remarkable pinnate leaves with winged petioles. This wood is well known as one of the most intense bitters, and is considered an effectual remedy in any disorder where pure bitters are required. Surinam quassia is not, however, to be met with now. That sold in the shops is the tough, fibrous, bitter bark of the root of *Simaruba (Quassia) excelsa* and *officinalis*, very large forest trees, growing in Cayenne, Jamaica, and other parts of the West India Islands, where they bear the local name of bitter-wood. Its infusion is used as a tonic. 23 tons of bitter-wood were shipped from Montego Bay, Jamaica, in 1851. Quassia acts as a narcotic poison on flies and other insects. Although prohibited by law, it is frequently employed by brewers as a substitute for hops. The duty of L8 17s. 6d. per cwt., levied on quassia, is intended to restrict its use for such a purpose.

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Rhubarb.—This most important plant belongs to the genus Rheum. The officinal rhubarb is the root of an undetermined species. There are about thirteen different kinds which are said to yield rhubarb. Lindley enumerates fifteen. I however take Professor Balfour's classification:—

1. *Rheum palmatum*, native of Bucharia, which has perhaps the best title to be considered the true rhubarb-plant, grows spontaneously in the Mongolian empire on the confines of China.

2. *R. undulatum*, native of China, which yields much of the French rhubarb.

3. *R. compactum*, native of Tartary, another species yielding French rhubarb, and often cultivated in Britain for its acid petioles.

4. *R. Emodi* (Wallich). This species yields a kind of Himalayan rhubarb. Its petioles are much used for their acid properties.

5. *R. Rhaponticum*, native of Asia. Used in France and Britain in the same way as the third species. It is much cultivated in the department of Morbihan.

6. *R. hybridum* (Murr). Much cultivated in Germany for its root and in Britain for its stalks.

7. *R. Webbianum* (Royle). 8. *R. Spiceformi* (Royle). 9. *R.*

Moorcroftianum (Royle).
Himalayan species or varieties.

10. *R. crassinervium*
(Fisch), a Russian species.

11. *R. leucorhizum*
(Pall), a Siberian and Altai species, said to yield imperial or white rhubarb.
It has striped flowers, while all others are whitish green.

12. *R. Caspicum*
(Fisch), a Russian and Altai species.

13. *R. Ribes*,
native of the Levant, but some say an Afghanistan or Persian species.

All these grow in the cold parts of the world, as on the Altai mountains, in Siberia, Thibet, North of China, and on the Himalayan range. The rhubarb procured from one or more of these species is known in commerce under the names of Russian or Turkey, Chinese or East Indian, and English rhubarb.

The plants all thrive well in a rich loamy soil, or light sandy soil, and are increased by divisions of the roots or by seed.

The extent of country from which rhubarb of one kind or another is actually collected, according to Christison, stretches from Ludall, in 771/2 east longitude, to the Chinese province of Shen-si, 29 degrees further east, and from the Sue-chan mountains, in north latitude 26 degrees, nearly to the frontiers of Siberia, 24 degrees northward. The best rhubarb is said to come from the very heart of Thibet, within 95 degrees east longitude and 35 degrees north latitude, 500 or 600 miles north of Assam.

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The Chinese rhubarb is inferior to that of Russia and Turkey. The price varies in China from 38 dollars per picul upwards, and about 1,500 piculs are annually exported, on an average at 50 dollars per picul. In 1844, 2,077 piculs were shipped from Canton for Great Britain; and of 95,701 lbs. imported in 1841, 43,640 lbs. were brought from China, 8,349 lbs. from the Philippines, 7,290 lbs. from the East Indies, and 33,710 lbs. from the United States; only 1,462 lbs. were brought from Russia. The imports from the East Indies have decreased more than 70 per cent. in the last twelve years, as compared with the preceding. The wholesale prices are, for round rhubarb, 8d. to 3s. per lb.; flat, 6d. to 3s. 3d. per lb.; Dutch trimmed, 6s. to 7s. per lb.; Russian, 13s. to 13s. 6d. per lb.

