**Farmers of Forty Centuries; Or, Permanent Agriculture in China, Korea, and Japan eBook**

**Farmers of Forty Centuries; Or, Permanent Agriculture in China, Korea, and Japan by Franklin Hiram King**

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**INTRODUCTION**

A word of introduction is needed to place the reader at the best view point from which to consider what is said in the following pages regarding the agricultural practices and customs of China, Korea and Japan.  It should be borne in mind that the great factors which today characterize, dominate and determine the agricultural and other industrial operations of western nations were physical impossibilities to them one hundred years ago, and until then had been so to all people.

It should be observed, too, that the United States as yet is a nation of but few people widely scattered over a broad virgin land with more than twenty acres to the support of every man, woman and child, while the people whose practices are to be considered are toiling in fields tilled more than three thousand years and who have scarcely more than two acres per capita,\* more than one-half of which is uncultivable mountain land.

*[Footnote:  This figure was wrongly stated in the first edition as one acre, owing to a mistake in confusing the area of cultivated land with total area.]*

Again, the great movement of cargoes of feeding stuffs and mineral fertilizers to western Europe and to the eastern United States began less than a century ago and has never been possible as a means of maintaining soil fertility in China, Korea or Japan, nor can it be continued indefinitely in either Europe or America.  These importations are for the time making tolerable the waste of plant food materials through our modern systems of sewage disposal and other faulty practices; but the Mongolian races have held all such wastes, both urban and rural, and many others which we ignore, sacred to agriculture, applying them to their fields.

We are to consider some of the practices of a virile race of some five hundred millions of people who have an unimpaired inheritance moving with the momentum acquired through four thousand years; a people morally and intellectually strong, mechanically capable, who are awakening to a utilization of all the possibilities which science and invention during recent years have brought to western nations; and a people who have long dearly loved peace but who can and will fight in self defense if compelled to do so.

We had long desired to stand face to face with Chinese and Japanese farmers; to walk through their fields and to learn by seeing some of their methods, appliances and practices which centuries of stress and experience have led these oldest farmers in the world to adopt.  We desired to learn how it is possible, after twenty and perhaps thirty or even forty centuries, for their soils to be made to produce sufficiently for the maintenance of such dense populations as are living now in these three countries.  We have now had this opportunity and almost every day we were instructed, surprised and amazed at the conditions and practices which confronted us whichever way we turned; instructed in the ways and extent to which these nations for centuries have been and are conserving and utilizing their natural resources, surprised at the magnitude of the returns they are getting from their fields, and amazed at the amount of efficient human labor cheerfully given for a daily wage of five cents and their food, or for fifteen cents, United States currency, without food.

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The three main islands of Japan in 1907 had a population of 46,977,003 maintained on 20,000 square miles of cultivated field.  This is at the rate of more than three people to each acre, and of 2,349 to each square mile; and yet the total agricultural imports into Japan in 1907 exceeded the agricultural exports by less than one dollar per capita.  If the cultivated land of Holland is estimated at but one-third of her total area, the density of her population in 1905 was, on this basis, less than one-third that of Japan in her three main islands.  At the same time Japan is feeding 69 horses and 56 cattle, nearly all laboring animals, to each square mile of cultivated field, while we were feeding in 1900 but 30 horses and mules per same area, these being our laboring animals.

As coarse food transformers Japan was maintaining 16,500,000 domestic fowl, 825 per square mile, but only one for almost three of her people.  We were maintaining, in 1900, 250,600,000 poultry, but only 387 per square mile of cultivated field and yet more than three for each person.  Japan’s coarse food transformers in the form of swine, goats and sheep aggregated but 13 to the square mile and provided but one of these units for each 180 of her people while in the United States in 1900 there were being maintained, as transformers of grass and coarse grain into meat and milk, 95 cattle, 99 sheep and 72 swine per each square mile of improved farms.  In this reckoning each of the cattle should be counted as the equivalent of perhaps five of the sheep and swine, for the transforming power of the dairy cow is high.  On this basis we are maintaining at the rate of more than 646 of the Japanese units per square mile, and more than five of these to every man, woman and child, instead of one to every 180 of the population, as is the case in Japan.

Correspondingly accurate statistics are not accessible for China but in the Shantung province we talked with a farmer having 12 in his family and who kept one donkey, one cow, both exclusively laboring animals, and two pigs on 2.5 acres of cultivated land where he grew wheat, millet, sweet potatoes and beans.  Here is a density of population equal to 3,072 people, 256 donkeys, 256 cattle and 512 swine per square mile.  In another instance where the holding was one and two-thirds acres the farmer had 10 in his family and was maintaining one donkey and one pig, giving to this farm land a maintenance capacity of 3,840 people, 384 donkeys and 384 pigs to the square mile, or 240 people, 24 donkeys and 24 pigs to one of our forty-acre farms which our farmers regard too small for a single family.  The average of seven Chinese holdings which we visited and where we obtained similar data indicates a maintenance capacity for those lands of 1,783 people, 212 cattle or donkeys and 399 swine,—­1,995 consumers and 399 rough food transformers per square mile of farm land.  These statements for China represent strictly rural populations.  The rural population of the United States in 1900 was placed at the rate of 61 per square mile of improved farm land and there were 30 horses and mules.  In Japan the rural population had a density in 1907 of 1,922 per square mile, and of horses and cattle together 125.

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The population of the large island of Chungming in the mouth of the Yangtse river, having an area of 270 square miles, possessed, according to the official census of 1902, a density of 3,700 per square mile and yet there was but one large city on the island, hence the population is largely rural.

It could not be other than a matter of the highest industrial, educational and social importance to all nations if there might be brought to them a full and accurate account of all those conditions which have made it possible for such dense populations to be maintained so largely upon the products of Chinese, Korean and Japanese soils.  Many of the steps, phases and practices through which this evolution has passed are irrevocably buried in the past but such remarkable maintenance efficiency attained centuries ago and projected into the present with little apparent decadence merits the most profound study and the time is fully ripe when it should be made.  Living as we are in the morning of a century of transition from isolated to cosmopolitan national life when profound readjustments, industrial, educational and social, must result, such an investigation cannot be made too soon.  It is high time for each nation to study the others and by mutual agreement and co-operative effort, the results of such studies should become available to all concerned, made so in the spirit that each should become coordinate and mutually helpful component factors in the world’s progress.

One very appropriate and immensely helpful means for attacking this problem, and which should prove mutually helpful to citizen and state, would be for the higher educational institutions of all nations, instead of exchanging courtesies through their baseball teams, to send select bodies of their best students under competent leadership and by international agreement, both east and west, organizing therefrom investigating bodies each containing components of the eastern and western civilization and whose purpose it should be to study specifically set problems.  Such a movement well conceived and directed, manned by the most capable young men, should create an international acquaintance and spread broadcast a body of important knowledge which would develop as the young men mature and contribute immensely toward world peace and world progress.  If some broad plan of international effort such as is here suggested were organized the expense of maintenance might well be met by diverting so much as is needful from the large sums set aside for the expansion of navies for such steps as these, taken in the interests of world uplift and world peace, could not fail to be more efficacious and less expensive than increase in fighting equipment.  It would cultivate the spirit of pulling together and of a square deal rather than one of holding aloof and of striving to gain unneighborly advantage.

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Many factors and conditions conspire to give to the farms and farmers of the Far East their high maintenance efficiency and some of these may be succinctly stated.  The portions of China, Korea and Japan where dense populations have developed and are being maintained occupy exceptionally favorable geographic positions so far as these influence agricultural production.  Canton in the south of China has the latitude of Havana, Cuba, while Mukden in Manchuria, and northern Honshu in Japan are only as far north as New York city, Chicago and northern California.  The United States lies mainly between 50 degrees and 30 degrees of latitude while these three countries lie between 40 degrees and 20 degrees, some seven hundred miles further south.  This difference of position, giving them longer seasons, has made it possible for them to devise systems of agriculture whereby they grow two, three and even four crops on the same piece of ground each year.  In southern China, in Formosa and in parts of Japan two crops of rice are grown; in the Chekiang province there may be a crop of rape, of wheat or barley or of windsor beans or clover which is followed in midsummer by another of cotton or of rice.  In the Shantung province wheat or barley in the winter and spring may be followed in summer by large or small millet, sweet potatoes, soy beans or peanuts.  At Tientsin, 39 deg north, in the latitude of Cincinnati, Indianapolis, and Springfield, Illinois, we talked with a farmer who followed his crop of wheat on his small holding with one of onions and the onions with cabbage, realizing from the three crops at the rate of $163, gold, per acre; and with another who planted Irish potatoes at the earliest opportunity in the spring, marketing them when small, and following these with radishes, the radishes with cabbage, realizing from the three crops at the rate of $203 per acre.

Nearly 500,000,000 people are being maintained, chiefly upon the products of an area smaller than the improved farm lands of the United States.  Complete a square on the lines drawn from Chicago southward to the Gulf and westward across Kansas, and there will be enclosed an area greater than the cultivated fields of China, Korea and Japan and from which five times our present population are fed.

The rainfall in these countries is not only larger than that even in our Atlantic and Gulf states, but it falls more exclusively during the summer season when its efficiency in crop production may be highest.  South China has a rainfall of some 80 inches with little of it during the winter, while in our southern states the rainfall is nearer 60 inches with less than one-half of it between June and September.  Along a line drawn from Lake Superior through central Texas the yearly precipitation is about 30 inches but only 16 inches of this falls during the months May to September; while in the Shantung province, China, with an annual rainfall of little more than 24 inches, 17 of these

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fall during the months designated and most of this in July and August.  When it is stated that under the best tillage and with no loss of water through percolation, most of our agricultural crops require 300 to 600 tons of water for each ton of dry substance brought to maturity, it can be readily understood that the right amount of available moisture, coming at the proper time, must be one of the prime factors of a high maintenance capacity for any soil, and hence that in the Far East, with their intensive methods, it is possible to make their soils yield large returns.

The selection of rice and of the millets as the great staple food crops of these three nations, and the systems of agriculture they have evolved to realize the most from them, are to us remarkable and indicate a grasp of essentials and principles which may well cause western nations to pause and reflect.

Notwithstanding the large and favorable rainfall of these countries, each of the nations have selected the one crop which permits them to utilize not only practically the entire amount of rain which falls upon their fields, but in addition enormous volumes of the run-off from adjacent uncultivable mountain country.  Wherever paddy fields are practicable there rice is grown.  In the three main islands of Japan 56 per cent of the cultivated fields, 11,000 square miles, is laid out for rice growing and is maintained under water from transplanting to near harvest time, after which the land is allowed to dry, to be devoted to dry land crops during the balance of the year, where the season permits.

To anyone who studies the agricultural methods of the Far East in the field it is evident that these people, centuries ago, came to appreciate the value of water in crop production as no other nations have.  They have adapted conditions to crops and crops to conditions until with rice they have a cereal which permits the most intense fertilization and at the same time the ensuring of maximum yields against both drought and flood.  With the practice of western nations in all humid climates, no matter how completely and highly we fertilize, in more years than not yields are reduced by a deficiency or an excess of water.

It is difficult to convey, by word or map, an adequate conception of the magnitude of the systems of canalization which contribute primarily to rice culture.  A conservative estimate would place the miles of canals in China at fully 200,000 and there are probably more miles of canal in China, Korea and Japan than there are miles of railroad in the United States.  China alone has as many acres in rice each year as the United States has in wheat and her annual product is more than double and probably threefold our annual wheat crop, and yet the whole of the rice area produces at least one and sometimes two other crops each year.

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The selection of the quick-maturing, drought-resisting millets as the great staple food crops to be grown wherever water is not available for irrigation, and the almost universal planting in hills or drills, permitting intertillage, thus adopting centuries ago the utilization of earth mulches in conserving soil moisture, has enabled these people to secure maximum returns in seasons of drought and where the rainfall is small.  The millets thrive in the hot summer climates; they survive when the available soil moisture is reduced to a low limit, and they grow vigorously when the heavy rains come.  Thus we find in the Far East, with more rainfall and a better distribution of it than occurs in the United States, and with warmer, longer seasons, that these people have with rare wisdom combined both irrigation and dry farming methods to an extent and with an intensity far beyond anything our people have ever dreamed, in order that they might maintain their dense populations.

Notwithstanding the fact that in each of these countries the soils are naturally more than ordinarily deep, inherently fertile and enduring, judicious and rational methods of fertilization are everywhere practiced; but not until recent years, and only in Japan, have mineral commercial fertilizers been used.  For centuries, however, all cultivated lands, including adjacent hill and mountain sides, the canals, streams and the sea have been made to contribute what they could toward the fertilization of cultivated fields and these contributions in the aggregate have been large.  In China, in Korea and in Japan all but the inaccessible portions of their vast extent of mountain and hill lands have long been taxed to their full capacity for fuel, lumber and herbage for green manure and compost material; and the ash of practically all of the fuel and of all of the lumber used at home finds its way ultimately to the fields as fertilizer.

In China enormous quantities of canal mud are applied to the fields, sometimes at the rate of even 70 and more tons per acre.  So, too, where there are no canals, both soil and subsoil are carried into the villages and there between the intervals when needed they are, at the expense of great labor, composted with organic refuse and often afterwards dried and pulverized before being carried back and used on the fields as home-made fertilizers.  Manure of all kinds, human and animal, is religiously saved and applied to the fields in a manner which secures an efficiency far above our own practices.  Statistics obtained through the Bureau of Agriculture, Japan, place the amount of human waste in that country in 1908 at 23,950,295 tons, or 1.75 tons per acre of her cultivated land.  The International Concession of the city of Shanghai, in 1908, sold to a Chinese contractor the privilege of entering residences and public places early in the morning of each day in the year and removing the night soil, receiving therefor more than $31,000, gold, for 78,000 tons of waste.  All of this we not only throw away but expend much larger sums in doing so.

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Japan’s production of fertilizing material, regularly prepared and applied to the land annually, amounts to more than 4.5 tons per acre of cultivated field exclusive of the commercial fertilizers purchased.  Between Shanhaikwan and Mukden in Manchuria we passed, on June 18th, thousands of tons of the dry highly nitrified compost soil recently carried into the fields and laid down in piles where it was waiting to be “fed to the crops.”

It was not until 1888, and then after a prolonged war of more than thirty years, generaled by the best scientists of all Europe, that it was finally conceded as demonstrated that leguminous plants acting as hosts for lower organisms living on their roots are largely responsible for the maintenance of soil nitrogen, drawing it directly from the air to which it is returned through the processes of decay.  But centuries of practice had taught the Far East farmers that the culture and use of these crops are essential to enduring fertility, and so in each of the three countries the growing of legumes in rotation with other crops very extensively for the express purpose of fertilizing the soil is one of their old, fixed practices.

Just before, or immediately after the rice crop is harvested, fields are often sowed to “clover” (Astragalus sinicus) which is allowed to grow until near the next transplanting time when it is either turned under directly, or more often stacked along the canals and saturated while doing so with soft mud dipped from the bottom of the canal.  After fermenting twenty or thirty days it is applied to the field.  And so it is literally true that these old world farmers whom we regard as ignorant, perhaps because they do not ride sulky plows as we do, have long included legumes in their crop rotation, regarding them as indispensable.

Time is a function of every life process as it is of every physical, chemical and mental reaction.  The husbandman is an industrial biologist and as such is compelled to shape his operations so as to conform with the time requirements of his crops.  The oriental farmer is a time economizer beyond all others.  He utilizes the first and last minute and all that are between.  The foreigner accuses the Chinaman of being always long on time, never in a fret, never in a hurry.  This is quite true and made possible for the reason that they are a people who definitely set their faces toward the future and lead time by the forelock.  They have long realized that much time is required to transform organic matter into forms available for plant food and although they are the heaviest users in the world, the largest portion of this organic matter is predigested with soil or subsoil before it is applied to their fields, and at an enormous cost of human time and labor, but it practically lengthens their growing season and enables them to adopt a system of multiple cropping which would not otherwise be possible.  By planting in hills and rows with intertillage it is very common to see three crops growing upon the same field at one time, but in different stages of maturity, one nearly ready to harvest one just coming up, and the other at the stage when it is drawing most heavily upon the soil.  By such practice, with heavy fertilization, and by supplemental irrigation when needful, the soil is made to do full duty throughout the growing season.

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Then, notwithstanding the enormous acreage of rice planted each year in these countries, it is all set in hills and every spear is transplanted.  Doing this, they save in many ways except in the matter of human labor, which is the one thing they have in excess.  By thoroughly preparing the seed bed, fertilizing highly and giving the most careful attention, they are able to grow on one acre, during 30 to 50 days, enough plants to occupy ten acres and in the mean time on the other nine acres crops are maturing, being harvested and the fields being fitted to receive the rice when it is ready for transplanting, and in effect this interval of time is added to their growing season.

Silk culture is a great and, in some ways, one of the most remarkable industries of the Orient.  Remarkable for its magnitude; for having had its birthplace apparently in oldest China at least 2700 years B. C.; for having been laid on the domestication of a wild insect of the woods; and for having lived through more than 4000 years, expanding until a million-dollar cargo of the product has been laid down on our western coast and rushed by special fast express to the cast for the Christmas trade.

A low estimate of China’s production of raw silk would be 120,000,000 pounds annually, and this with the output of Japan, Korea and a small area of southern Manchuria, would probably exceed 150,000,000 pounds annually, representing a total value of perhaps $700,000,000, quite equaling in value the wheat crop of the United States, but produced on less than one-eighth the area of our wheat fields.

The cultivation of tea in China and Japan is another of the great industries of these nations, taking rank with that of sericulture if not above it in the important part it plays in the welfare of the people.  There is little reason to doubt that this industry has its foundation in the need of something to render boiled water palatable for drinking purposes.  The drinking of boiled water is universally adopted in these countries as an individually available and thoroughly efficient safeguard against that class of deadly disease germs which thus far it has been impossible to exclude from the drinking water of any densely peopled country.