In 1831, we imported 133,462 lbs. from the East India Company's possessions, and 6,901 lbs. from Russia. In 1843, only 71,298 lbs. came from the East. From China we received, in 1843, 172,882 lbs.

The quantities of rhubarb on which duty of 1s. per lb. was paid in the six years ending 1840, were as follows;—

	East Indian.	Foreign.
	lbs.	lbs.
1835	32,515	10,647
1836	36,836	7,752
1837	44,669	5,946
1838	37,026	7,402
1839	22,575	12,525
1840	16,745	22,203

The imports and consumption of rhubarb are thus stated in the *Pharmaceutical Journal*:—

	Imports.	Consumption.
	lbs.	lbs.
1826	102,624	32,936

1831	140,395	40,124
1836	122,142	44,468
1841	95,701	67,877
1846	427,694	—
1847	305,736	—
1848	116,005	—
1849	94,914	—

The rhubarb brought into Siberia grows wild in Chinese Tartary, especially in the province Gansun, on hills, heaths, and meadows, and is generally gathered in summer from plants of six years of age. "When the root is dug up, it is washed to free it from earthy particles; peeled, bored through the centre, strung on a thread, and dried in the sun. In autumn all the dried rhubarb collected in the province is brought in horsehair sacks, containing about 200 lbs., to Sinin (the residence of the dealers), loaded on camels, and sent over Mongolia to Kiachta, and the ports and capital of China.

Sarsaparilla.—The root of various species of *Smilax* constitutes the sarsaparilla of the shops. It is an evergreen climbing undershrub, having whitish green flowers, and grows readily from suckers. It is a native of the temperate and tropical regions of Asia and America. The officinal part is the bark, which comes off from the rhizomes. They are mucilaginous, bitter, and slightly acid. Sarsaparilla is used in decoction and infusion as a tonic and alterative. The following are enumerated as sources whence sarsaparilla of various kinds is derived.

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Smilax China and *sagittaefolia*, yielding the Chinese root, are said to come from the province of Onansi in China.

S. pseudo China, *S. Sarsaparilla*, *S. rubens*, and *S. Watsoni*, furnish the drug of North America.

The sarsaparilla distinguished in commerce as the Lisbon or Brazilian is the root of *S. papyracea* of Poiret. It is an undershrub, the stem of which is compressed and angular below, and armed with prickles at the angles. The leaves are elliptic, acuminate, and marked with three longitudinal nerves. This species grows principally in the regions bordering the river Amazon, and on the banks of most of its tributary streams. It is generally brought from the provinces of Para and Maranham. It is in large cylindrical bundles, long and straight, and the flexible stem of the plant is bound round the bundles, so as to entirely cover them. Its fibres are very long, cylindrical, wrinkled longitudinally, and furnished with some lateral fibrils. Its color is of a fawn brown, or sometimes of a dark grey, approaching to black. The color internally is nearly white. Besides this species there are others indigenous, such as *S. officinalis*, which grows in the province of Mina; *S. syphilitica*, which grows in the northern regions, and three new species, *S. japicanga*, *S. Brasiliensis*, and *S. syringioides*. There is also met with in Brazil another plant, *Herreria sarsaparilla*, belonging to the same natural order, which abounds in the provinces of Rio, Bahia, and Mina, and the roots of which receive the name of wild sarsaparilla.

From Mexico, Honduras, and Angostura very good qualities are imported. *S. zeylanica*, *glabra*, and *perfoliata* furnish sarsaparilla from Asia, and *S. excelsa* and *aspera* are used as substitutes for the officinal drug in Europe.

Smilax officinalis, found in woods near the Rio Magdalena in New Granada, furnishes the best in the market, which is commonly known as Jamaica Sarza. It differs from the other kinds in having a deep red cuticle of a close texture, and the color is more generally diffused through the ligneous part. It is shipped in bales, formed either of the spirally formed roots, as in the Jamaica and Lima varieties, or of unfolded parallel roots, as in the Brazilian varieties. The roots are usually several feet long, about the thickness of a quill, more or less wrinkled, and the whole quantity retained for home consumption, in 1840, was 143,000 lbs. In 1844, 184,748 lbs., and in 1845 111,775 lbs. were shipped from Honduras.

The prices in the London market, at the close of 1853, were —Brazil, 1s. 3d. per lb.; Honduras, 1s. 3d. to 1s. 8d. per lb.; Vera Cruz, 6d. to 11d. per lb.; Jamaica, 1s. 8d. to 3s. 4d. per lb. The duty received on sarsaparilla in 1842 was L1,536.

The average annual quantity of sarsaparilla obtained from Mexico and South America, exclusive of Brazil, and taken for home consumption, in the twelve years ending with 1843 was 37,826 lbs.

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IMPORTS OF BRAZILIAN SARSAPARILLA.

	lbs.
1827	28,155
1828	49,280
1829	52,772
1830	19,842
1831	31,972
1832	91,238
1833	13,077
1834	28,803
1835	22,387
1836	1,718
1837	12,842
1838	—
1839	9,484
1840	4,141
1841	1,399
1842	5,572

The total imports in 1849 were 118,934 lbs.

Sarsaparilla has been found growing in the Port Phillip district of Australia, and has been shipped thence in small quantities. It seems to be indigenous to the Bahamas, and is to be found on many of the out islands. Mr. Wm. Dalzell, of Abaco, collected some considerable quantity at a place called Marsh Harbor, which was found to be of a superior quality.

Some thousands of pounds of sarsaparilla were brought to Falmouth, Jamaica, last year, and bought by merchants for export. It came from the parish of St. Elizabeth, and there are whole forests covered with this weed, for such in reality it is. It is too the real black Jamaica sarsaparilla, that is so much valued in the European and American markets. It is also found in other parts of the island.

In 1798 3,674 lbs. of sarsaparilla were shipped from La Guayra; 2,394 lbs. in 1801 from Puerto Cabella, and 400 quintals from Costa Rica, in 1845, valued at eight dollars a quintal.

SENNA.—Several varieties of Cassia, natives of the East, are grown for the production of this drug. The dried leaves of C. *lanceolata* or *orientalis*, grown in Egypt, Syria, and Arabia, the true Mecca senna, are considered the best. In Egypt the leaves of *Cynanchum Arghel* are used for adulterating senna, *Cassia obovata* or *C. senna*, also a native of Egypt, cultivated in the East Indies, as well as in Spain, Italy, and Jamaica. It is a perennial herb, one or two feet high. In the East Indies there is a variety (*C. elongata*) common about Tinnivelly, Coimbatore, Bombay, and Agra, &c. Several of this species are common in the West India islands. The plants, which are for the most part evergreens, grow from two to fifteen feet high; they delight in a loamy soil, or mixture of loam or peat.

The seed is drilled in the ground, and the only attention required by the plant is loosening the ground and weeding two or three times when it is young.

The senna leaves imported from India are not generally so clean and free from rubbish as those from Alexandria. They are worth from 20s. to 27s. per cwt. in the Bombay market.

The prices are—Alexandria, l1/2d. to 6d. per lb.; East Indian, 2d. to 3d. per lb.; Tinnevelly, 7d. to 91/2d. per lb.

Senna is collected in various parts of Africa by the Arabs, who make two crops annually; one, the most productive, after the rains in August and September, the other about the middle of March. It is brought to Boulack, the port of Cairo, by the caravans, &c., from Abyssinia, Nubia, and Sennaar, also by the way of Cossier, the Red Sea, and Suez. The different leaves are mixed, and adulterated with arghel leaves. The whole shipments from Boulack to Alexandria, whence it finds it way to Europe, is 14,000 to 15,500 quintals.

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The quantities imported for home consumption were—

	From the East Indies.	Other places.	Total.
	lbs.	lbs.	lbs.
1838	72,576	69,538	142,114
1839	110,409	63,766	174,175

In 1840, 211,400 lbs. paid duty, which is now only 1d. per lb.