Judged by the success of the most thorough sanitary measures thus far instituted, and taking into consideration the inherent difficulties which must increase enormously with increasing populations, it appears inevitable that modern methods must ultimately fail in sanitary efficiency and that absolute safety can be secured only in some manner having the equivalent effect of boiling drinking water, long ago adopted by the Mongolian races.

In the year 1907 Japan had 124,482 acres of land in tea plantations, producing 60,877,975 pounds of cured tea.  In China the volume annually produced is much larger than that of Japan, 40,000,000 pounds going annually to Tibet alone from the Szechwan province and the direct export to foreign countries was, in 1905, 176,027,255 pounds, and in 1906 it was 180,271,000, so that their annual export must exceed 200,000,000 pounds with a total annual output more than double this amount of cured tea.

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But above any other factor, and perhaps greater than all of them combined in contributing to the high maintenance efficiency attained in these countries must be placed the standard of living to which the industrial classes have been compelled to adjust themselves, combined with their remarkable industry and with the most intense economy they practice along every line of effort and of living.

Almost every foot of land is made to contribute material for food, fuel or fabric.  Everything which can be made edible serves as food for man or domestic animals.  Whatever cannot be eaten or worn is used for fuel.  The wastes of the body, of fuel and of fabric worn beyond other use are taken back to the field; before doing so they are housed against waste from weather, compounded with intelligence and forethought and patiently labored with through one, three or even six months, to bring them into the most efficient form to serve as manure for the soil or as feed for the crop.  It seems to be a golden rule with these industrial classes, or if not golden, then an inviolable one, that whenever an extra hour or day of labor can promise even a little larger return then that shall be given, and neither a rainy day nor the hottest sunshine shall be permitted to cancel the obligation or defer its execution.

**I**

**FIRST GLIMPSES OF JAPAN**

We left the United States from Seattle for Shanghai, China, sailing by the northern route, at one P. M. February second, reaching Yokohama February 19th and Shanghai, March 1st.  It was our aim throughout the journey to keep in close contact with the field and crop problems and to converse personally, through interpreters or otherwise, with the farmers, gardeners and fruit growers themselves; and we have taken pains in many cases to visit the same fields or the same region two, three or more times at different intervals during the season in order to observe different phases of the same cultural or fertilization methods as these changed or varied with the season.

Our first near view of Japan came in the early morning of February 19th when passing some three miles off the point where the Pacific passenger steamer Dakota was beached and wrecked in broad daylight without loss of life two years ago.  The high rounded hills were clothed neither in the dense dark forest green of Washington and Vancouver, left sixteen days before, nor yet in the brilliant emerald such as Ireland’s hills in June fling in unparalleled greeting to passengers surfeited with the dull grey of the rolling ocean.  This lack of strong forest growth and even of shrubs and heavy herbage on hills covered with deep soil, neither cultivated nor suffering from serious erosion, yet surrounded by favorable climatic conditions, was our first great surprise.

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To the southward around the point, after turning northward into the deep bay, similar conditions prevailed, and at ten o’clock we stood off Uraga where Commodore Perry anchored on July 8th, 1853, bearing to the Shogun President Fillmore’s letter which opened the doors of Japan to the commerce of the world and, it is to be hoped brought to her people, with their habits of frugality and industry so indelibly fixed by centuries of inheritance, better opportunities for development along those higher lines destined to make life still more worth living.

As the Tosa Maru drew alongside the pier at Yokohama it was raining hard and this had attired an army after the manner of Robinson Crusoe, dressed as seen in Fig. 1, ready to carry you and yours to the Customs house and beyond for one, two, three or five cents.  Strong was the contrast when the journey was reversed and we descended the gang plank at Seattle, where no one sought the opportunity of moving baggage.

Through the kindness of Captain Harrison of the Tosa Maru in calling an interpreter by wireless to meet the steamer, it was possible to utilize the entire interval of stop in Yokohama to the best advantage in the fields and gardens spread over the eighteen miles of plain extending to Tokyo, traversed by both electric tram and railway lines, each running many trains making frequent stops; so that this wonderfully fertile and highly tilled district could be readily and easily reached at almost any point.

We had left home in a memorable storm of snow, sleet and rain which cut out of service telegraph and telephone lines over a large part of the United States; we had sighted the Aleutian Islands, seeing and feeling nothing on the way which could suggest a warm soil and green fields, hence our surprise was great to find the jinricksha men with bare feet and legs naked to the thighs, and greater still when we found, before we were outside the city limits, that the electric tram was running between fields and gardens green with wheat, barley, onions, carrots, cabbage and other vegetables.  We were rushing through the Orient with everything outside the car so strange and different from home that the shock came like a bolt of lightning out of a clear sky.

In the car every man except myself and one other was smoking tobacco and that other was inhaling camphor through an ivory mouthpiece resembling a cigar holder closed at the end.  Several women, tiring of sitting foreign style, slipped off—­I cannot say out of—­their shoes and sat facing the windows, with toes crossed behind them on the seat.  The streets were muddy from the rain and everybody Japanese was on rainy-day wooden shoes, the soles carried three to four inches above the ground by two cross blocks, in the manner seen in Fig. 2.  A mother, with baby on her back and a daughter of sixteen years came into the car.  Notwithstanding her high shoes the mother had dipped one toe into the mud.  Seated,

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she slipped her foot off.  Without evident instructions the pretty black-eyed, glossy-haired, red-lipped lass, with cheeks made rosy, picked up the shoe, withdrew a piece of white tissue paper from the great pocket in her sleeve, deftly cleaned the otherwise spotless white cloth sock and then the shoe, threw the paper on the floor, looked to see that her fingers were not soiled, then set the shoe at her mother’s foot, which found its place without effort or glance.

Everything here was strange and the scenes shifted with the speed of the wildest dream.  Now it was driving piles for the foundation of a bridge.  A tripod of poles was erected above the pile and from it hung a pulley.  Over the pulley passed a rope from the driving weight and from its end at the pulley ten cords extended to the ground.  In a circle at the foot of the tripod stood ten agile Japanese women.  They were the hoisting engine.  They chanted in perfect rhythm, hauled and stepped, dropped the weight and hoisted again, making up for heavier hammer and higher drop by more blows per minute.  When we reached Shanghai we saw the pile driver being worked from above.  Fourteen Chinese men stood upon a raised staging, each with a separate cord passing direct from the hand to the weight below.  A concerted, half-musical chant, modulated to relieve monotony, kept all hands together.  What did the operation of this machine cost?  Thirteen cents, gold, per man per day, which covered fuel and lubricant, both automatically served.  Two additional men managed the piles, two directed the hammer, eighteen manned the outfit.  Two dollars and thirty-four cents per day covered fuel, superintendence and repairs.  There was almost no capital invested in machinery.  Men were plenty and to spare.  Rice was the fuel, cooked without salt, boiled stiff, reinforced with a hit of pork or fish, appetized with salted cabbage or turnip and perhaps two or three of forty and more other vegetable relishes.  And are these men strong and happy?  They certainly were strong.  They are steadily increasing their millions, and as one stood and watched them at their work their faces were often wreathed in smiles and wore what seemed a look of satisfaction and contentment.

Among the most common sights on our rides from Yokohama to Tokyo, both within the city and along the roads leading to the fields, starting early in the morning, were the loads of night soil carried on the shoulders of men and on the backs of animals, but most commonly on strong carts drawn by men, bearing six to ten tightly covered wooden containers holding forty, sixty or more pounds each.  Strange as it may seem, there are not today and apparently never have been, even in the largest and oldest cities of Japan, China or Korea, anything corresponding to the hydraulic systems of sewage disposal used now by western nations.  Provision is made for the removal of storm waters but when I asked my interpreter if it was not the custom of the city during the winter months to discharge

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its night soil into the sea, as a quicker and cheaper mode of disposal, his reply came quick and sharp, “No, that would be waste.  We throw nothing away.  It is worth too much money.”  In such public places as rail way stations provision is made for saving, not for wasting, and even along the country roads screens invite the traveler to stop, primarily for profit to the owner more than for personal convenience.

Between Yokohama and Tokyo along the electric car line and not far distant from the seashore, there were to be seen in February very many long, fence-high screens extending east and west, strongly inclined to the north, and built out of rice straw, closely tied together and supported on bamboo poles carried upon posts of wood set in the ground.  These screens, set in parallel series of five to ten or more in number and several hundred feet long, were used for the purpose of drying varieties of delicate seaweed, these being spread out in the manner shown in Fig. 3.

The seaweed is first spread upon separate ten by twelve inch straw mats, forming a thin layer seven by eight inches.  These mats are held by means of wooden skewers forced through the body of the screen, exposing the seaweed to the direct sunshine.  After becoming dry the rectangles of seaweed are piled in bundles an inch thick, cut once in two, forming packages four by seven inches, which are neatly tied and thus exposed for sale as soup stock and for other purposes.  To obtain this seaweed from the ocean small shrubs and the limbs of trees are set up in the bottom of shallow water, as seen in Fig. 4.  To these limbs the seaweeds become attached, grow to maturity and are then gathered by hand.  By this method of culture large amounts of important food stuff are grown for the support of the people on areas otherwise wholly unproductive.

Another rural feature, best shown by photograph taken in February, is the method of training pear orchards in Japan, with their limbs tied down upon horizontal over-bead trellises at a height under which a man can readily walk erect and easily reach the fruit with the hand while standing upon the ground.  Pear orchards thus form arbors of greater or less size, the trees being set in quincunx order about twelve feet apart in and between the rows.  Bamboo poles are used overhead and these carried on posts of the same material 1.5 to 2.5 inches in diameter, to which they are tied.  Such a pear orchard is shown in Fig. 5.

The limbs of the pear trees are trained strictly in one plane, tying them down and pruning out those not desired.  As a result the ground beneath is completely shaded and every pear is within reach, which is a great convenience when it becomes desirable to protect the fruit from insects, by tying paper bags over every pear as seen in Figs. 6 and 7.  The orchard ground is kept free from weeds and not infrequently is covered with a layer of rice or other straw, extensively used in Japan as a ground cover with various crops and when so used is carefully laid in handfuls from bundles, the straws being kept parallel as when harvested.

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To one from a country of 160-acre farms, with roads four rods wide; of cities with broad streets and residences with green lawns and ample back yards; and where the cemeteries are large and beautiful parks, the first days of travel in these old countries force the over-crowding upon the attention as nothing else can.  One feels that the cities are greatly over-crowded with houses and shops, and these with people and wares; that the country is over-crowded with fields and the fields with crops; and that in Japan the over-crowding is greatest of all in the cemeteries, gravestones almost touching and markers for families literally in bundles at a grave, while round about there may be no free country whatever, dwellings, gardens or rice paddies contesting the tiny allotted areas too closely to leave even foot-paths between.

Unless recently modified through foreign influence the streets of villages and cities are narrow, as seen in Fig. 8, where however the street is unusually broad.  This is a village in the Hakone district on a beautiful lake of the same name, where stands an Imperial summer palace, seen near the center of the view on a hill across the lake.  The roofs of the houses here are typical of the neat, careful thatching with rice straw, very generally adopted in place of tile for the country villages throughout much of Japan.  The shops and stores, open full width directly upon the street, are filled to overflowing, as seen in Fig. 9 and in Fig. 22.

In the canalized regions of China the country villages crowd both banks of a canal, as is the case in Fig. 10.  Here, too, often is a single street and it very narrow, very crowded and very busy.  Stone steps lead from the houses down into the water where clothing, vegetables, rice and what not are conveniently washed.  In this particular village two rows of houses stand on one side of the canal separated by a very narrow street, and a single row on the other.  Between the bridge where the camera was exposed and one barely discernible in the background, crossing the canal a third of a mile distant, we counted upon one side, walking along the narrow street, eighty houses each with its family, usually of three generations and often of four.  Thus in the narrow strip, 154 feet broad, including 16 feet of street and 30 feet of canal, with its three lines of houses. lived no less than 240 families and more than 1200 and probably nearer 2000 people.

When we turn to the crowding of fields in the country nothing except seeing can tell so forcibly the fact as such landscapes as those of Figs. 11, 12 and 13, one in Japan, one in Korea and one in China, not far from Nanking, looking from the hills across the fields to the broad Yangtse kiang, barely discernible as a band of light along the horizon.

The average area of the rice field in Japan is less than five square rods and that of her upland fields only about twenty.  In the case of the rice fields the small size is necessitated partly by the requirement of holding water on the sloping sides of the valley, as seen in Fig. 11.  These small areas do not represent the amount of land worked by one family, the average for Japan being more nearly 2.5 acres.  But the lands worked by one family are seldom contiguous, they may even be widely scattered and very often rented.

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The people generally live in villages, going often considerable distances to their work.  Recognizing the great disadvantage of scattered holdings broken into such small areas, the Japanese Government has passed laws for the adjustment of farm lands which have been in force since 1900.  It provides for the exchange of lands; for changing boundaries; for changing or abolishing roads, embankments, ridges or canals and for alterations in irrigation and drainage which would ensure larger areas with channels and roads straightened, made less numerous and less wasteful of time, labor and land.  Up to 1907 Japan had issued permits for the readjustment of over 240,000 acres, and Fig. 14 is a landscape in one of these readjusted districts.  To provide capable experts for planning and supervising these changes the Government in 1905 intrusted the training of men to the higher agricultural school belonging to the Dai Nippon Agricultural Association and since 1906 the Agricultural College and the Kogyokusha have undertaken the same task and now there are men sufficient to push the work as rapidly as desired.

It may be remembered, too, as showing how, along other fundamental lines, Japan is taking effective steps to improve the condition of her people, that she already has her Imperial highways extending from one province to another; her prefectural roads which connect the cities and villages within the prefecture; and those more local which serve the farms and villages.  Each of the three systems of roads is maintained by a specific tax levied for the purpose which is expended under proper supervision, a designated section of road being kept in repair through the year by a specially appointed crew, as is the practice in railroad maintenance.  The result is, Japan has roads maintained in excellent condition, always narrow, sacrificing the minimum of land, and everywhere without fences.

How the fields are crowded with crops and all available land is made to do full duty in these old, long-tilled countries is evident in Fig. 15 where even the narrow dividing ridges but a foot wide, which retain the water on the rice paddies, are bearing a heavy crop of soy beans; and where may be seen the narrow pear orchard standing on the very slightest rise of ground, not a foot above the water all around, which could better be left in grading the paddies to proper level.

How closely the ground itself may be crowded with plants is seen in Fig. 16, where a young peach orchard, whose tree tops were six feet through, planted in rows twenty-two feet apart, had also ten rows of cabbage, two rows of large windsor beans and a row of garden peas.  Thirteen rows of vegetables in 22 feet, all luxuriant and strong, and note the judgment shown in placing the tallest plants, needing the most sun, in the center between the trees.

But these old people, used to crowding and to being crowded, and long ago capable of making four blades of grass grow where Nature grew but one, have also learned how to double the acreage where a crop needs more elbow than it does standing room, as seen in Fig. 17.  This man’s garden had an area of but 63 by 68 feet and two square rods of this was held sacred to the family grave mound, and yet his statement of yields, number of crops and prices made his earning $100 a year on less than one-tenth of an acre.

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His crop of cucumbers on less than .06 of an acre would bring him $20.  He had already sold $5 worth of greens and a second crop would follow the cucumbers.  He had just irrigated his garden from an adjoining canal, using a foot-power pump, and stated that until it rained he would repeat the watering once per week.  It was his wife who stood in the garden and, although wearing trousers, her dress showed full regard for modesty.

But crowding crops more closely in the field not only requires higher feeding to bring greater returns, but also relatively greater care, closer watchfulness in a hundred ways and a patience far beyond American measure; and so, before the crowding of the crops in the field and along with it, there came to these very old farmers a crowding of the grey matter in the brain with the evolution of effective texture.  This is shown in his fields which crowd the landscape.  It is seen in the crops which crowd his fields.  You see it in the old man’s face, Fig. 18, standing opposite his compeer, Prince Ching, Fig. 19, each clad in winter dress which is the embodiment of conversation, retaining the fires of the body for its own needs, to release the growth on mountain sides for other uses.  And when one realizes how, nearly to the extreme limits, conservation along all important lines is being practiced as an inherited instinct, there need be no surprise when one reflects that the two men, one as feeder and the other as leader, are standing in the fore of a body of four hundred millions of people who have marched as a nation through perhaps forty centuries, and who now, in the light and great promise of unfolding science have their faces set toward a still more hopeful and longer future.

On February 21st the Tosa Maru left Yokohama for Kobe at schedule time on the tick of the watch, as she had done from Seattle.  All Japanese steamers appear to be moved with the promptness of a railway train.  On reaching Kobe we transferred to the Yamaguchi Maru which sailed the following morning, to shorten the time of reaching Shanghai.  This left but an afternoon for a trip into the country between Kobe and Osaka, where we found, if possible, even higher and more intensive culture practices than on the Tokyo plain, there being less land not carrying a winter crop.  And Fig. 20 shows how closely the crops crowd the houses and shops.  Here were very many cement lined cisterns or sheltered reservoirs for collecting manures and preparing fertilizers and the appearance of both soil and crops showed in a marked manner to what advantage.  We passed a garden of nearly an acre entirely devoted to English violets just coming into full bloom.  They were grown in long parallel east and west beds about three feet wide.  On the north edge of each bed was erected a rice-straw screen four feet high which inclined to the south, overhanging the bed at an angle of some thirty-five degrees, thus forming a sort of bake-oven tent which reflected the sun, broke the force of the wind and checked the loss of heat absorbed by the soil.

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The voyage from Kobe to Moji was made between 10 in the morning, February 24th, and 5 .30 P. M. of February 25th over a quiet sea with an enjoyable ride.  Being fogbound during the night gave us the whole of Japan’s beautiful Inland Sea, enchanting beyond measure, in all its near and distant beauty but which no pen, no brush, no camera may attempt.  Only the eye can convey.  Before reaching harbor the tide had been rising and the strait separating Honshu from Kyushu island was running like a mighty swirling river between Moji and Shimonoseki, dangerous to attempt in the dark, so we waited until morning.