In 1848, we imported 800,000 lbs. from India; in 1849, the total imports were 541,143 lbs. The imports into the United Kingdom were, in 1847, 246 tons; 1848, 402 tons; 1849, 240 tons.

Alexandrian senna (*Cassia acutifolia*). This species is said by some to constitute the bulk of the senna consumed for medical purposes in Europe. It is much adulterated with the leaves of *Cynanchum Arghel, Tiphrosia apollinea*, and *Coriaria myrtifolia*.

C. lanceolata and *C. ethiopica* furnish other species of the same article, the greater part of the produce of which find its way to India, through the Red Sea, Surat, Bombay and Calcutta, the imports into Calcutta, in 1849, having been 79,212 lbs. *C. obovata* furnishes the Aleppo and Italian drug.

At least eight varieties of senna leaf are known in commerce in Europe—1. the Senna palthe; 2. Senna of Sennaar or Alexandria; 3. of Tripoli; 4. of Aleppo; 5. of Moka; 6. of Senegambia; 7. the false or Arghel; 8. the Tinnevelly.

In Egypt the senna harvest takes place twice annually, in April and September; the stalks are cut off with the leaves, dried before the sun, and then packed with date leaves. At Boulka, the drug is sorted, mixed, and adulterated, and passed into commerce through Alexandria.

Alexandrian senna, according to Mr. Jacob Bell ("Pharmaceutical Journal," vol. 2, p. 63), contains a mixture of two or more species of true senna. It consists principally of *Cassia obovata* and *C. obtusata*, and according to some authorities it occasionally contains *C. acutifolia*. This mixture is unimportant, but the *Cynanchum Arghel*, which generally constitutes a fifth of the weight on an average, possesses properties differing in some respects from true senna, and which render it particularly objectionable. The Tinnevelly senna, that most esteemed by the profession, is known by the size of the leaflets, which are much larger than those of any other variety; they are also less brittle, thinner and larger, and are generally found in a very perfect state, while the other varieties, especially the Alexandrian, are more or less broken. The leaves of the Cynanchum are similar in form to those of the lanceolate senna, but they are thicker and stiffer, the veins are scarcely visible, they are not oblique at the base, their surface is rugose, and the color grey or greenish drab; their taste is bitter and disagreeable, and they are often spotted with a yellow, intensely bitter gummo-resinous incrustation. Being less fragile than the leaflets of the true senna, they are more often found entire, and are very easily distinguishable from the varieties which constitute true Alexandrian senna.

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In their botanical character they are essentially different, being distinct leaves, not leaflets, which is the case with true senna.

The SUMBUL root, which has recently been introduced into the French market, is the root of an umbelliferous plant, which is characterised by a strong odor of musk. The pilgrims, on their return from Mecca, generally import to Salonika, Constantinople, &c., among other articles of trade, various plants with a musk-like odor. The preparation of these vegetable substances is said to be effected by smearing them over with musk-balsam.

FOOTNOTES:

[Footnote 1: Ure's Dictionary of Arts and Manufactures.]

[Footnote 2: Fractional parts are not necessary to include.]

[Footnote 3: Dr. Lindley is in error as to the discriminating duties—British cacao pays 9s., and foreign 18s.]

[Footnote 4: According to Breen's History of St. Lucia up to 1844.]

[Footnote 5: Caffeine (the principle of coffee) and theobromine (the principle of cacao) are the most highly nitrogenised products in nature, as the following analysis will show:—

Caffeine, according to Pfaff and Liebig, contains—
Carbon 49.77 Hydrogen 5.33 *Nitrogen* 28.78 Oxygen 16.12
Theobromine, according to Woskreseusky, contains—
Carbon 47.21 Hydrogen 4.53 *Nitrogen* 35.38 Oxygen 12.80