There was cargo to take on board and the steamer must coal.  No sooner had the anchor dropped and the steamer swung into the current than lighters came alongside with out-going freight.  The small, strong, agile Japanese stevedores had this task completed by 8:30 P. M. and when we returned to the deck after supper another scene was on.  The cargo lighters had gone and four large barges bearing 250 tons of coal had taken their places on opposite sides of the steamer, each illuminated with buckets of blazing coal or by burning conical heaps on the surface.  From the bottom of these pits in the darkness the illumination suggested huge decapitated ant heaps in the wildest frenzy, for the coal seemed covered and there was hurry in every direction.  Men and women, boys and girls, bending to their tasks, were filling shallow saucer-shaped baskets with coal and stacking them eight to ten high in a semi-circle, like coin for delivery.  Rising out of these pits sixteen feet up the side of the steamer and along her deck to the chutes leading to her bunkers were what seemed four endless human chains, in service the prototype of our modern conveyors, but here each link animated by its own power.  Up these conveyors the loaded buckets passed, one following another at the rate of 40 to 60 per minute, to return empty by the descending line, and over the four chains one hundred tons per hour, for 250 tons of coal passed to the bunkers in two and a half hours.  Both men and women stood in the line and at the upper turn of one of these, emptying the buckets down the chute, was a mother with her two-year-old child in the sling on back, where it rocked and swayed to and fro, happy the entire time.  It was often necessary for the mother to adjust her baby in the sling whenever it was leaning uncomfortably too far to one side or the other, but she did it skillfully, always with a shrug of the shoulders, for both hands were full.  The mother looked strong, was apparently accepting her lot as a matter of course and often, with a smile, turned her face to the child, who patted it and played with her ears and hair.  Probably her husband was doing his part in a more strenuous place in the chain and neither had time to be troubled with affinities for it was 10:30 P. M. when the baskets stopped, and somewhere no doubt there was a home to be reached and perhaps supper to get.  Shall we be able, when our numbers have vastly increased, to permit all needful earnings to be acquired in a better way?

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We left Moji in the early morning and late in the evening of the same day entered the beautiful harbor of Nagasaki, all on board waiting until morning for a launch to go ashore.  We were to sail again at noon so available time for observation was short and we set out in a ricksha at once for our first near view of terraced gardening on the steep hillsides in Japan.  In reaching them and in returning our course led through streets paved with long, thick and narrow stone blocks, having deep open gutters on one or both sides close along the houses, into which waste water was emptied and through which the storm waters found their way to the sea.  Few of these streets were more than twelve feet wide and close watching, with much dodging, was required to make way through them.  Here, too, the night soil of the city was being removed in closed receptacles on the shoulders of men, on the backs of horses and cattle and on carts drawn by either.  Other men and women were hurrying along with baskets of vegetables well illustrated in Fig. 21, some with fresh cabbage, others with high stacks of crisp lettuce, some with monstrous white radishes or turnips, others with bundles of onions, all coming down from the terraced gardens to the markets.  We passed loads of green bamboo poles just cut, three inches in diameter at the butt and twenty feet long, drawn on carts.  Both men and women were carrying young children and older ones were playing and singing in the street.  Very many old women, some feeble looking, moved, loaded, through the throng.  Homely little dogs, an occasional lean cat, and hens and roosters scurried across the street from one low market or store to another.  Back of the rows of small stores and shops fronting on the clean narrow streets were the dwellings whose exits seemed to open through the stores, few or no open courts of any size separating them from the market or shop.  The opportunity which the oriental housewife may have in the choice of vegetables on going to the market, and the attractive manner of displaying such products in Japan, are seen in Fig. 22.

We finally reached one of the terraced hillsides which rise five hundred to a thousand feet above the harbor with sides so steep that garden areas have a width of seldom more than twenty to thirty feet and often less, while the front of each terrace may be a stone wall, sometimes twelve feet high, often more than six, four and five feet being the most common height.  One of these hillside slopes is seen in Fig. 23.  These terraced gardens are both short and narrow and most of them bounded by stone walls on three sides, suggesting house foundations, the two end walls sloping down the hill from the height of the back terrace, dropping to the ground level in front, these forming foot-paths leading up the slope occasionally with one, two or three steps in places.

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Each terrace sloped slightly down the hill at a small angle and had a low ridge along the front.  Around its entire border a narrow drain or furrow was arranged to collect surface water and direct it to drainage channels or into a catch basin where it might be put back on the garden or be used in preparing liquid fertilizer.  At one corner of many of these small terraced gardens were cement lined pits, used both as catch basins for water and as receptacles for liquid manure or as places in which to prepare compost.  Far up the steep paths, too, along either side, we saw many piles of stable manure awaiting application, all of which had been brought up the slopes in backets on bamboo poles, carried on the shoulders of men and women.

**II**

**GRAVE LANDS OF CHINA**

The launch had returned the passengers to the steamer at 11:30; the captain was on the bridge; prompt to the minute at the call “Hoist away” the signal went below and the Yamaguchi’s whistle filled the harbor and over-flowed the hills.  The cable wound in, and at twelve, noon, we were leaving Nagasaki, now a city of 153,000 and the western doorway of a nation of fifty-one millions of people but of little importance before the sixteenth century when it became the chief mart of Portuguese trade.  We were to pass the Koreans on our right and enter the portals of a third nation of four hundred millions.  We had left a country which had added eighty-five millions to its population in one hundred years and which still has twenty acres for each man, woman and child, to pass through one which has but one and a half acres per capita, and were going to another whose allotment of acres, good and bad, is less than 2.4.  We had gone from practices by which three generations had exhausted strong virgin fields, and were coming to others still fertile after thirty centuries of cropping.  On January 30th we crossed the head waters of the Mississippi-Missouri, four thousand miles from its mouth, and on March 1st were in the mouth of the Yangtse river whose waters are gathered from a basin in which dwell two hundred millions of people.

The Yamaguchi reached Woosung in the night and anchored to await morning and tide before ascending the Hwangpoo, believed by some geographers to be the middle of three earlier delta arms of the Yangtse kiang, the southern entering the sea at Hangchow 120 miles further south, the third being the present stream.  As we wound through this great delta plain toward Shanghai, the city of foreign concessions to all nationalities, the first striking feature was the “graves of the fathers”, of “the ancestors”.  At first the numerous grass-covered hillocks dotting the plain seemed to be stacks of grain or straw; then came the query whether they might not be huge compost heaps awaiting distribution in the fields, but as the river brought us nearer to them we seemed to be moving through a land of ancient mound builders and Fig. 24 shows, in its upper section, their appearance as seen in the distance.

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As the journey led on among the fields, so large were the mounds, often ten to twelve feet high and twenty or more feet at the base; so grass-covered and apparently neglected; so numerous and so irregularly scattered, without apparent regard for fields, that when we were told these were graves we could not give credence to the statement, but before the city was reached we saw places where, by the shifting of the channel, the river had cut into some of these mounds, exposing brick vaults, some so low as to be under water part of the time, and we wonder if the fact does not also record a slow subsidence of the delta plain under the ever increasing load of river silt.

A closer view of these graves in the same delta plain is given in the lower section of Fig. 24, where they are seen in the midst of fields and to occupy not only large areas of valuable land but to be much in the way of agricultural operations.  A still closer view of other groups, with a farm village in the background, is shown in the middle section of the same illustration, and here it is better seen how large is the space occupied by them.  On the right in the same view may be seen a line of six graves surmounting a common lower base which is a type of the larger and higher ones so suggestive of buildings seen in the horizon of the upper section.

Everywhere we went in China, about all of the very old and large cities, the proportion of grave land to cultivated fields is very large.  In the vicinity of Canton Christian college, on Honam island, more than fifty per cent of the land was given over to graves and in many places they were so close that one could step from one to another.  They are on the higher and dryer lands, the cultivated areas occupying ravines and the lower levels to which water may be more easily applied and which are the most productive.  Hilly lands not so readily cultivated, and especially if within reach of cities, are largely so used, as seen in Fig. 25, where the graves are marked by excavated shelves rather than by mounds, as on the plains.  These grave lands are not altogether unproductive for they are generally overgrown with herbage of one or another kind and used as pastures for geese, sheep, goats and cattle, and it is not at all uncommon, when riding along a canal, to see a huge water buffalo projected against the sky from the summit of one of the largest and highest grave mounds within reach.  If the herbage is not fed off by animals it is usually cut for feed, for fuel, for green manure or for use in the production of compost to enrich the soil.

Caskets may be placed directly upon the surface of a field, encased in brick vaults with tile roofs, forming such clusters as was seen on the bank of the Grand Canal in Chekiang province, represented in the lower section of Fig. 26, or they may stand singly in the midst of a garden, as in the upper section of the same figure; in a rice paddy entirely surrounded by water parts of the year, and indeed in almost any unexpected place.  In Shanghai in 1898, 2,763 exposed coffined corpses were removed outside the International Settlement or buried by the authorities.

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Further north, in the Shantung province, where the dry season is more prolonged and where a severe drought had made grass short, the grave lands had become nearly naked soil, as seen in Fig. 27 where a Shantung farmer had just dug a temporary well to irrigate his little field of barley.  Within the range of the camera, as held to take this view, more than forty grave mounds besides the seven near by, are near enough to be fixed on the negative and be discernible under a glass, indicating what extensive areas of land, in the aggregate, are given over to graves.

Still further north, in Chihli, a like story is told in, if possible, more emphatic manner and fully vouched for in the next illustration, Fig. 28, which shows a typical family group, to be observed in so many places between Taku and Tientsin and beyond toward Peking.  As we entered the mouth of the Pei-ho for Tientsin, far away to the vanishing horizon there stretched an almost naked plain except for the vast numbers of these “graves of the fathers”, so strange, so naked, so regular in form and so numerous that more than an hour of our journey had passed before we realized that they were graves and that the country here was perhaps more densely peopled with the dead than with the living.  In so many places there was the huge father grave, often capped with what in the distance suggested a chimney, and the many associated smaller ones, that it was difficult to realize in passing what they were.

It is a common custom, even if the residence has been permanently changed to some distant province, to take the bodies back for interment in the family group; and it is this custom which leads to the practice of choosing a temporary location for the body, waiting for a favorable opportunity to remove it to the family group.  This is often the occasion for the isolated coffin so frequently seen under a simple thatch of rice straw, as in Fig. 29; and the many small stone jars containing skeletons of the dead, or portions of them, standing singly or in rows in the most unexpected places least in the way in the crowded fields and gardens, awaiting removal to the final resting place.  It is this custom, too, I am told, which has led to placing a large quantity of caustic lime in the bottom of the casket, on which the body rests, this acting as an effective absorbent.

It is the custom in some parts of China, if not in all, to periodically restore the mounds, maintaining their height and size, as is seen in the next two illustrations, and to decorate these once in the year with flying streamers of colored paper, the remnants of which may be seen in both Figs. 30 and 31, set there as tokens that the paper money has been burned upon them and its essence sent up in the smoke for the maintenance of the spirits of their departed friends.  We have our memorial day; they have for centuries observed theirs with religious fidelity.

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The usual expense of a burial among the working people is said to be $100, Mexican, an enormous burden when the day’s wage or the yearly earning of the family is considered and when there is added to this the yearly expense of ancestor worship.  How such voluntary burdens are assumed by people under such circumstances is hard to understand.  Missionaries assert it is fear of evil consequences in this life and of punishment and neglect in the hereafter that leads to assuming them.  Is it not far more likely that such is the price these people are willing to pay for a good name among the living and because of their deep and lasting friendship for the departed?  Nor does it seem at all strange that a kindly, warm-hearted people with strong filial affection should have reached, carry in their long history, a belief in one spirit of the departed which hovers about the home, one which hovers about the grave and another which wanders abroad, for surely there are associations with each of these conditions which must long and forcefully awaken memories of friends gone.  If this view is possible may not such ancestral worship be an index of qualities of character strongly fixed and of the highest worth which, when improvements come that may relieve the heavy burdens now carried, will only shine more brightly and count more for right living as well as comfort?

Even in our own case it will hardly be maintained that our burial customs have reached their best and final solution, for in all civilized nations they are unnecessarily expensive and far too cumbersome.  It is only necessary to mentally add the accumulation of a few centuries to our cemeteries to realize how impossible our practice must become.  Clearly there is here a very important line for betterment which all nationalities should undertake.

When the steamer anchored at Shanghai the day was pleasant and the rain coats which greeted us in Yokohama were not in evidence but the numbers who had met the steamer in the hope of an opportunity for earning a trifle was far greater and in many ways in strong contrast with the Japanese.  We were much surprised to find the men of so large stature, much above the Chinese usually seen in the United States.  They were fully the equal of large Americans in frame but quite without surplus flesh yet few appeared underfed.  To realize that these are strong, hardy men it was only necessary to watch them carrying on their shoulders bales of cotton between them, supported by a strong bamboo; while the heavy loads they transport on wheel-barrows through the country over long distances, as seen in Fig. 32, prove their great endurance.  This same type of vehicle, too, is one of the common means of transporting people, especially Chinese women, and four six and even eight may be seen riding together, propelled by a single wheelbarrow man.

**III**

**TO HONGKONG AND CANTON**

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We had come to learn how the old-world farmers bad been able to provide materials for food and clothing on such small areas for so many millions, at so low a price, during so many centuries, and were anxious to see them at the soil and among the crops.  The sun was still south of the equator, coming north only about twelve miles per day, so, to save time, we booked on the next steamer for Hongkong to meet spring at Canton, beyond the Tropic of Cancer, six hundred miles farther south, and return with her.

On the morning of March 4th the Tosa Maru steamed out into the Yangtse river, already flowing with the increased speed of ebb tide.  The pilots were on the bridge to guide her course along the narrow south channel through waters seemingly as brown and turbid as the Potomac after a rain.  It was some distance beyond Gutzlaff Island, seventy miles to sea, where there is a lighthouse and a telegraph station receiving six cables, that we crossed the front of the out-going tide, showing in a sharp line of contrast stretching in either direction farther than the eye could see, across the course of the ship and yet it was the season of low water in this river.  During long ages this stream of mighty volume has been loading upon itself in far-away Tibet, without dredge, barge, fuel or human effort, unused and there unusable soils, bringing them down from inaccessible heights across two or three thousand miles, building up with them, from under the sea, at the gateways of commerce, miles upon miles of the world’s most fertile fields and gardens.  Today on this river, winding through six hundred miles of the most highly cultivated fields, laid out on river-built plains, go large ocean steamers to the city of Hankow-Wuchang-Hanyang where 1,770,000 people live and trade within a radius less than four miles; while smaller steamers push on a thousand miles and are then but 130 feet above sea level.

Even now, with the aid of current, tide and man, these brown turbid waters are rapidly adding fertile delta plains for new homes.  During the last twenty-five years Chungming island has grown in length some 1800 feet per year and today a million people are living and growing rice, wheat, cotton and sweet potatoes on 270 square miles of fertile plain where five hundred years ago were only submerged river sands and silt.  Here 3700 people per square mile have acquired homes.

The southward voyage was over a quiet sea and as we passed among and near the off-shore islands these, as seen in Japan, appeared destitute of vegetation other than the low herbaceous types with few shrubs and almost no forest growth and little else that gave the appearance of green.  Captain Harrison informed me that at no time in the year are these islands possessed of the grass-green verdure so often seen in northern climates, and yet the islands lie in a region of abundant summer rain, making it hard to understand why there is not a more luxuriant growth.

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Sunday morning, March 7th, passing first extensive sugar refineries, found us entering the long, narrow and beautiful harbor of Hongkong.  Here, lying at anchor in the ten square miles of water, were five battleships, several large ocean steamers, many coastwise vessels and a multitude of smaller craft whose yearly tonnage is twenty to thirty millions.  But the harbor lies in the track of the terrible East Indian typhoon and, although sheltered on the north shore of a high island, one of these storms recently sunk nine vessels, sent twenty-three ashore, seriously damaged twenty-one others, wrought great destruction among the smaller craft and over a thousand dead were recovered.  Such was the destruction wrought by the September storm of 1906.

Our steamer did not go to dock but the Nippon Yusen Kaisha’s launch transferred us to a city much resembling Seattle in possessing a scant footing between a long sea front and high steep mountain slopes behind.  Here cliffs too steep to climb rise from the very sidewalk and are covered with a great profusion and variety of ferns, small bamboo, palms, vines, many flowering shrubs, all interspersed with pine and great banyan trees that do so much toward adding the beauty of northern landscapes to the tropical features which reach upward until hidden in a veil of fog that hung, all of the time we were there, over the city, over the harbor and stretched beyond Old and New Kowloon.

Hongkong island is some eleven miles long and but two to five miles wide, while the peak carrying the signal staff rises 1,825 feet above the streets from which ascends the Peak tramway, where, hanging from opposite ends of a strong cable, one car rises up the slope and another descends every fifteen to twenty minutes, affording communication with business houses below and homes in beautiful surroundings and a tempered climate above.  Extending along the slopes of the mountains, too, above the city, are very excellent roads, carefully graded, provided with concrete gutters and bridges, along which one may travel on foot, on horseback, by ricksha or sedan chair, but too narrow for carriages.  Over one of these we ascended along one side of Happy Valley, around its head and down the other side.  Only occasionally could we catch glimpses of the summit through the lifting fog but the views, looking down and across the city and beyond the harbor with its shipping, and up and down the many ravines from via-ducts, are among the choicest and rarest ever made accessible to the residents of any city.  It was the beginning of the migratory season for birds, and trees and shrubbery thronged with many species.