Of the two, cacao contains the larger quantity of nitrogen; and this chemical fact explains why cacao should be so much more nutritive than tea, though the principle of tea (theine) is nearly identical with the principle of cacoa—tea containing in 100 parts 29.009 of nitrogen. On this subject Liebig has made an observation which I cannot avoid noticing. He says, "We shall never certainly be able to discover how men were led to the use of the hot infusion of the leaves of a certain shrub (tea), or of a decoction of certain roasted seeds (coffee). Some cause there must be, which would explain how the practice has become a necessary of life to whole nations. But it is surely still more remarkable that the beneficial effects of both plants on the health must be ascribed to one and the same substance, the presence of which in two vegetables, belonging to different natural families, and the produce of different quarters of the globe, could hardly have presented itself to the boldest imagination. Yet recent researches have shown, in such a manner as to exclude all doubt, that caffeine, the peculiar principle of coffee, and theine, that of tea, are in all respects identical."—*(Anim. Chem.*, pp. 178-9.) We really can see nothing in all this but the manifestation of that instinct which, implanted in us by the Almighty, led the untutored Indian (as

we are pleased to call him) to breathe into the nostril of the buffalo or the wild horse, and by that single act to subdue his angry rage, or that impelled the first discoverer of combustion to extract fire from the attrition of two pieces of wood. The American Indian, living entirely on flesh, "discovered for himself in tobacco smoke a means of retarding the change of matter in the tissues of the body, and thereby of making hunger more endurable."—(P. 179.) But the wonder ceases, when we reflect that man was endued with certain properties by his Maker which must have been at some remote period, of which we can form no idea, active and manifest the moment he breathed the breath of life. To inquire how he lost this property is not our business at present, but it is only by supposing the *quondam* existence of such a property, active and manifest, that can in any way explain a first knowledge of the therapeutic, or threptic, qualities of plants and shrubs.
With regard to the identity of theine, caffeine, theobromine, &c., it would be as well that the reader should keep in mind that it is so chemically *only*, for in appearance, taste, weight, odor, &c., no substances can differ more. Does the palate exert some peculiar action on the ingesta, so as to give to each a distinct sapor? Or *vice versa*?]

[Footnote 6: In the West Indies, from my own experience, I have found this to be one of the worst descriptions of soil. *P.L.S.*]

[Footnote 7: Correspondent of the Singapore *Free Press*, December, 1852.]

[Footnote 8: It is important, in considering what tea may be had from China, to consider the manner of its production. It is grown over an immense district, in small farms, or rather gardens, no farm producing more that 600 chests. "The tea merchant goes himself, or sends his agents to all the small towns, villages, and temples in the district,

to purchase tea from the priests and small farmers; the large merchant, into whose hands the tea thus comes, *has to refire it and pack it for the foreign market."—(Fortune's Tea Districts.)*
This refiring is the only additional process of manufacture for our market. Mr. Fortune elsewhere, in his valuable work, giving an account of the cost of tea from the farmers, the conveyance to market, and the merchant's profit, states that " the small farmer and manipulator is not overpaid, but that the great profits are received by the middlemen."
No doubt these men do their utmost to keep the farmers in complete ignorance of the state of the tea-market, that they may monopolise the advantages, but it is pretty certain that the news of a bold reduction of duty, and the promise of an immensely increased consumption, would reach even the Chinese farmers, and make them pick their trees more closely—a little of which amongst so many would make a vast difference in the total supply.]

[Footnote 9: See article Thea, by Dr. Royle, in "Penny Cyclopaedia," vol xxiv., p. 286.]

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[Footnote 10: Hooker's "Bot. Mag.," 1.3148. It is the Assam tea plant.]

[Footnote 11: Report on Tea Cultivation submitted to House of Commons. See Blue Book, 1839, p. 1-3.]

[Footnote 12: In a short time rain gauges will be established at Bheemtal, Huwalbaugh, Paoree, and Kaolagir, in order to measure the quantity of rain that falls annually, for the purpose of ascertaining how much the quantity and quality of the produce of tea is affected by the weather.]

[Footnote 13: In China this process, according to the statement of tea manufacturers, is carried on to a great extent.]

[Footnote 14: Dr. Jameson, in a late communication, remarks—"From the accounts I have received of that place (Darjeeling), I doubt not but that the plants there grown will yield tea of a superior description."]