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Many of the women in Hongkong were seen engaged in such heavy manual labor with the men as carrying crushed rock and sand, for concrete and macadam work, up the steep street slopes long distances from the dock, but they were neither tortured nor incapacitated by bound feet.  Like the men, they were of smaller stature than most seen at Shanghai and closely resemble the Chinese in the United States.  Both sexes are agile, wiry and strong.  Here we first saw lumber sawing in the open streets after the manner shown in Fig. 33, where wide boards were being cut from camphor logs.  In the damp, already warm weather the men were stripped to the waist, their limbs bare to above the knee, and each carried a large towel for wiping away the profuse perspiration.

It was here, too, that we first met the remarkable staging for the erection of buildings of four and six stories, set up without saw, hammer or nail; without injury to or waste of lumber and with the minimum of labor in construction and removal.  Poles and bamboo stems were lashed together with overlapping ends, permitting any interval or height to be secured without cutting or nailing, and admitting of ready removal with absolutely no waste, all parts being capable of repeated use unless it be some of the materials employed in tying members.  Up inclined stairways, from staging to staging, in the erection of six-story granite buildings, mortar was being carried in baskets swinging from bamboo poles on the shoulders of men and women, as the cheapest hoists available in English Hongkong where there is willing human labor and to spare.

The Singer sewing machine, manufactured in New Jersey, was seen in many Chinese shops in Hongkong and other cities, operated by Chinese men and women, purchased, freight prepaid, at two-thirds the retail price in the United States.  Such are the indications of profit to manufacturers on the home sale of home-made goods while at the same time reaping good returns from a large trade in heathen lands, after paying the freight.

Industrial China, Korea and Japan do not observe our weekly day of rest and during our walk around Happy Valley on Sunday afternoon, looking down upon its terraced gardens and tiny fields, we saw men and women busy fitting the soil for new crops, gathering vegetables for market, feeding plants with liquid manure and even irrigating certain crops, notwithstanding the damp, foggy, showery weather.  Turning the head of the valley, attention was drawn to a walled enclosure and a detour down the slope brought us to a florist’s garden within which were rows of large potted foliage plants of semi-shrubbery habit, seen in Fig. 35, trained in the form of life-size human figures with limbs, arms and trunk provided with highly glazed and colored porcelain feet, hands and head.  These, with many other potted plants and trees, including dwarf varieties, are grown under out-door lattice shelters in different parts of China, for sale to the wealthy Chinese families.

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How thorough is the tillage, how efficient and painstaking the garden fitting, and how closely the ground is crowded to its upper limit of producing power are indicated in Fig. 36; and when one stops and studies the detail in such gardens he expects in its executor an orderly, careful, frugal and industrious man, getting not a little satisfaction out of his creations however arduous his task or prolonged his day.  If he is in the garden or one meets him at the house, clad as the nature of his duties and compensation have determined, you may be disappointed or feel arising an unkind judgment.  But who would risk a reputation so clad and so environed?  Many were the times, during our walks in the fields and gardens among these old, much misunderstood, misrepresented and undervalued people, when the bond of common interest was recognized between us, that there showed through the face the spirit which put aside both dress and surroundings and the man stood forth who, with fortitude and rare wisdom, is feeding the millions and who has carried through centuries the terrible burden of taxes levied by dishonor and needless wars.  Nay, more than this, the man stood forth who has kept alive the seeds of manhood and has nourished them into such sturdy stock as has held the stream of progress along the best interests of civilization in spite of the driftwood heaped upon it.

Not only are these people extremely careful and painstaking in fitting their fields and gardens to receive the crop, but they are even more scrupulous in their care to make everything that can possibly serve as fertilizer for the soil, or food for the crop being grown, do so unless there is some more remunerative service it may render.  Expense is incurred to provide such receptacles as are seen in Fig. 37 for receiving not only the night soil of the home and that which may be bought or otherwise procured, but in which may be stored any other fluid which can serve as plant food.  On the right of these earthenware jars too is a pile of ashes and one of manure.  All such materials are saved and used in the most advantageous ways to enrich the soil or to nourish the plants being grown.

Generally the liquid manures must be diluted with water to a greater or less extent before they are “fed”, as the Chinese say, to their plants, hence there is need of an abundant and convenient water supply.  One of these is seen in Fig. 38, where the Chinaman has adopted the modern galvanized iron pipe to bring water from the mountain slope of Happy Valley to his garden.  By the side of this tank are the covered pails in which the night soil was brought, perhaps more than a mile, to be first diluted and then applied.  But the more general method for supplying water is that of leading it along the ground in channels or ditches to a small reservoir in one corner of a terraced field or garden, as seen in Fig. 39, where it is held and the surplus led down from terrace to terrace, giving each its permanent supply.  At the upper right corner of the engraving may be seen two manure receptacles and a third stands near the reservoir.  The plants on the lower terrace are water cress and those above the same.  At this time of the year, on the terraced gardens of Happy Valley, this is one of the crops most extensively grown.

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Walking among these gardens and isolated homes, we passed a pig pen provided with a smooth, well-laid stone floor that had just been washed scrupulously clean, like the floor of a house.  While I was not able to learn other facts regarding this case, I have little doubt that the washings from this floor had been carefully collected and taken to some receptacle to serve as a plant food.

Looking backward as we left Hongkong for Canton on the cloudy evening of March 8th, the view was wonderfully beautiful.  We were drawing away from three cities, one, electric-lighted Hongkong rising up the steep slopes, suggesting a section of sky set with a vast array of stars of all magnitudes up to triple Jupiters; another, old and new Kowloon on the opposite side of the harbor; and between these two, separated from either shore by wide reaches of wholly unoccupied water, lay the third, a mid-strait city of sampans, junks and coastwise craft of many kinds segregated, in obedience to police regulation, into blocks and streets with each setting sun, but only to scatter again with the coming morn.  At night, after a fixed hour, no one is permitted to leave shore and cross the vacant water strip except from certain piers and with the permission of the police, who take the number of the sampan and the names of its occupants.  Over the harbor three large search lights were sweeping and it was curious to see the junks and other craft suddenly burst into full blazes of light, like so many monstrous fire-flies, to disappear and reappear as the lights came and went.  Thus is the mid-strait city lighted and policed and thus have steps been taken to lessen the number of cases of foul play where people have left the wharves at night for some vessel in the strait, never to be heard from again.

Some ninety miles is the distance by water to Canton, and early the next morning our steamer dropped anchor off the foreign settlement of Shameen.  Through the kindness of Consul-General Amos P. Wilder in sending a telegram to the Canton Christian College, their little steam launch met the boat and took us directly to the home of the college on Honam Island, lying in the great delta south of the city where sediments brought by the Si-kiang—­west, Pei-kiang—­north, and Tung-kiang—­east—­rivers through long centuries have been building the richest of land which, because of the density of population, are squared up everywhere to the water’s edge and appropriated as fast as formed, and made to bring forth materials for food fuel and raiment in vast quantities.

It was on Honam Island that we walked first among the grave lands and came to know them as such, for Canton Christian College stands in the midst of graves which, although very old, are not permitted to be disturbed and the development of the campus must wait to secure permission to remove graves, or erect its buildings in places not the most desirable.  Cattle were grazing among the graves and with them a flock

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of some 250 of the brown Chinese geese, two-thirds grown, was watched by boys, gleaning their entire living from the grave lands and adjacent water.  A mature goose sells in Canton for $1.20, Mexican, or less than 52 cents, gold, but even then how can the laborer whose day’s wage is but ten or fifteen cents afford one for his family?  Here, too, we saw the Chinese persistent, never-ending industry in keeping their land, their sunshine and their rain, with themselves, busy in producing something needful.  Fields which had matured two crops of rice during the long summer, had been laboriously, and largely by hand labor, thrown into strong ridges as seen in Fig. 40, to permit still a third winter crop of some vegetable to be taken from the land.

But this intensive, continuous cropping of the land spells soil exhaustion and creates demands for maintenance and restoration of available plant food or the adding of large quantities of something quickly convertible into it, and so here in the fields on Honam Island, as we had found in Happy Valley, there was abundant evidence of the most careful attention and laborious effort devoted to plant feeding.  The boat standing in the canal in Fig. 41 had come from Canton in the early morning with two tons of human manure and men were busy applying it, in diluted form, to beds of leeks at the rate of 16,000 gallons per acre, all carried on the shoulders in such pails as stand in the foreground.  The material is applied with long-handled dippers holding a gallon, dipping it from the pails, the men wading, with bare feet and trousers rolled above the knees, in the water of the furrows between the beds.  This is one of their ways of “feeding the crop,” and they have other methods of “manuring the soil.”

One of these we first met on Honam Island.  Large amounts of canal mud are here collected in boats and brought to the fields to be treated and there left to drain and dry before distributing.  Both the material used to feed the crop and that used for manuring the land are waste products, hindrances to the industry of the region, but the Chinese make them do essential duty in maintaining its life.  The human waste must be disposed of.  They return it to the soil.  We turn it into the sea.  Doing so, they save for plant feeding more than a ton of phosphorus (2712 pounds) and more than two tons of potassium (4488 pounds) per day for each million of adult population.  The mud collects in their canals and obstructs movement.  They must be kept open.  The mud is highly charged with organic matter and would add humus to the soil if applied to the fields, at the same time raising their level above the river and canal, giving them better drainage; thus are they turning to use what is otherwise waste, causing the labor which must be expended in disposal to count in a remunerative way.

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During the early morning ride to Canton Christian College and three others which we were permitted to enjoy in the launch on the canal and river waters, everything was again strange, fascinating and full of human interest.  The Cantonese water population was a surprise, not so much for its numbers as for the lithe, sinewy forms, bright eyes and cheerful faces, particularly among the women, young and old.  Nearly always one or more women, mother and daughter oftenest, grandmother many times, wrinkled, sometimes grey, but strong, quick and vigorous in motion, were manning the oars of junks, houseboats and sampans.  Sometimes husband and wife and many times the whole family were seen together when the craft was both home and business boat as well.  Little children were gazing from most unexpected peek holes, or they toddled tethered from a waist belt at the end of as much rope as would arrest them above water, should they go overboard.  And the cat was similarly tied.  Through an overhanging latticed stern, too, hens craned their necks, longing for scenes they could not reach.  With bare heads, bare feet, in short trousers and all dressed much alike, men, women, boys and girls showed equal mastery of the oar.  Beginning so young, day and night in the open air on the tide-swept streams and canals, exposed to all of the sunshine the fogs and clouds will permit, and removed from the dust and filth of streets, it would seem that if the children survive at all they must develop strong.  The appearance of the women somehow conveyed the impression that they were more vigorous and in better fettle than the men.

Boats selling many kinds of steaming hot dishes were common.  Among these was rice tied in green leaf wrappers, three small packets in a cluster suspended by a strand of some vegetable fiber, to be handed hot from the cooker to the purchaser, some one on a passing junk or on an in-coming or out-going boat.  Another would buy hot water for a brew of tea, while still another, and for a single cash, might be handed a small square of cotton cloth, wrung hot from the water, with which to wipe his face and hands and then be returned.

Perhaps nothing better measures the intensity of the maintenance struggle here, and better indicates the minute economies practiced, than the value of their smallest currency unit, the Cash, used in their daily retail transactions.  On our Pacific coast, where less thought is given to little economies than perhaps anywhere else in the world, the nickel is the smallest coin in general use, twenty to the dollar.  For the rest of the United States and in most English speaking countries one hundred cents or half pennies measure an equal value.  In Russia 170 kopecks, in Mexico 200 centavos, in France 250 two-centime pieces, and in Austria-Hungary 250 two-heller coins equal the United States dollar; while in Germany 400 pfennigs, and in India 400 pie are required for an equal value.  Again 500 penni in Finland and of stotinki in Bulgaria, of centesimi in Italy and of half cents in Holland equal our dollar; but in China the small daily financial transactions are measured against a much smaller unit, their Cash, 1500 to 2000 of which are required to equal the United States dollar, their purchasing power fluctuating daily with the price of silver.

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In the Shantung province, when we inquired of the farmers the selling prices of their crops, their replies were given like this:  “Thirty-five strings of cash for 420 catty of wheat and twelve to fourteen strings of cash for 1000 catty of wheat straw.”  At this time, according to my interpreter, the value of one string of cash was 40 cents Mexican, from which it appears that something like 250 of these coins were threaded on a string.  Twice we saw a wheelbarrow heavily loaded with strings of cash being transported through the streets of Shanghai, lying exposed on the frame, suggesting chains of copper more than money.  At one of the go-downs or warehouses in Tsingtao, where freight was being transferred from a steamer, the carriers were receiving their pay in these coin.  The pay-master stood in the doorway with half a bushel of loose cash in a grain sack at his feet.  With one hand he received the bamboo tally-sticks from the stevedores and with the other paid the cash for service rendered.

Reference has been made to buying hot water.  In a sampan managed by a woman and her daughter, who took us ashore, the middle section of the boat was furnished in the manner of a tiny sitting-room, and on the sideboard sat the complete embodiment of our fireless cookers, keeping boiled water hot for making tea.  This device and the custom are here centuries old and throughout these countries boiled water, as tea, is the universal drink, adopted no doubt as a preventive measure against typhoid fever and allied diseases.  Few vegetables are eaten raw and nearly all foods are taken hot or recently cooked if not in some way pickled or salted.  Houseboat meat shops move among the many junks on the canals.  These were provided with a compartment communicating freely with the canal water where the fish were kept alive until sold.  At the street markets too, fish are kept alive in large tubs of water systematically aerated by the water falling from an elevated receptacle in a thin stream.  A live fish may even be sliced before the eyes of a purchaser and the unsold portion returned to the water.  Poultry is largely retailed alive although we saw much of it dressed and cooked to a uniform rich brown, apparently roasted, hanging exposed in the markets of the very narrow streets in Canton, shaded from the hot sun under awnings admitting light overhead through translucent oyster-shell latticework.  Perhaps these fowl had been cooked in hot oil and before serving would be similarly heated.  At any rate it is perfectly clear that among these people many very fundamental sanitary practices are rigidly observed.

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One fact which we do not fully understand is that, wherever we went, house flies were very few.  We never spent a summer with so little annoyance from them as this one in China, Korea and Japan.  It may be that our experience was exceptional but, if so, it could not be ascribed to the season of our visit for we have found flies so numerous in southern Florida early in April as to make the use of the fly brush at the table very necessary.  If the scrupulous husbanding of waste refuse so universally practiced in these countries reduces the fly nuisance and this menace to health to the extent which our experience suggests, here is one great gain.  We breed flies in countless millions each year, until they become an intolerable nuisance, and then expend millions of dollars on screens and fly poison which only ineffectually lessen the intensity and danger of the evil.

The mechanical appliances in use on the canals and in the shops of Canton demonstrate that the Chinese possess constructive ability of a high order, notwithstanding so many of these are of the simplest forms.  This statement is well illustrated in the simple yet efficient foot-power seen in Fig. 42, where a father and his two sons are driving an irrigation pump, lifting water at the rate of seven and a half acre-inches per ten hours, and at a cost, including wage and food, of 36 to 45 cents, gold.  Here, too, were large stern-wheel passenger boats, capable of carrying thirty to one hundred people, propelled by the same foot-power but laid crosswise of the stern, the men working in long single or double lines, depending on the size of the boat.  On these the fare was one cent, gold, for a fifteen mile journey, a rate one-thirtieth our two-cent railway tariff.  The dredging and clearing of the canals and water channels in and about Canton is likewise accomplished with the same foot-power, often by families living on the dredge boats.  A dipper dredge is used, constructed of strong bamboo strips woven into the form of a sliding, two-horse road scraper, guided by a long bamboo handle.  The dredge is drawn along the bottom by a rope winding about the projecting axle of the foot-power, propelled by three or more people.  When the dipper reaches the axle and is raised from the water it is swung aboard, emptied and returned by means of a long arm like the old well sweep, operated by a cord depending from the lower end of the lever, the dipper swinging from the other.  Much of the mud so collected from the canals and channels of the city is taken to the rice and mulberry fields, many square miles of which occupy the surrounding country.  Thus the channels are kept open, the fields grow steadily higher above flood level, while their productive power is maintained by the plant food and organic matter carried in the sediment.

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The mechanical principle involved in the boy’s button buzz was applied in Canton and in many other places for operating small drills as well as in grinding and polishing appliances used in the manufacture of ornamental ware.  The drill, as used for boring metal, is set in a straight shaft, often of bamboo, on the upper end of which is mounted a circular weight.  The drill is driven by a pair of strings with one end attached just beneath the momentum weight and the other fastened at the ends of a cross hand-bar, having a hole at its center through which the shaft carrying the drill passes.  Holding the drill in position for work and turning the shaft, the two cords are wrapped about it in such a manner that simple downward pressure on the hand bar held in the two hands unwinds the cords and thus revolves the drill.  Relieving the pressure at the proper time permits the momentum of the revolving weight to rewind the cords and the next downward pressure brings the drill again into service.

**IV**

**UP THE SI-KIANG, WEST RIVER**

On the morning of March 10th we took passage on the Nanning for Wuchow, in Kwangsi province, a journey of 220 miles up the West river, or Sikiang.  The Nanning is one of two English steamers making regular trips between the two places, and it was the sister boat which in the summer of 1906 was attacked by pirates on one of her trips and all of the officers and first class passengers killed while at dinner.  The cause of this attack, it is said, or the excuse for it, was threatened famine resulting from destructive floods which had ruined the rice and mulberry crops of the great delta region and had prevented the carrying of manure and bean cake as fertilizers to the tea fields in the hill lands beyond, thus bringing ruin to three of the great staple crops of the region.  To avoid the recurrence of such tragedies the first class quarters on the Nanning had been separated from the rest of the ship by heavy iron gratings thrown across the decks and over the hatchways.  Armed guards stood at the locked gateways, and swords were hanging from posts under the awnings of the first cabin quarters, much as saw and ax in our passenger coaches.  Both British and Chinese gunboats were patrolling the river; all Chinese passengers were searched for concealed weapons as they came aboard, even though Government soldiers, and all arms taken into custody until the end of the journey.  Several of the large Chinese merchant junks which were passed, carrying valuable cargoes on the river, were armed with small cannon and when riding by rail from Canton to Sam Shui, a government pirate detective was in our coach.

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The Sikiang is one of the great rivers of China and indeed of the world.  Its width at Wuchow at low water was nearly a mile and our steamer anchored in twenty-four feet of water to a floating dock made fast by huge iron chains reaching three hundred feet up the slope to the city proper, thus providing for a rise of twenty-six feet in the river at its flood stage during the rainy season.  In a narrow section of river where it winds through Shui Hing gorge, the water at low stage has a depth of more than twenty-five fathoms, too deep for anchorage, so in times of prospective fog, boats wait for clearing weather.  Fluctuations in the height of the river limit vessels passing up to Wuchow to those drawing six and a half feet of water during the low stage, and at high stage to those drawing sixteen feet.

When the West river emerges from the high lands, with its burden of silt, to join its waters with those of the North and East rivers, it has entered a vast delta plain some eighty miles from east to west and nearly as many from north to south, and this has been canalized, diked, drained and converted into the most productive of fields, bearing three or more crops each year.  As we passed westward through this delta region the broad flat fields, surrounded by dikes to protect them against high water, were being plowed and fitted for the coming crop of rice.  In many places the dikes which checked off the fields were planted with bananas and in the distance gave the appearance of extensive orchards completely occupying the ground.  Except for the water and the dikes it was easy to imagine that we were traversing one of our western prairie sections in the early spring, at seeding time, the scattered farm villages here easily suggested distant farmsteads; but a nearer approach to the houses showed that the roofs and sides were thatched with rice straw and stacks were very numerous about the buildings.  Many tide gates were set in the dikes, often with double trunks.

At times we approached near enough to the fields to see how they were laid out.  From the gates long canals, six to eight feet wide, led back sometimes eighty or a hundred rods.  Across these and at right angles, head channels were cut and between them the fields were plowed in long straight lands some two rods wide, separated by water furrows.  Many of the fields were bearing sugar cane standing eight feet high.  The Chinese do no sugar refining but boil the sap until it will solidify, when it is run into cakes resembling chocolate or our brown maple sugar.  Immense quantities of sugar cane, too, are exported to the northern provinces, in bundles wrapped with matting or other cover, for the retail markets where it is sold, the canes being cut in short sections and sometimes peeled, to be eaten from the hands as a confection.

Much of the way this water-course was too broad to permit detailed study of field conditions and crops, even with a glass.  In such sections the recent dikes often have the appearance of being built from limestone blocks but a closer view showed them constructed from blocks of the river silt cut and laid in walls with slightly sloping faces.  In time however the blocks weather and the dikes become rounded earthen walls.

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We passed two men in a boat, in charge of a huge flock of some hundreds of yellow ducklings.  Anchored to the bank was a large houseboat provided with an all-around, over-hanging rim and on board was a stack of rice straw and other things which constituted the floating home of the ducks.  Both ducks and geese are reared in this manner in large numbers by the river population.  When it is desired to move to another feeding ground a gang plank is put ashore and the flock come on board to remain for the night or to be landed at another place.

About five hours journey westward in this delta plain, where the fields lie six to ten feet above the present water stage, we reached the mulberry district.  Here the plants are cultivated in rows about four feet apart, having the habit of small shrubs rather than of trees, and so much resembling cotton that our first impression was that we were in an extensive cotton district.  On the lower lying areas, surrounded by dikes, some fields were laid out in the manner of the old Italian or English water meadows, with a shallow irrigation furrow along the crest of the bed and much deeper drainage ditches along the division line between them.  Mulberries were occupying the ground before the freshly cut trenches we saw were dug, and all the surface between the rows had been evenly overlaid with the fresh earth removed with the spade, the soil lying in blocks essentially unbroken.  In Fig. 43 may be seen the mulberry crop on a similarly treated surface, between Canton and Samshui, with the earth removed from the trenches laid evenly over the entire surface between and around the plants, as it came from the spade.

At frequent intervals along the river, paths and steps were seen leading to the water and within a distance of a quarter of a mile we counted thirty-one men and women carrying mud in baskets on bamboo poles swung across their shoulders, the mud being taken from just above the water line.  The disposition of this material we could not see as it was carried beyond a rise in ground.  We have little doubt that the mulberry fields were being covered with it.  It was here that a rain set in and almost like magic the fields blossomed out with great numbers of giant rain hats and kittysols, where people had been unobserved before.  From one o’clock until six in the afternoon we had traveled continuously through these mulberry fields stretching back miles from our line of travel on either hand, and the total acreage must have been very large.  But we had now nearly reached the margin of the delta and the mulberries changed to fields of grain, beans, peas and vegetables.

After leaving the delta region the balance of the journey to Wuchow was through a hill country, the slopes rising steeply from near the river bank, leaving relatively little tilled or readily tillable land.  Rising usually five hundred to a thousand feet, the sides and summits of the rounded, soil-covered hills were generally clothed with a short herbaceous growth and small scattering trees, oftenest pine, four to sixteen feet high, Fig. 44 being a typical landscape of the region.

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In several sections along the course of this river there are limited areas of intense erosion where naked gulleys of no mean magnitude have developed but these were exceptions and we were continually surprised at the remarkable steepness of the slopes, with convexly rounded contours almost everywhere, well mantled with soil, devoid of gulleys and completely covered with herbaceous growth dotted with small trees.  The absence of forest growth finds its explanation in human influence rather than natural conditions.

Throughout the hill-land section of this mighty river the most characteristic and persistent human features were the stacks of brush-wood and the piles of stove wood along the banks or loaded upon boats and barges for the market.  The brush-wood was largely made from the boughs of pine, tied into bundles and stacked like grain.  The stove wood was usually round, peeled and made from the limbs and trunks of trees two to five inches in diameter.  All this fuel was coming to the river from the back country, sent down along steep slides which in the distance resemble paths leading over hills but too steep for travel.  The fuel was loaded upon large barges, the boughs in the form of stacks to shed rain but with a tunnel leading into the house of the boat about which they were stacked, while the wood was similarly corded about the dwelling, as seen in Fig. 44.  The wood was going to Canton and other delta cities while the pine boughs were taken to the lime and cement kilns, many of which were located along the river.  Absolutely the whole tree, including the roots and the needles, is saved and burned; no waste is permitted.

The up-river cargo of the Nanning was chiefly matting rush, taken on at Canton, tied in bundles like sheaves of wheat.  It is grown upon the lower, newer delta lands by methods of culture similar to those applied to rice, Fig. 45 showing a field as seen in Japan.

The rushes were being taken to one of the country villages on a tributary of the Sikiang and the steamer was met by a flotilla of junks from this village, some forty-five miles up the stream, where the families live who do the weaving.  On the return trip the flotilla again met the steamer with a cargo of the woven matting.  In keeping record of packages transferred the Chinese use a simple and unique method.  Each carrier, with his two bundles, received a pair of tally sticks.  At the gang-plank sat a man with a tally-case divided into twenty compartments, each of which could receive five, but no more, tallies.  As the bundles left the steamer the tallies were placed in the tally-case until it contained one hundred, when it was exchanged for another.

Wuchow is a city of some 65,000 inhabitants, standing back on the higher ground, not readily visible from the steamer landing nor from the approach on the river.  On the foreground, across which stretched the anchor chains of the dock, was living a floating population, many in shelters less substantial than Indian wigwams, but engaged in a great variety of work, and many water buffalo had been tied for the night along the anchor chains.  Before July much of this area would lie beneath the flood waters of the Sikiang.

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Here a ship builder was using his simple, effective bow-brace, boring holes for the dowel pins in the planking for his ship, and another was bending the plank to the proper curvature.  The bow-brace consisted of a bamboo stalk carrying the bit at one end and a shoulder rest at the other.  Pressing the bit to its work with the shoulder, it was driven with the string of a long bow wrapped once around the stalk by drawing the bow back and forth, thus rapidly and readily revolving the bit.

The bending of the long, heavy plank, four inches thick and eight inches wide, was more simple still, It was saturated with water and one end raised on a support four feet above the ground.  A bundle of burning rice straw moved along the under side against the wet wood had the effect of steaming the wood and the weight of the plank caused it to gradually bend into the shape desired.  Bamboo poles are commonly bent or straightened in this manner to suit any need and Fig. 46 shows a wooden fork shaped in the manner described from a small tree having three main branches.  This fork is in the hands of my interpreter and was used by the woman standing at the right, in turning wheat.

When the old ship builder had finished shaping his plank he sat down on the ground for a smoke.  His pipe was one joint of bamboo stem a foot long, nearly two inches in diameter and open at one end.  In the closed end, at one side, a small hole was bored for draft.  A charge of tobacco was placed in the bottom, the lips pressed into the open end and the pipe lighted by suction, holding a lighted match at the small opening.  To enjoy his pipe the bowl rested on the ground between his legs.  With his lips in the bowl and a long breath, he would completely fill his lungs, retaining the smoke for a time, then slowly expire and fill the lungs again, after an interval of natural breathing.

On returning to Canton we went by rail, with an interpreter, to Samshui, visiting fields along the way, and Fig. 47 is a view of one landscape.  The woman was picking roses among tidy beds of garden vegetables.  Beyond her and in front of the near building are two rows of waste receptacles.  In the center background is a large “go-down”, in function that of our cold storage warehouse and in part that of our grain elevator for rice.  In them, too, the wealthy store their fur-lined winter garments for safe keeping.  These are numerous in this portion of China and the rank of a city is indicated by their number.  The conical hillock is a large near-by grave mound and many others serrate the sky line on the hill beyond.

In the next landscape, Fig. 48, a crop of winter peas, trained to canes, are growing on ridges among the stubble of the second crop of rice, In front is one canal, the double ridge behind is another and a third canal extends in front of the houses.  Already preparations were being made for the first crop of rice, fields were being flooded and fertilized.  One such is seen in Fig. 49, where a laborer was engaged at the time in bringing stable manure, wading into the water to empty the baskets.

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Two crops of rice are commonly grown each year in southern China and during the winter and early spring, grain, cabbage, rape, peas, beans, leeks and ginger may occupy the fields as a third or even fourth crop, making the total year’s product from the land very large; but the amount of thought, labor and fertilizers given to securing these is even greater and beyond anything Americans will endure.  How great these efforts are will be appreciated from what is seen in Fig. 50, representing two fields thrown into high ridges, planted to ginger and covered with straw.  All of this work is done by hand and when the time for rice planting comes every ridge will again be thrown down and the surface smoothed to a water level.  Even when the ridges and beds are not thrown down for the crops of rice, the furrows and the beds will change places so that all the soil is worked over deeply and mainly through hand labor.  The statement so often made, that these people only barely scratch the surface of their fields with the crudest of tools is very far from the truth, for their soils are worked deeply and often, notwithstanding the fact that their plowing, as such, may be shallow.

Through Dr. John Blumann of the missionary hospital at Tungkun, east from Canton, we learned that the good rice lands there a few years ago sold at $75 to $130 per acre but that prices are rising rapidly.  The holdings of the better class of farmers there are ten to fifteen mow—­one and two-thirds to two and a half acres—­upon which are maintained families numbering six to twelve.  The day’s wage of a carpenter or mason is eleven to thirteen cents of our currency, and board is not included, but a day’s ration for a laboring man is counted worth fifteen cents, Mexican, or less than seven cents, gold.

Fish culture is practiced in both deep and shallow basins, the deep permanent ones renting as high as $30 gold, per acre.  The shallow basins which can be drained in the dry season are used for fish only during the rainy period, being later drained and planted to some crop.  The permanent basins have often come to be ten or twelve feet deep, increasing with long usage, for they are periodically drained by pumping and the foot or two of mud which has accumulated, removed and sold as fertilizer to planters of rice and other crops.  It is a common practice, too, among the fish growers, to fertilize the ponds, and in case a foot path leads alongside, screens are built over the water to provide accommodation for travelers.  Fish reared in the better fertilized ponds bring a higher price in the market.  The fertilizing of the water favors a stronger growth of food forms, both plant and animal, upon which the fish live and they are better nourished, making a more rapid growth, giving their flesh better qualities, as is the case with well fed animals.

In the markets where fish are exposed for sale they are often sliced in halves lengthwise and the cut surface smeared with fresh blood.  In talking with Dr. Blumann as to the reason for this practice he stated that the Chinese very much object to eating meat that is old or tainted and that he thought the treatment simply had the effect of making the fish look fresher.  I question whether this treatment with fresh blood may not have a real antiseptic effect and very much doubt that people so shrewd as the Chinese would be misled by such a ruse.

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**V**

*Extent* *of* *canalization* *and  
surface* *fitting* *of* *fields*

On the evening of March 15th we left Canton for Hongkong and the following day embarked again on the Tosa Maru for Shanghai.  Although our steamer stood so far to sea that we were generally out of sight of land except for some off-shore islands, the water was turbid most of the way after we had crossed the Tropic of Cancer off the mouth of the Han river at Swatow.  Over a sea bottom measuring more than six hundred miles northward along the coast, and perhaps fifty miles to sea, unnumbered acre-feet of the richest soil of China are being borne beyond the reach of her four hundred millions of people and the children to follow them.  Surely it must be one of the great tasks of future statesmanship, education and engineering skill to divert larger amounts of such sediments close along inshore in such manner as to add valuable new land annually to the public domain, not alone in China but in all countries where large resources of this type are going to waste.

In the vast Cantonese delta plains which we had just left, in the still more extensive ones of the Yangtse kiang to which we were now going, and in those of the shifting Hwang ho further north, centuries of toiling millions have executed works of almost incalculable magnitude, fundamentally along such lines as those just suggested.  They have accomplished an enormous share of these tasks by sheer force of body and will, building levees, digging canals, diverting the turbid waters of streams through them and then carrying the deposits of silt and organic growth out upon the fields, often borne upon the shoulders of men in the manner we have seen.

It is well nigh impossible, by word or map, to convey an adequate idea of the magnitude of the systems of canalization and delta and other lowland reclamation work, or of the extent of surface fitting of fields which have been effected in China, Korea and Japan through the many centuries, and which are still in progress.  The lands so reclaimed and fitted constitute their most enduring asset and they support their densest populations.  In one of our journeys by houseboat on the delta canals between Shanghai and Hangchow, in China, over a distance of 117 miles, we made a careful record of the number and dimensions of lateral canals entering and leaving the main one along which our boat-train was traveling.  This record shows that in 62 miles, beginning north of Kashing and extending south to Hangchow, there entered from the west 134 and there left on the coast side 190 canals.  The average width of these canals, measured along the water line, we estimated at 22 and 19 feet respectively on the two sides.  The height of the fields above the water level ranged from four to twelve feet, during the April and May stage of water.  The depth of water, after we entered the Grand Canal, often exceeded six feet and our best judgment would place the average depth of all canals in this part of China at more than eight feet below the level of the fields.

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In Fig. 51, representing an area of 718 square miles in the region traversed, all lines shown are canals, but scarcely more than one-third of those present are shown on the map.  Between A, where we began our records, before reaching Kashing, and B, near the left margin of the map, there were forty-three canals leading in from the up-country side, instead of the eight shown, and on the coast side there were eighty-six leading water out into the delta plain toward the coast, instead of the twelve shown.  Again, on one of our trips by rail, from Shanghai to Nanking, we made a similar record of the number of canals seen from the train, close along the track, and the notes show, in a distance of 162 miles, 593 canals between Lungtan and Nansiang.  This is an average of more than three canals per mile for this region and that between Shanghai and Hangchow.

The extent, nature and purpose of these vast systems of internal improvement may be better realized through a study of the next two sketch maps.  The first, Fig. 52, represents an area 175 by 160 miles, of which the last illustration is the portion enclosed in the small rectangle.  On this area there are shown 2,700 miles of canals and only about one-third of the canals shown in Fig. 51 are laid down on this map, and according to our personal observations there are three times as many canals as are shown on the map of which Fig. 51 represents a part.  It is probable, therefore, that there exists today in the area of Fig. 52 not less than 25,000 miles of canals.

In the next illustration, Fig. 53, an area of northeast China, 600 by 725 miles, is represented.  The unshaded land area covers nearly 200,000 square miles of alluvial plain.  This plain is so level that at Ichang, nearly a thousand miles up the Yangtse, the elevation is only 130 feet above the sea.  The tide is felt on the river to beyond Wuhu, 375 miles from the coast.  During the summer the depth of water in the Yangtse is sufficient to permit ocean vessels drawing twenty-five feet of water to ascend six hundred miles to Hankow, and for smaller steamers to go on to Ichang, four hundred miles further.

The location, in this vast low delta and coastal plain, of the system of canals already described, is indicated by the two rectangles in the south-east corner of the sketch map, Fig. 53.  The heavy barred black line extending from Hangchow in the south to Tientsin in the north represents the Grand Canal which has a length of more than eight hundred miles.  The plain, east of this canal, as far north as the mouth of the Hwang ho in 1852, is canalized much as is the area shown in Fig. 52.  So, too, is a large area both sides of the present mouth of the same river in Shantung and Chihli, between the canal and the coast.  Westward, up the Yangtse valley, the provinces of Anhwei, Kiangsi, Hunan and Hupeh have very extensive canalized tracts, probably exceeding 28,000 square miles in area, and Figs. 54 and 55 are two views in this more western region.  Still further west, in Szechwan province, is the Chengtu plain, thirty by seventy miles, with what has been called “the most remarkable irrigation system in China.”

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Westward beyond the limits of the sketch map, up the Hwang ho valley, there is a reach of 125 miles of irrigated lands about Ninghaifu, and others still farther west, at Lanchowfu and at Suchow where the river has attained an elevation of 5,000 feet, in Kansu province; and there is still to be named the great Canton delta region.  A conservative estimate would place the miles of canals and leveed rivers in China, Korea and Japan equal to eight times the number represented in Fig. 52.  Fully 200,000 miles in all.  Forty canals across the United States from east to west and sixty from north to south would not equal, in number of miles those in these three countries today.  Indeed, it is probable that this estimate is not too large for China alone.