[Footnote 15: The crops of this district, such as rice, mundooa, and other grains, are so plentiful and cheap as scarcely to pay the carriage to the nearest market town, much less to the plains. In Almorah a maund of rice or mundooa sells for something less than a rupee; barley for eight annas; and wheat for a rupee.]

[Footnote 16: There is frequently a discrepancy in the figures in the Parliamentary papers, which will account for a want of agreement in some of these returns.]

[Footnote 17: See the "Pharmaceutical Journal" for June, 1849, p. 15, et seq.]

[Footnote 18: Reports of Dr. Roxburgh, Mr. Touchet of Radanagore, and Mr. Cardin of Mirzapore, Cutna. Papers on East India Sugar, page 258.]

[Footnote 19: Many are of opinion, that although the juice of this cane is larger in quantity, yet that it contains less sugar. There is some sense in the reason they assign, which is, that in the Mauritius and elsewhere it has the full time of twelve or fourteen months allowed for its coming to maturity—whereas the agriculture of India, and especially in Bengal, only allows it eight or nine months, which, though ample to mature the smaller country canes, is not sufficient for the Otaheite.]

[Footnote 20: Roxburgh on the Culture of Sugar and Jaggary in the Rajahmundry Circar; Third Ap. to Report on East India Sugar, p. 2.]

[Footnote 21: L'Exploitation de Sucreries. Porter on the Sugar Cane, 53,321.]

[Footnote 22: That the above application would be beneficial, is rendered still more worthy of credit from the following experience:—In the Dhoon, the white ant is a most formidable enemy to the sugar planter, owing to the destruction it causes to the sets when first planted. Mr. G.H. Smith says, that there is a wood very common there, called by the natives *Butch*, through, which, they say, if the irrigating waters are passed in its progress to the beds, the white ants are driven away. (Trans. Agri-Hort. Soc. of India, v. 65.)]

[Footnote 23: Fitzmaurice on the Culture of the Sugar Cane.]

[Footnote 24: The kilogramme is equal to 2 lb, 3 oz. avoirdupois.]

[Footnote 25: A lecture on the nutritive value of different articles of food, by C. Daubeny, M.D., "Gardener's Chronicle" (London), January 20th, 1849, p. 37.]

[Footnote 26: Transactions of the New York State Agricultural Society, 1849, p. 646.]

[Footnote 27: A lecture "On the Geographical Distribution of Corn Plants," by the Rev. E. Sidney—Proceedings of the Royal Institution (London), May 18th, 1849.]

[Footnote 28: Boussingault's Rural Economy, American edition, pp. 85 and 86.]

[Footnote 29: Zenas Coffin, one of the oldest whalemen in Nantucket, states that corn meal in tight rum puncheons when sent to the Went Indies will keep sweet, while in common flour barrels it will spoil. Report of the Commissioner of Patents for 1847, p. 133.]

[Footnote 30: From remarks of Col. Skinner, and others, at a meeting of the American Institute, held in April 1846. Transactions of American Institute, 1846, p. 509 *et seq*.]

[Footnote 31: Comptes Rendus des Seances de L'Academie des Sciences, February 5th, 1819.]

[Footnote 32: A Treatise on Diet and Regimen, by Wm. Henry Robertson, M.D., vol. i. p. 153.]

[Footnote 33: The Plant: a Biography; by M.H. Schleiden, M.D., Professor of Botany in the University of Jena. English translation, p. 54.]

[Footnote 34: Transactions of the New York State Agricultural Society for 1847, p. 190. In this communication, Mr. Bentz does not describe the process which he adopts, but enumerates some of its supposed advantages.]

[Footnote 35: Quoted by Boussingault, Rural Economy, Amer. edition, p. 410.]

[Footnote 36: A Treatise on Diet and Regimen, by Wm. Henry Robertson, M.D., Vol. i. p. 140.]

[Footnote 37: Experimental Researches on the Food of Animals, &c., by R.D. Thomson, M.D., p. 156.]