As adjuncts to these vast canalization works there have been enormous amounts of embankment, dike and levee construction.  More than three hundred miles of sea wall alone exist in the area covered by the sketch map, Fig. 52.  The east bank of the Grand Canal, between Yangchow and Hwaianfu, is itself a great levee, holding back the waters to the west above the eastern plain, diverting them south, into the Yangtse kiang.  But it is also provided with spillways for use in times of excessive flood, permitting waters to discharge eastward.  Such excess waters however are controlled by another dike with canal along its west side, some forty miles to the east, impounding the water in a series of large lakes until it may gradually drain away.  This area is seen in Fig. 53, north of the Yangtse river.

Along the banks of the Yangtse, and for many miles along the Hwang ho, great levees have been built, some-times in reinforcing series of two or three at different distances back from the channel where the stream bed is above the adjacent country, in order to prevent widespread disaster and to limit the inundated areas in times of unusual flood.  In the province of Hupeh, where the Han river flows through two hundred miles of low country, this stream is diked on both sides throughout the whole distance, and in a portion of its course the height of the levees reaches thirty feet or more.  Again, in the Canton delta region there are other hundreds of miles of sea wall and dikes, so that the aggregate mileage of this type of construction works in the Empire can only be measured in thousands of miles.

In addition to the canal and levee construction works there are numerous impounding reservoirs which are brought into requisition to control overflow waters from the great streams.  Some of these reservoirs, like Tungting lake in Hupeh and Poyang in Hunan, have areas of 2,000 and 1,800 square miles respectively and during the heaviest rainy seasons each may rise through twenty to thirty feet, Then there are other large and small lakes in the coastal plain giving an aggregate reservoir area exceeding 13,000 square miles, all of which are brought into service in controlling flood waters, all of which are steadily filling with the sediments brought from the far away uncultivable mountain slopes and which are ultimately destined to become rich alluvial plains, doubtless to be canalized in the manner we have seen.

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There is still another phase of these vast construction works which has been of the greatest moment in increasing the maintenance capacity of the Empire,—­the wresting from the flood waters of the enormous volumes of silt which they carry, depositing it over the flooded areas, in the canals and along the shores in such manner as to add to the habitable and cultivable land.  Reference has been made to the rapid growth of Chungming island in the mouth of the Yangtse kiang, and the million people now finding homes on the 270 square miles of newly made land which now has its canals, as may be seen in the upper margin of Fig. 52.  The city of Shanghai, as its name signifies, stood originally on the seashore, which has now grown twenty miles to the northward and to the eastward.  In 220 B. C. the town of Putai in Shantung stood one-third of a mile from the sea, but in 1730 it was forty-seven miles inland, and is forty-eight miles from the shore today.

Sienshuiku, on the Pei ho, stood upon the seashore in 500 A. D. We passed the city, on our way to Tientsin, eighteen miles inland.  The dotted line laid in from the coast of the Gulf of Chihli in Fig. 53 marks one historic shore line and indicates a general growth of land eighteen miles to seaward.

Besides these actual extensions of the shore lines the centuries of flooding of lakes and low lying lands has so filled many depressions as to convert large areas of swamp into cultivated fields.  Not only this, but the spreading of canal mud broadcast over the encircled fields has had two very important effects,—­namely, raising the level of the low lying fields, giving them better drainage and so better physical condition, and adding new plant food in the form of virgin soil of the richest type, thus contributing to the maintenance of soil fertility, high maintenance capacity and permanent agriculture through all the centuries.

These operations of maintenance and improvement had a very early inception; they appear to have persisted throughout the recorded history of the Empire and are in vogue today.  Canals of the type illustrated in Figs. 51 and 52 have been built between 1886 and 1901, both on the extensions of Chungming island and the newly formed main land to the north, as is shown by comparison of Stieler’s atlas, revised in 1886, with the recent German survey.

Earlier than 2255 B. C., more than 4100 years ago, Emperor Yao appointed “The Great” Yu “Superintendent of Works” and entrusted him with the work of draining off the waters of disastrous floods and of canalizing the rivers, and he devoted thirteen years to this work.  This great engineer is said to have written several treatises on agriculture and drainage, and was finally called, much against his wishes, to serve as Emperor during the last seven years of his life.

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The history of the Hwang ho is one of disastrous floods and shiftings of its course, which have occurred many times in the years since before the time of the Great Yu, who perhaps began the works perpetuated today.  Between 1300 A. D. and 1852 the Hwang ho emptied into the Yellow Sea south of the highlands of Shantung, but in that year, when in unusual flood, it broke through the north levees and finally took its present course, emptying again into the Gulf of Chihli, some three hundred miles further north.  Some of these shiftings of course of the Hwang ho and of the Yangtse kiang are indicated in dotted lines on the sketch map, Fig. 53, where it may he seen that the Hwang ho during 146 years, poured its waters into the sea as far north as Tientsin, through the mouth of the Pei ho, four hundred miles to the northward of its mouth in 1852.

This mighty river is said to carry at low stage, past the city of Tsinan in Shantung, no less than 4,000 cubic yards of water per second, and three times this volume when running at flood.  This is water sufficient to inundate thirty-three square miles of level country ten feet deep in twenty-four hours.  What must be said of the mental status of a people who for forty centuries have measured their strength against such a Titan racing past their homes above the level of their fields, confined only between walls of their own construction?  While they have not always succeeded in controlling the river, they have never failed to try again.  In 1877 this river broke its banks, inundating a vast. area, bringing death to a million people.  Again, as late as 1898, fifteen hundred villages to the northeast of Tsinan and a much larger area to the southwest of the same city were devastated by it, and it is such events as these which have won for the river the names “China’s Sorrow,” “The Ungovernable” and “The Scourge of the Sons of Han.”

The building of the Grand Canal appears to have been a comparatively recent event in Chinese history.  The middle section, between the Yangtse and Tsingkiangpu, is said to have been constructed about the sixth century B. C.; the southern section, between Chingkiang and Hangchow, during the years 605 to 617 A. D.; but the northern section, from the channel of the Hwang ho deserted in 1852, to Tientsin, was not built until the years 1280-1283.

While this canal has been called by the Chinese Yu ho (Imperial river), Yun ho (Transport river) or Yunliang ho (Tribute bearing river) and while it has connected the great rivers coming down from the far interior into a great water-transport system, this feature of construction may have been but a by-product of the great dominating purpose which led to the vast internal improvements in the form of canals, dikes, levees and impounding reservoirs so widely scattered, so fully developed and so effectively utilized.  Rather the master purpose must have been maintenance for the increasing flood of humanity.  And I am willing to grant to the Great Yu, with his finger on the pulse of the nation, the power to project his vision four thousand years into the future of his race and to formulate some of the measures which might he inaugurated to grow with the years and make certain perpetual maintenance for those to follow.

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The exhaustion of cultivated fields must always have been the most fundamental, vital and difficult problem of all civilized people and it appears clear that such canalization as is illustrated in Figs. 51 and 52 may have been primarily initial steps in the reclamation of delta and overflow lands.  At any rate, whether deliberately so planned or not, the canalization of the delta and overflow plains of China has been one of the most fundamental and fruitful measures for the conservation of her national resources that they could have taken, for we are convinced that this oldest nation in the world has thus greatly augmented the extension of its coastal plains, conserving and building out of the waste of erosion wrested from the great streams, hundreds of square miles of the richest and most enduring of soils, and we have little doubt that were a full and accurate account given of human influence upon the changes in this remarkable region during the last four thousand years it would show that these gigantic systems of canalization have been matters of slow, gradual growth, often initiated and always profoundly influenced by the labors of the strong, patient, persevering, thoughtful but ever silent husband-men in their efforts to acquire homes and to maintain the productive power of their fields.

Nothing appears more clear than that the greatest material problem which can engage the best thought of China today is that of perfecting, extending and perpetuating the means for controlling her flood waters, for better draining of her vast areas of low land, and for utilizing the tremendous loads of silt borne by her streams more effectively in fertilizing existing fields and in building and reclaiming new land.  With her millions of people needing homes and anxious for work; who have done so much in land building, in reclamation and in the maintenance of soil fertility, the government should give serious thought to the possibility of putting large numbers of them at work, effectively directed by the best engineering skill.  It must now be entirely practicable, with engineering skill and mechanical appliances, to put the Hwang ho, and other rivers of China subject to overflow, completely under control.  With the Hwang ho confined to its channel, the adjacent low lands can be better drained by canalization and freed from the accumulating saline deposits which are rendering them sterile.  Warping may be resorted to during the flood season to raise the level of adjacent low-lying fields, rendering them at the same time more fertile.  Where the river is running above the adjacent plains there is no difficulty in drawing off the turbid water by gravity, under controlled conditions, into diked basins, and even in compelling the river to buttress its own levees.  There is certainly great need and great opportunity for China to make still better and more efficient her already wonderful transportation canals and those devoted to drainage, irrigation and fertilization.

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In the United States, along the same lines, now that we are considering the development of inland waterways, the subject should be surveyed broadly and much careful study may well be given to the works these old people have developed and found serviceable through so many centuries.  The Mississippi is annually bearing to the sea nearly 225,000 acre-feet of the most fertile sediment, and between levees along a raised bed through two hundred miles of country subject to inundation.  The time is here when there should he undertaken a systematic diversion of a large part of this fertile soil over the swamp areas, building them into well drained, cultivable, fertile fields provided with waterways to serve for drainage, irrigation, fertilization and transportation.  These great areas of swamp land may thus be converted into the most productive rice and sugar plantations to be found anywhere in the world, and the area made capable of maintaining many millions of people as long as the Mississippi endures, bearing its burden of fertile sediment.

But the conservation and utilization of the wastes of soil erosion, as applied in the delta plain of China, stupendous as this work has been, is nevertheless small when measured by the savings which accrue from the careful and extensive fitting of fields so largely practiced, which both lessens soil erosion and permits a large amount of soluble and suspended matter in the run-off to be applied to, and retained upon, the fields through their extensive systems of irrigation.  Mountainous and hilly as are the lands of Japan, 11,000 square miles of her cultivated fields in the main islands of Honshu, Kyushu and Shikoku have been carefully graded to water level areas bounded by narrow raised rims upon which sixteen or more inches of run-off water, with its suspended and soluble matters, may be applied, a large part of which is retained on the fields or utilized by the crop, while surface erosion is almost completely prevented.  The illustrations, Figs. 11, 12 and 13 show the application of the principle to the larger and more level fields, and in Figs. 151, 152 and 225 may be seen the practice on steep slopes.

If the total area of fields graded practically to a water level in Japan aggregates 11,000 square miles, the total area thus surface fitted in China must be eight or tenfold this amount.  Such enormous field erosion as is tolerated at the present time in our southern and south Atlantic states is permitted nowhere in the Far East, so far as we observed, not even where the topography is much steeper.  The tea orchards as we saw them on the steeper slopes, not level-terraced, are often heavily mulched with straw which makes erosion, even by heavy rains impossible, while the treatment retains the rain where it falls, giving the soil opportunity to receive it under the impulse of both capillarity and gravity, and with it the soluble ash ingredients leached from the straw.  The straw mulches we

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saw used in this manner were often six to eight inches deep, thus constituting a dressing of not less than six tons per acre, carrying 140 pounds of soluble potassium and 12 pounds of phosphorus.  The practice, therefore, gives at once a good fertilizing, the highest conservation and utilization of rainfall, and a complete protection against soil erosion.  It is a multum in parvo treatment which characterizes so many of the practices of these people, which have crystallized from twenty centuries of high tension experience.

In the Kiangsu and Chekiang provinces as elsewhere in the densely populated portions of the Far East, we found almost all of the cultivated fields very nearly level or made so by grading.  Instances showing the type of this grading in a comparatively level country are seen in Figs. 56 and 57.  By this preliminary surface fitting of the fields these people have reduced to the lowest possible limit the waste of soil fertility by erosion and surface leaching.  At the same time they are able to retain upon the field, uniformly distributed over it, the largest part of the rainfall practicable, and to compel a much larger proportion of the necessary run off to leave by under-drainage than would be possible otherwise, conveying the plant food developed in the surface soil to the roots of the crops, while they make possible a more complete absorption and retention by the soil of the soluble plant food materials not taken up.  This same treatment also furnishes the best possible conditions for the application of water to the fields when supplemental irrigation would be helpful, and for the withdrawal of surplus rainfall by surface drainage, should this be necessary.

Besides this surface fitting of fields there is a wide application of additional methods aiming to conserve both rainfall and soil fertility, one of which is illustrated in Fig. 58, showing one end of a collecting reservoir.  There were three of these reservoirs in tandem, connected with each other by surface ditches and with an adjoining canal.  About the reservoir the level field is seen to be thrown into beds with shallow furrows between the long narrow ridges.  The furrows are connected by a head drain around the margin of the reservoir and separated from it by a narrow raised rim.  Such a reservoir may be six to ten feet deep but can be completely drained only by pumping or by evaporation during the dry season.  Into such reservoirs the excess surface water is drained where all suspended matter carried from the field collects and is returned, either directly as an application of mud or as material used in composts.  In the preparation of composts, pits are dug near the margin of the reservoir, as seen in the illustration, and into them are thrown coarse manure and any roughage in the form of stubble or other refuse which may be available, these materials being saturated with the soft mud dipped from the bottom of the reservoir.

In all of the provinces where canals are abundant they also serve as reservoirs for collecting surface washings and along their banks great numbers of compost pits are maintained and repeatedly filled during the season, for use on the fields as the crops are changed.  Fig. 59 shows two such pits on the bank of a canal, already filled.

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In other cases, as in the Shantung province, illustrated in Fig. 60, the surface of the field may be thrown into broad leveled lands separated and bounded by deep and wide trenches into which the excess water of very heavy rains may collect.  As we saw them there was no provision for draining the trenches and the water thus collected either seeps away or evaporates, or it may be returned in part by underflow and capillary rise to the soil from which it was collected, or be applied directly for irrigation by pumping.  In this province the rains may often be heavy but the total fall for the year is small, being little more than twenty-four inches hence there is the greatest need for its conservation, and this is carefully practiced.

**VI**

*Some* *customs* *of* *the* *common  
people*

The Tosa Maru brought us again into Shanghai March 20th, just in time for the first letters from home.  A ricksha man carried us and our heavy valise at a smart trot from the dock to the Astor House more than a mile, for 8.6 cents, U. S. currency, and more than the conventional price for the service rendered.  On our way we passed several loaded carryalls of the type seen in Fig. 61, on which women were riding for a fare one-tenth that we had paid, but at a slower pace and with many a jolt.

The ringing chorus which came loud and clear when yet half a block away announced that the pile drivers were still at work on the foundation for an annex to the Astor House, and so were they on May 27th when we returned from the Shantung province, 88 days after we saw them first, but with the task then practically completed.  Had the eighteen men labored continuously through this interval, the cost of their services to the contractor would have been but $205.92.  With these conditions the engine-driven pile driver could not compete.  All ordinary labor here receives a low wage.  In the Chekiang province farm labor employed by the year received $30 and board, ten years ago, but now is receiving $50.  This is at the rate of about $12.90 and $21.50, gold, materially less than there is paid per month in the United States.  At Tsingtao in the Shantung province a missionary was paying a Chinese cook ten dollars per month, a man for general work nine dollars per month, and the cook’s wife, for doing the mending and other family service, two dollars per month, all living at home and feeding themselves.  This service rendered for $9.03, gold, per month covers the marketing, all care of the garden and lawn as well as all the work in the house.  Missionaries in China find such servants reliable and satisfactory, and trust them with the purse and the marketing for the table, finding them not only honest but far better at a bargain and at economical selection than themselves.

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We had a soil tube made in the shops of a large English ship building and repair firm, employing many hundred Chinese as mechanics, using the most modern and complex machinery, and the foreman stated that as soon as the men could understand well enough to take orders they were even better shop hands than the average in Scotland and England.  An educated Chinese booking clerk at the Soochow railway station in Kiangsu province was receiving a salary of $10.75, gold, per month.  We had inquired the way to the Elizabeth Blake hospital and he volunteered to escort us and did so, the distance being over a mile.

He would accept no compensation, and yet I was an entire stranger, without introduction of any kind.  Everywhere we went in China, the laboring people appeared generally happy and contented if they have something to do, and showed clearly that they were well nourished.  The industrial classes are thoroughly organized, having had their guilds or labor unions for centuries and it is not at all uncommon for a laborer who is known to have violated the rules of his guild to be summarily dealt with or even to disappear without questions being asked.  In going among the people, away from the lines of tourist travel, one gets the impression that everybody is busy or is in the harness ready to be busy.  Tramps of our hobo type have few opportunities here and we doubt if one exists in either of these countries.  There are people physically disabled who are asking alms and there are organized charities to help them, but in proportion to the total population these appear to be fewer than in America or Europe.  The gathering of unfortunates and habitual beggars about public places frequented by people of leisure and means naturally leads tourists to a wrong judgment regarding the extent of these social conditions.  Nowhere among these densely crowded people, either Chinese, Japanese or Korean, did we see one intoxicated, but among Americans and Europeans many instances were observed.  All classes and both sexes use tobacco and the British-American Tobacco Company does a business in China amounting to millions of dollars annually.

During five months among these people we saw but two children in a quarrel.  The two little boys were having their trouble on Nanking road, Shanghai, where, grasping each other’s pigtails, they tussled with a vengeance until the mother of one came and parted their ways.

Among the most frequent sights in the city streets are the itinerant vendors of hot foods and confections.  Stove, fuel, supplies and appliances may all be carried on the shoulders, swinging from a bamboo pole.  The mother in Fig. 63 was quite likely thus supporting her family and the children are seen at lunch, dressed in the blue and white calico prints so generally worn by the young.  The printing of this calico by the very ancient, simple yet effective method we witnessed in the farm village along the canal seen in Fig. 10.

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This art, as with so many others in China, was the inheritance of the family we saw at work, handed down to them through many generations.  The printer was standing at a rough work bench upon which a large heavy stone in cubical form served as a weight to hold in place a thoroughly lacquered sheet of tough cardboard in which was cut the pattern to appear in white on the cloth.  Beside the stone stood a pot of thick paste prepared from a mixture of lime and soy bean flour.  The soy beans were being ground in one corner of the same room by a diminutive edition of such an outfit as seen in Fig. 64.  The donkey was working in his permanent abode and whenever off duty he halted before manger and feed.  At the operator’s right lay a bolt of white cotton cloth fixed to unroll and pass under the stencil, held stationary by the heavy weight.  To print, the stencil was raised and the cloth brought to place under it.  The paste was then deftly spread with a paddle over the surface and thus upon the cloth beneath wherever exposed through the openings in the stencil.  This completes the printing of the pattern on one section of the bolt of cloth.  The free end of the stencil is then raised, the cloth passed along the proper distance by hand and the stencil dropped in place for the next application.  The paste is permitted to dry upon the cloth and when the bolt has been dipped into the blue dye the portions protected by the paste remain white.  In this simple manner has the printing of calico been done for centuries for the garments of millions of children.  From the ceiling of the drying room in this printery of olden times were hanging some hundreds of stencils bearing different patterns.  In our great calico mills, printing hundreds of yards per minute, the mechanics and the chemistry differ only in detail of application and in dispatch, not in fundamental principle.

In almost any direction we traveled outside the city, in the pleasant mornings when the air was still, the laying of warp for cotton cloth could be seen, to be woven later in the country homes.  We saw this work in progress many times and in many places in the early morning, usually along some roadside or open place, as seen in Fig. 65, but never later in the day.  When the warp is laid each will be rolled upon its stretcher and removed to the house to be woven.

In many places in Kiangsu province batteries of the large dye pits were seen sunk in the fields and lined with cement.  These were six to eight feet in diameter and four to five feet deep.  In one case observed there were nine pits in the set.  Some of the pits were neatly sheltered beneath live arbors, as represented in Fig. 66.  But much of this spinning, weaving, dyeing and printing of late years is being displaced by the cheaper calicos of foreign make and most of the dye pits we saw were not now used for this purpose, the two in the illustration serving as manure receptacles.  Our interpreter stated however that there is a growing dissatisfaction with foreign goods on account of their lack of durability; and we saw many cases where the cloth dyed blue was being dried in large quantities on the grave lands.

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In another home for nearly an hour we observed a method of beating cotton and of laying it to serve as the body for mattresses and the coverlets for beds.  This we could do without intrusion because the home was also the work shop and opened full width directly upon the narrow street.  The heavy wooden shutters which closed the home at night were serving as a work bench about seven feet square, laid upon movable supports.  There was barely room to work between it and the sidewalk without impeding traffic, and on the three other sides there was a floor space three or four feet wide.  In the rear sat grandmother and wife while in and out the four younger children were playing.  Occupying the two sides of the room were receptacles filled with raw cotton and appliances for the work.  There may have been a kitchen and sleeping room behind but no door, as such, was visible.  The finished mattresses, carefully rolled and wrapped in paper, were suspended from the ceiling.  On the improvised work table, with its top two feet above the floor, there had been laid in the morning before our visit, a mass of soft white cotton more than six feet square and fully twelve inches deep.  On opposite sides of this table the father and his son, of twelve years, each twanged the string of their heavy bamboo bows, snapping the lint from the wads of cotton and flinging it broadcast in an even layer over the surface of the growing mattress, the two strings the while emitting tones pitched far below the hum of the bumblebee.  The heavy bow was steadied by a cord secured around the body of the operator, allowing him to manage it with one hand and to move readily around his work in a manner different from the custom of the Japanese seen in Fig. 67.  By this means the lint was expeditiously plucked and skillfully and uniformly laid, the twanging being effected by an appliance similar to that used in Japan.

Repeatedly, taken in small bits from the barrel of cotton, the lint was distributed over the entire surface with great dexterity and uniformity, the mattress growing upward with perfectly vertical sides, straight edges and square corners.  In this manner a thoroughly uniform texture is secured which compresses into a body of even thickness, free from hard places.

The next step in building the mattress is even more simple and expeditious.  A basket of long bobbins of roughly spun cotton was near the grandmother and probably her handiwork.  The father took from the wall a slender bamboo rod like a fish-pole, six feet long, and selecting one of the spools, threaded the strand through an eye in the small end.  With the pole and spool in one hand and the free end of the thread, passing through the eye, in the other, the father reached the thread across the mattress to the boy who hooked his finger over it, carrying it to one edge of the bed of cotton.  While this was doing the father had whipped the pole back to his side and caught the thread over his own finger, bringing

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this down upon the cotton opposite his son.  There was thus laid a double strand, but the pole continued whipping hack and forth across the bed, father and son catching the threads and bringing them to place on the cotton at the rate of forty to fifty courses per minute, and in a very short time the entire surface of the mattress had been laid with double strands.  A heavy bamboo roller was next laid across the strands at the middle, passed carefully to one side, back again to the middle and then to the other edge.  Another layer of threads was then laid diagonally and this similarly pressed with the same roller; then another diagonally the other way and finally straight across in both directions.  A similar network of strands had been laid upon the table before spreading the cotton.  Next a flat bottomed, circular, shallow basket-like form two feet in diameter was used to gently compress the material from twelve to six inches in thickness.  The woven threads were now turned over the edge of the mattress on all sides and sewed down, after which, by means of two heavy solid wooden disks eighteen inches in diameter, father and son compressed the cotton until the thickness was reduced to three inches.  There remained the task of carefully folding and wrapping the finished piece in oiled paper and of suspending it from the ceiling.

On March 20th, when visiting the Boone Road and Nanking Road markets in Shanghai, we had our first surprise regarding the extent to which vegetables enter into the daily diet of the Chinese.  We had observed long processions of wheelbarrow men moving from the canals through the streets carrying large loads of the green tips of rape in bundles a foot long and five inches in diameter.  These had come from the country on boats each carrying tons of the succulent leaves and stems.  We had counted as many as fifty wheelbarrow men passing a given point on the street in quick succession, each carrying 300 to 500 pounds of the green rape and moving so rapidly that it was not easy to keep pace with them, as we learned in following one of the trains during twenty minutes to its destination.  During this time not a man in the train halted or slackened his pace.

This rape is very extensively grown in the fields, the tips of the stems cut when tender and eaten, after being boiled or steamed, after the manner of cabbage.  Very large quantities are also packed with salt in the proportion of about twenty pounds of salt to one hundred pounds of the rape.  This, Fig. 68, and many other vegetables are sold thus pickled and used as relishes with rice, which invariably is cooked and served without salt or other seasoning.

Another field crop very extensively grown for human food, and partly as a source of soil nitrogen, is closely allied to our alfalfa.  This is the Medicago astragalus, two beds of which are seen in Fig. 69.  Tender tips of the stems are gathered before the stage of blossoming is reached and served as food after boiling or steaming.  It is known among the foreigners as Chinese “clover.”  The stems are also cooked and then dried for use when the crop is out of season.  When picked very young, wealthy Chinese families pay an extra high price for the tender shoots, sometimes as much as 20 to 28 cents, our currency, per pound.

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The markets are thronged with people making their purchases in the early mornings, and the congested condition, with the great variety of vegetables, makes it almost as impressive a sight as Billingsgate fish market in London.  In the following table we give a list of vegetables observed there and the prices at which they were selling.

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*List* *of* *vegetables* *displayed* *for* *sale* *in* *Boone* *road* *market*,
*Shanghai*, *April* 6*th*, 1900, *with* *prices* *expressedin* U. S. *Currency*.—­
---------------------------------------------------------
Cents
Lotus roots, per lb. 1.60
Bamboo sprouts, per lb. 6.40
English cabbage, per lb. 1.33
Olive greens, per lb. .67
White greens, per lb. .33
Tee Tsai, per lb. .53
Chinese celery, per lb. .67
Chinese clover, per lb. .58
Chinese clover, very young, lb. 21.33
Oblong white cabbage, per lb. 2.00
Red beans, per lb. 1.33
Yellow beans, per lb. 1.87
Peanuts, per lb. 2.49
Ground nuts, per lb. 2.96
Cucumbers, per lb. 2.58
Green pumpkin, per lb. 1.62
Maize, shelled, per lb. 1.00
Windsor beans, dry, per lb. 1.72
French lettuce, per head .44
Hau Tsai, per head .87
Cabbage lettuce, per head .22
Kale, per lb. 1.60
Rape, per lb. .23
Portuguese water cress, basket 2.15
Shang tsor, basket 8.60
Carrots, per lb. .97
String beans; per lb. 1.60
Irish potatoes, per lb. 1.60
Red onions, per lb. 4.96
Long white turnips, per lb. .44
Flat string beans, per lb. 4.80
Small white turnips, bunch .44
Onion stems, per lb. 1.29
Lima beans, green, shelled, lb. 6.45
Egg plants, per lb. 4.30
Tomatoes, per lb. 5.16
Small flat turnips, per lb. .86
Small red beets, per lb. 1.29
Artichokes, per lb. 1.29
White beans, dry, per lb. 4.80
Radishes, per lb. 1.29
Garlic, per lb. 2.15
Kohl rabi, per lb. 2.15
Mint, per lb. 4.30
Leeks, per lb. 2.18
Large celery, bleached, bunch 2.10
Sprouted peas, per lb. .80
Sprouted beans, per lb. .93
Parsnips, per lb. 1.29
Ginger roots, per lb. 1.60
Water chestnuts, per lb. 1.33
Large sweet potatoes, per lb. 1.33
Small sweet potatoes, per lb. 1.00
Onion sprouts, per lb. 2.13

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Spinach, per lb. 1.00
Fleshy stemmed lettuce, peeled,
per lb. 2.00
Fleshy stemmed lettuce, unpeeled,
per lb. .67
Bean curd, per lb. 3.93
Shantung walnuts, per lb. 4.30
Duck eggs, dozen 8.34
Hen’s eggs, dozen 7.30
Goat’s meat, per lb. 6.45
Pork, per lb. 6.88
Hens, live weight, per lb. 6.45
Ducks, live weight, per lb. 5.59
Cockerels, live weight, per lb. 5.59—­
---------------------------------------------------------  
re>
  
This long list, made up chiefly of fresh vegetables
displayed for sale on one market day, is by no means
complete. The record is only such as was made
in passing down one side and across one end of the
market occupying nearly one city block. Nearly
everything is sold by weight and the problem of correct
weights is effectively solved by each purchaser carrying
his own scales, which he unhesitatingly uses in the
presence of the dealer. These scales are made
on the pattern of the old time steelyards but from
slender rods of wood or bamboo provided with a scale
and sliding poise, the suspensions all being made
with strings.
  
We stood by through the purchasing of two cockerels
and the dickering over their weight. A dozen
live birds were under cover in a large, open-work
basket. The customer took out the birds one by
one, examining them by touch, finally selecting two,
the price being named. These the dealer tied
together by their feet and weighed them, announcing
the result; whereupon the customer checked the statement
with his own scales. An animated dialogue followed,
punctuated with many gesticulations and with the customer
tossing the birds into the basket and turning to go
away while the dealer grew more earnest. The
purchaser finally turned back, and again balancing
the roosters upon his scales, called a bystander to
read the weight, and then flung them in apparent disdain
at the dealer, who caught them and placed them in
the customer’s basket. The storm subsided
and the dealer accepted 92c, Mexican, for the two birds.
They were good sized roosters and must have dressed
more than three pounds each, yet for the two he paid
less than 40 cents in our currency.
  
Bamboo sprouts are very generally used in China, Korea
and Japan and when one sees them growing they suggest
giant stalks of asparagus, some of them being three
and even five inches in diameter and a foot in height
at the stage for cutting. They are shipped in
large quantities from province to province where they
do not grow or when they are out of season. Those
we saw in Nagasaki referred to in Fig. 22, had come
from Canton or Swatow or possibly Formosa. The
form, foliage and bloom of the bamboo give the most
beautiful effects in the landscape, especially when
grouped with tree forms. They are usually cultivated
in small clumps about dwellings in places not otherwise

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readily utilized, as seen in Fig. 66. Like the
asparagus bud, the bamboo sprout grows to its full
height between April and August, even when it exceeds
thirty or even sixty feet in height. The buds
spring from fleshy underground stems or roots whose
stored nourishment permits this rapid growth, which
in its earlier stages may exceed twelve inches in
twenty-four hours. But while the full size of
the plant is attained the first season, three or four
years are required to ripen and harden the wood sufficiently
to make it suitable for the many uses to which the
stems are put. It would seem that the time must
come when some of the many forms of bamboo will be
introduced and largely grown in many parts of this
country.
  
Lotus roots form another article of diet largely used
and widely cultivated from Canton to Tokyo. These
are seen in the lower section of Fig. 70, and the
plants in bloom in Fig. 71, growing in water, their
natural habitat. The lotus is grown in permanent
ponds not readily drained for rice or other crops,
and the roots are widely shipped.
  
Sprouted beans and peas of many kinds and the sprouts
of other vegetables, such as onions, are very generally
seen in the markets of both China and Japan, at least
during the late winter and early spring, and are sold
as foods, having different flavors and digestive qualities,
and no doubt with important advantageous effects in
nutrition.
  
Ginger is another. crop which is very widely and extensively
cultivated. It is generally displayed in the market
in the root form. No one thing was more generally
hawked about the streets of China than the water chestnut.
This is a small corm or fleshy bulb having the shape
and size of a small onion. Boys pare them and
sell a dozen spitted together on slender sticks the
length of a knitting needle. Then there are the
water caltropes, grown in the canals producing a fruit
resembling a horny nut having a shape which suggests
for them the name “buffalo-horn”.
Still another plant, known as water-grass (Hydropyrum
latifolium) is grown in Kiangsu province where the
land is too wet for rice. The plant has a tender
succulent crown of leaves and the peeling of the outer
coarser ones away suggests the husking of an ear of
green corn. The portion eaten is the central
tender new growth, and when cooked forms a delicate
savory dish. The farmers’ selling price
is three to four dollars, Mexican, per hundred catty,
or $.97 to $1.29 per hundredweight, and the return
per acre is from $13 to $20.
  
The small number of animal products which are included
in the market list given should not be taken as indicating
the proportion of animal to vegetable foods in the
dietaries of these people. It is nevertheless
true that they are vegetarians to a far higher degree
than are most western nations, and the high maintenance
efficiency of the agriculture of China, Korea and
Japan is in great measure rendered possible by the
adoption of a diet so largely vegetarian. Hopkins,

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in his Soil Fertility and Permanent Agriculture, page
234, makes this pointed statement of fact: “1000
bushels of grain has at least five times as much food
value and will support five times as many people as
will the meat or milk that can be made from it”.
He also calls attention to the results of many Rothamsted
feeding experiments with growing and fattening cattle,
sheep and swine, showing that the cattle destroyed
outright, in every 100 pounds of dry substance eaten,
57.3 pounds, this passing off into the air, as does
all of wood except the ashes, when burned in the stove;
they left in the excrements 36.5 pounds, and stored
as increase but 6.2 pounds of the 100. With sheep
the corresponding figures were 60.1 pounds; 31.9 pounds
and 8 pounds; and with swine they were 65.7 pounds;
16.7 pounds and 17.6 pounds. But less than two-thirds
of the substance stored in the animal can become food
for man and hence we get but four pounds in one hundred
of the dry substances eaten by cattle in the form
of human food; but five pounds from the sheep and
eleven pounds from swine.
  
In view of these relations, only recently established
as scientific facts by rigid research, it is remarkable
that these very ancient people came long ago to discard
cattle as milk and meat producers; to use sheep more
for their pelts and wool than for food; while swine
are the one kind of the three classes which they did
retain in the role of middleman as transformers of
coarse substances into human food.
  
It is clear that in the adoption of the succulent
forms of vegetables as human food important advantages
are gained. At this stage of maturity they have
a higher digestibility, thus making the elimination
of the animal less difficult. Their nitrogen content
is relatively higher and this in a measure compensates
for loss of meat. By devoting the soil to growing
vegetation which man can directly digest they have
saved 60 pounds per 100 of absolute waste by the animal,
returning their own wastes to the field for the maintenance
of fertility. In using these immature forms of
vegetation so largely as food they are able to produce
an immense amount that would otherwise be impossible,
for this is grown in a shorter time, permitting the
same soil to produce more crops. It is also produced
late in the fall and early in the spring when the
season is too cold and the hours of sunshine too few
each day to permit of ripening crops.

**VII**

*The* *fuel* *problem*, *building* *and  
textile* *materials*

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With the vast and ever increasing demands made upon
materials which are the products of cultivated fields,
for food, for apparel, for furnishings and for cordage,
better soil management must grow more important as
populations multiply. With the increasing cost
and ultimate exhaustion of mineral fuel; with our
timber vanishing rapidly before the ever growing demands
for lumber and paper; with the inevitably slow growth
of trees and the very limited areas which the world
can ever afford to devote to forestry, the time must
surely come when, in short period rotations, there
will be grown upon the farm materials from which to
manufacture not only paper and the substitutes for
lumber, but fuels as well. The complete utilization
of every stream which reaches the sea, reinforced by
the force of the winds and the energy of the waves
which may be transformed along the coast lines, cannot
fully meet the demands of the future for power and
heat; hence only in the event of science and engineering
skill becoming able to devise means for transforming
the unlimited energy of space through which we are
ever whirled, with an economy approximating that which
crops now exhibit, can good soil management be relieved
of the task of meeting a portion of the world’s
demand for power and heat.
  