[Footnote 38: Chemistry of Vegetable and Animal Physiology, translated by Prof. J.F.W. Johnston, p. 684.]

[Footnote 39: See Dr. R.D. Thomson's Experimental Researches on the Food of Animals, &c.]

[Footnote 40: Mulder's Chemistry of Vegetable and Animal Physiology; English Translation, p. 816.]

[Footnote 41: I have had no opportunity of analysing samples of flour from the South-Western States, and therefore cannot extend this comparison to them.]

[Footnote 42: Transactions of "Agri.-Hort. Society, of Calcutta," vol. iv. p. 125.]

[Footnote 43: Dict. of Arts and Manufacture.]

[Footnote 44: Pharmaceutical Journal, vol. 3, p. 138.]

[Footnote 45: The glasses used were all of the sort described in Griffin's catalogue under the name of Clark's test-glasses. They were all, as nearly as possible, of the same size and shape.]

[Footnote 46: I have determined the amount of nitrogen contained in the meal made from the whole maize, the growth of the colony, as also from plantain meal; I have also ascertained its amount in cassava meal, prepared in the manner mentioned in the text, and in meal prepared from the cassava sliced, dried, and ground without expressing the juice. Assuming Liebig's formula of Proteine, namely, C-48 N-6 H-36 0-4 the results stand thus:—

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	Nitrogen. Per cent.	Proteine compounds. Per cent.
Maize meal (unhusked)	1.73	10.72
Plantain meal	.88	5.45
Cassava meal (juice expressed)	.36	2.23
Ditto from the sliced and dried roots	.78	4.83

]

[Footnote 47: Les Moyens de prevenir la Maladie des Pommes de Terre. Experiences et Conclusions de A.N.C. Bollman, Conseiller d'etat, Professeur, &c. 8vo, St. Petersburg, 1853.]

[Footnote 48: If cinnamon seeds after washing be exposed to the sun, even for twenty minutes, the shells will crack in two, and this prevents the seeds from growing.]

[Footnote 49: No export duties exist in the Straits Settlements.]

[Footnote 50: Since these remarks were written, the duty has been wholly abolished.]

[Footnote 51: Although this was the amount of produce for 1842, it must be remarked that that crop was a complete failure, and the average crop for some years past has been 46,666 pounds.]

[Footnote 52: Ure's Dictionary of Arts and Manufactures.]

[Footnote 53: The vernacular name for stale or putrid urine.]

[Footnote 54: "Lit" was the name applied to the plant, from which the dye was to be prepared, and "pig" is the Scotch synonym for any kind of earthenware vessel——in which the maceration was generally carried on.]

[Footnote 55: Pitkins' Statistics of the United States.]

[Footnote 56: A great portion of the crop I grew had leaves measuring two feet nine inches in length and eighteen inches wide, being larger than I ever knew to have been grown in America. The average weight I obtained per acre, was 25 cwt.; whereas I see by the public returns, the average of what is grown here is only 17 1-7th cwt.]

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1844	506,796	6,586

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"	"	1833	83,153|	"	"	1833	50,543
"	"	1834	87,979|	"	"	1834	53,413
"	"	1835	94,353|	"	"	1835	57,458
"	"	1836	109,042|	"	"	1836	68,918
"	"	1837	100,232|	"	"	1837	38,703
"	"	1838	100,593|	"	"	1838	31,067
"	"	1839	78,995|	"	"	1839	38,715
"	"	1840	119,484|	"	"	1840	37,623
"	"	1841	147,828|	"	"	1841	50,880
"	"	1842	158,710|	"	"	1842	62,496
June 30	(9 ms.)	1843	94,454|	"	"	1843	91,196
"	(12 ms.)	1844	163,042|	"	"	1844	88,973
"	"	1845	147,168|	"	"	1845	91,213
"	"	1846	147,998|	"	"	1846	100,774
"	"	1847	135,762|	"	"	1847	88,858
"	"	1848	130,665|	"	"	1848	80,391
"	"	1849	101,521|	"	"	1849	70,527
"	’	1850	145,729|	"	"	1850	66,777