When these statements were made in 1905 we did not
know that for centuries there had existed in China,
Korea and Japan a density of population such as to
require the extensive cultivation of crops for fuel
and building material, as well as for fabrics, by the
ordinary methods of tillage, and hence another of
the many surprises we had was the solution these people
had reached of their fuel problem and of how to keep
warm. Their solution has been direct and the simplest
possible. Dress to make fuel for warmth of body
unnecessary, and burn the coarser stems of crops,
such as cannot be eaten, fed to animals or otherwise
made useful. These people still use what wood
can be grown on the untillable land within transporting
distance, and convert much wood into charcoal, making
transportation over longer distances easier.
The general use of mineral fuels, such as coal, coke,
oils and gas, had been impossible to these as to every
other people until within the last one hundred years.
Coal, coke, oil and natural gas, however, have been
locally used by the Chinese from very ancient times.
For more than two thousand years brine from many deep
wells in Szechwan province has been evaporated with
heat generated by the burning of natural gas from
wells, conveyed through bamboo stems to the pans and
burned from iron terminals. In other sections
of the same province much brine is evaporated over
coal fires. Alexander Hosie estimates the production
of salt in Szechwan province at more than 600 million
pounds annually.
  
Coal is here used also to some extent for warming
the houses, burned in pits sunk in the floor, the
smoke escaping where it may. The same method
of heating we saw in use in the post office at Yokohama
during February. The fires were in large iron
braziers more than two feet across the top, simply
set about the room, three being in operation.
Stoves for house warming are not used in dwellings
in these countries.

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In both China and Japan we saw coal dust put into
the form and size of medium oranges by mixing it with
a thin paste of clay. Charcoal is similarly molded,
as seen in Fig. 72, using a by-product from the manufacture
of rice syrup for cementing. In Nanking we watched
with much interest the manufacture of charcoal briquets
by another method. A Chinese workman was seated
upon the earth floor of a shop. By his side was
a pile of powdered charcoal, a dish of rice syrup
by-product and a basin of the moistened charcoal powder.
Between his legs was a heavy mass of iron containing
a slightly conical mold two inches deep, two and a
half inches across at the top and a heavy iron hammer
weighing several pounds. In his left hand he held
a short heavy ramming tool and with his right placed
in the mold a pinch of the moistened charcoal; then
followed three well directed blows from the hammer
upon the ramming tool, compressing the charge of moistened,
sticky charcoal into a very compact layer. Another
pinch of charcoal was added and the process repeated
until the mold was filled, when the briquet was forced
out.
  
By this simplest possible mechanism, the man, utilizing
but a small part of his available energy, was subjecting
the charcoal to an enormous pressure such as we attain
only with the best hydraulic presses, and he was using
the principle of repeated small charges recently patented
and applied in our large and most efficient cotton
and hay presses, which permit much denser bales to
be made than is possible when large charges are added,
and the Chinese is here, as in a thousand other ways,
thoroughly sound in his application of mechanical
principles. His output for the day was small but
his patience seemed unlimited. His arms and body,
bared to the waist, showed vigor and good feeding,
while his face wore the look of contentment.
  
With forty centuries of such inheritance coursing
in the veins of four hundred millions of people, in
a country possessed of such marvelous wealth of coal
and water power, of forest and of agricultural possibilities,
there should be a future speedily blossoming and ripening
into all that is highest and best for such a nation.
If they will retain their economies and their industry
and use their energies to develop, direct and utilize
the power in their streams and in their coal fields
along the lines which science has now made possible
to them, at the same time walking in paths of peace
and virtue, there is little worth while which may not
come to such a people.
  
A Shantung farmer in winter dress, Fig. 18, and the
Kiangsu woman portrayed in Fig. 73, in corresponding
costume, are typical illustrations of the manner in
which food for body warmth is minimized and of the
way the heat generated in the body is conserved.
Observe his wadded and quilted frock, his trousers
of similar goods tied about the ankle, with his feet
clad in multiple socks and cloth shoes provided with
thick felted soles. These types of dress, with

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the wadding, quilting, belting and tying, incorporate
and confine as part of the effective material a large
volume of air, thus securing without cost, much additional
warmth without increasing the weight of the garments.
Beneath these outer garments several under pieces
of different weights are worn which greatly conserve
the warmth during the coldest weather and make possible
a wide range of adjustment to suit varying changes
in temperature. It is doubtful if there could
he devised a wardrobe suited to the conditions of
these people at a smaller first cost and maintenance
expense. Rev. E. A. Evans, of the China Inland
Mission, for many years residing at Sunking in Szechwan,
estimated that a farmer’s wardrobe, once it
was procured, could be maintained with an annual expenditure
of $2.25 of our currency, this sum procuring the materials
for both repairs and renewals.
  
The intense individual economy, extending to the smallest
matters, so universally practiced by these people,
has sustained the massive strength of the Mongolian
nations through their long history and this trait
is seen in their handling of the fuel problem, as it
is in all other lines. In the home of Mrs. Wu,
owner and manager of a 25-acre rice farm in Chekiang
province, there was a masonry kang seven by seven
feet, about twenty-eight inches high, which could be
warmed in winter by building a fire within. The
top was fitted for mats to serve as couch by day and
as a place upon which to spread the bed at night.
In the Shantung province we visited the home of a
prosperous farmer and here found two kangs in separate
sleeping apartments, both warmed by the waste heat
from the kitchen whose chimney flue passed horizontally
under the kangs before rising through the roof.
These kangs were wide enough to spread the beds upon,
about thirty inches high, and had been constructed
from brick twelve inches square and four inches thick,
made from the clay subsoil taken from the fields and
worked into a plastic mass, mixed with chaff and short
straw, dried in the sun and then laid in a mortar
of the same material. These massive kangs are
thus capable of absorbing large amounts of the waste
heat from the kitchen during the day and of imparting
congenial warmth to the couches by day and to the
beds and sleeping apartments during the night.
In some Manchurian inns large compound kangs are so
arranged that the guests sleep heads together in double
rows, separated only by low dividing rails, securing
the greatest economy of fuel, providing the guests
with places where they may sit upon the moderately
warmed fireplace, and spread their beds when they
retire.
  
The economy of the chimney beds does not end with
the warmth conserved. The earth and straw brick,
through the processes of fermentation and through
shrinkage, become open and porous after three or four
years of service, so that the draft is defective,
giving annoyance from smoke, which requires their renewal.
But the heat, the fermentation and the absorption
of products of combustion have together transformed
the comparatively infertile subsoil into what they
regard as a valuable fertilizer and these discarded
brick are used in the preparation of compost fertilizers
for the fields. On account of this value of the
discarded brick the large amount of labor involved
in removing and rebuilding the kangs is not regarded
altogether as labor lost.

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Our own observations have shown that heating soils
to dryness at a temperature of 110 deg C. greatly
increases the freedom with which plant food may be
recovered from them by the solvent power of water,
and the same heating doubtless improves the physical
and biological conditions of the soil as well.
Nitrogen combined as ammonia, and phosphorus, potash
and lime are all carried with the smoke or soot, mechanically
in the draft and arrested upon the inner walls of the
kangs or filter into the porous brick with the smoke,
and thus add plant food directly to the soil.
Soot from wood has been found to contain, as an average,
1.36 per cent of nitrogen; .51 per cent of phosphorus
and 5.34 per cent of potassium. We practice burning
straw and corn stalks in enormous quantities, to get
them easily out of the way, thus scattering on the
winds valuable plant food, thoughtlessly and lazily
wasting where these people laboriously and religiously
save. These are gains in addition to those which
result from the formation of nitrates, soluble potash
and other plant foods through fermentation. We
saw many instances where these discarded brick were
being used, both in Shantung and Chihli provinces,
and it was common in walking through the streets of
country villages to see piles of them, evidently recently
removed.
  
The fuel grown on the farms consists of the stems
of all agricultural crops which are to any extent
woody, unless they can be put to some better use.
Rice straw, cotton stems pulled by the roots after
the seed has been gathered, the stems of windsor beans,
those of rape and the millets, all pulled by the roots,
and many other kinds, are brought to the market tied
in bundles in the manner seen in Figs. 74, 75 and
76. These fuels are used for domestic purposes
and for the burning of lime, brick, roofing tile and
earthenware as well as in the manufacture of oil,
tea, bean-curd and many other processes. In the
home, when the meals are cooked with these light bulky
fuels, it is the duty of some one, often one of the
children, to sit on the floor and feed the fire with
one hand while with the other a bellows is worked
to secure sufficient draft. The manufacture of
cotton seed oil and cotton seed cake is one of the
common family industries in China, and in one of these
homes we saw rice hulls and rice straw being used
as fuel. In the large low, one-story, tile-roofed
building serving as store, warehouse, factory and
dwelling, a family of four generations were at work,
the grandfather supervising in the mill and the grandmother
leading in the home and store where the cotton seed
oil was being. retailed for 22 cents per pound and
the cotton seed cake at 33 cents, gold, per hundredweight.
Back of the store and living rooms, in the mill compartment,
three blindfolded water buffalo, each working a granite
mill, were crushing and grinding the cotton seed.
Three other buffalo, for relay service, were lying
at rest or eating, awaiting their turn at the ten-hour

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working day. Two of the mills were horizontal
granite burrs more than four feet in diameter, the
upper one revolving once with each circuit made by
the cow. The third mill was a pair of massive
granite rollers, each five feet in diameter and two
feet thick, joined on a very short horizontal axle
which revolved on a circular stone plate about a vertical
axis once with each circuit of the buffalo. Two
men tended the three mills. After the cotton
seed had been twice passed through the mills it was
steamed to render the oil fluid and more readily expressed.
The steamer consisted of two covered wooden hoops
not unlike that seen in Fig. 77, provided with screen
bottoms, and in these the meal was placed over openings
in the top of an iron kettle of boiling water from
which the steam was forced through the charge of meal.
Each charge was weighed in a scoop balanced on the
arm of a bamboo scale, thus securing a uniform weight
for the cakes.
  
On the ground in front of the furnace sat a boy of
twelve years steadily feeding rice chaff into the
fire with his left hand at the rate of about thirty
charges per minute, while with his right hand, and
in perfect rhythm, he drew back and forth the long
plunger of a rectangular box bellows, maintaining
a forced draft for the fire. At intervals the
man who was bringing fuel fed into the furnace a bundle
of rice straw, thus giving the boy’s left arm
a moment’s respite. When the steaming has
rendered the oil sufficiently fluid the meal is transferred,
hot, to ten-inch hoops two inches deep, made of braided
bamboo strands, and is deftly tramped with the bare
feet, while hot, the operator steadying himself by
a pair of hand bars. After a stack of sixteen
hoops, divided by a slight sifting of chaff or short
straw to separate the cakes, had been completed these
were taken to one of four pressmen, who were kept busy
in expressing the oil.
  
The presses consisted of two parallel timbers framed
together, long enough to receive the sixteen hoops
on edge above a gap between them. These cheeses
of meal are subjected to an enormous pressure secured
by means of three parallel lines of wedges forced against
the follower each by an iron-bound master wedge, driven
home with a heavy beetle weighing some twenty-five
or thirty pounds. The lines of wedges were tightened
in succession, the loosened line receiving an additional
wedge to take up the slack after drawing back the
master wedge, which was then driven home. To keep
good the supply of wedges which are often crushed
under the pressure a second boy, older than the one
at the furnace, was working on the floor, shaping
new ones, the broken wedges and the chips going to
the furnace for fuel.
  
By this very simple, readily constructed and inexpensive
mechanism enormous pressures were secured and when
the operator had obtained the desired compression
he lighted his pipe and sat down to smoke until the
oil ceased dripping into the pit sunk in the floor
beneath the press. In this interval the next
series of cakes went to another press and the work
thus kept up during the day.

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Six hundred and forty cakes was the average daily
output of this family of eight men and two boys, with
their six water buffalo. The cotton seed cakes
were being sold as feed, and a near-by Chinese dairyman
was using them for his herd of forty water buffalo,
seen in Fig. 78, producing milk for the foreign trade
in Shanghai. This herd of forty cows one of which
was an albino, was giving an average of but 200 catty
of milk per day, or at the rate of six and two-thirds
pounds per head! The cows have extremely small
udders but the milk is very rich, as indicated by
an analysis made in the office of the Shanghai Board
of Health and obtained through the kindness of Dr.
Arthur Stanley. The milk showed a specific gravity
of 1.028 and contained 20.1 per cent total solids;
7.5 per cent fat; 4.2 per cent milk sugar and .8 per
cent ash. In the family of Rev. W. H. Hudson,
of the Southern Presbyterian Mission, Kashing, whose
very gracious hospitality we enjoyed on two different
occasions, the butter made from the milk of two of
these cows, one of which, with her calf, is seen in
Fig. 79, was used on the family table. It was
as white as lard or cottolene but the texture and
flavor were normal and far better than the Danish
and New Zealand products served at the hotels.
  
The milk produced at the Chinese dairy in Shanghai
was being sold in bottles holding two pounds, at the
rate of one dollar a bottle, or 43 cents, gold.
This seems high and there may have been misunderstanding
on the part of my interpreter but his answer to my
question was that the milk was being sold at one Shanghai
dollar per bottle holding one and a half catty, which,
interpreted, is the value given above.
  
But fuel from the stems of cultivated plants which
are in part otherwise useful, is not sufficient to
meet the needs of country and village, notwithstanding
the intense economies practiced. Large areas
of hill and mountain land are made to contribute their
share, as we have seen in the south of China, where
pine boughs were being used for firing the lime and
cement kilns. At Tsingtao we saw the pine bough
fuel on the backs of mules, Fig. 80, coming from the
hills in Shantung province. Similar fuels were
being used in Korea and we have photographs of large
pine bough fuel stacks, taken in Japan at Funabashi,
east from Tokyo.
  
The hill and mountain lands, wherever accessible to
the densely peopled plains, have long been cut over
and as regularly has afforestation been encouraged
and deliberately secured even through the transplanting
of nursery stock grown expressly for that purpose.
We had read so much regarding the reckless destruction
of forests in China and Japan and had seen so few
old forest trees except where these had been protected
about temples, graves or houses, that when Rev. R.
A. Haden, of the Elizabeth Blake hospital, near Soochow
insisted that the Chinese were deliberate foresters
and that they regularly grow trees for fuel, transplanting
them when necessary to secure a close and early stand,
after the area had been cleared, we were so much surprised
that he generously volunteered to accompany us westward
on a two days journey into the hill country where the
practice could be seen.

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A family owning a houseboat and living upon it was
engaged for the journey. This family consisted
of a recently widowed father, his two sons, newly
married, and a helper. They were to transport
us and provide sleeping quarters for myself, Mr. Haden
and a cook for the consideration of $3.00, Mexican,
per day and to continue the journey through the night,
leaving the day for observation in the hills.
  
The recent funeral had cost the father $100 and the
wedding of the two sons $50 each, while the remodeling
of the houseboat to meet the needs of the new family
relations cost still another $100. To meet these
expenses it had been necessary to borrow the full amount,
$300. On $100 the father was paying 20 per cent
interest; on $50 he was compelled to pay 50 per cent
interest. The balance he had borrowed from friends
without interest but with the understanding that he
would return the favor should occasion be required.
  
Rev. A. E. Evans informed us that it is a common practice
in China for neighbors to help one another in times
of great financial stress. This is one of the
methods:
  
A neighbor may need 8000 cash. He prepares a
feast and sends invitations to a hundred friends.
They know there has been no death in his family and
that there is no wedding, still it is understood that
he is in need of money. The feast is prepared
at a small expense. The invited guests come,
each bringing eighty cash as a present. The recipient
is expected to keep a careful record of contributing
friends and to repay the sum. Another method is
like this: For some reason a man needs to borrow
20,000 cash. He proposes to twenty of his friends
that they organize a club to raise this sum.
If the friends agree each pays 1000 cash to the organizing
member. The balance of the club draw lots as to
which member shall be number two, three, four, five,
*etc*., designating the order in which payments
shall be made. The man borrowing the money is
then under obligation to see that these payments are
met in full at the times agreed upon. Not infrequently
a small rate of interest is charged.
  
Rates of interest are very high in China, especially
on small sums where securities are not the best.
Mr. Evans informs me that two per cent per month is
low and thirty per cent per annum is very commonly
collected. Such obligations are often never met
but they do not outlaw and may descend from father
to son.
  
The boat cost $292.40 in U. S. currency; the yearly
earning was $107.50 to $120.40. The funeral cost
$43 and $43 more was required for the wedding of the
two sons. They were receiving for the services
of six people $1.29 per day. An engagement for
two weeks or a month could have been made for materially
lower rates and their average daily earning, on the
basis of three hundred days service in the year, and
the $120.40 total earning, would be only 40.13 cents,
less than seven cents each, hence their trip with us
was two of their banner days. Foreigners in Shanghai
and other cities frequently engage such houseboat
service for two weeks or a month of travel on the
canals and rivers, finding it a very enjoyable as well
as inexpensive way of having a picnic outing.

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On reaching the hill lands the next morning there
were such scenes as shown in Fig. 82, where the strips
of tree growth, varying from two to ten years, stretched
directly up the slope, often in strong contrast on
account of the straight boundaries and different ages
of the timber. Some of these long narrow holdings
were less than two rods wide and on one of these only
recently cut, up which we walked for considerable
distance, the young pine were springing up in goodly
numbers. As many as eighteen young trees were
counted on a width of six feet across the strip of
thirty feet wide. On this area everything had
been recently cut clean. Even stumps and the large
roots were dug and saved for fuel.
  
In Fig. 83 are seen bundles of fuel from such a strip,
just brought into the village, the boughs retaining
the leaves although the fuel had been dried.
The roots, too, are tied in with the limbs so that
everything is saved. On our walk to the hills
we passed many people bringing their loads of fuel
swinging from carrying poles on their shoulders.
Inquiries regarding the afforestation of these strips
of hillside showed that the extensive digging necessitated
by the recovery of the roots usually caused new trees
to spring up quickly as volunteers from scattered
seed and from the roots, so that planting was not
generally required. Talking with a group of people
as to where we could see some of the trees used for
replanting the hillsides, a lad of seven years was
first to understand and volunteered to conduct us
to a planting. This he did and was overjoyed
on receipt of a trifle for his services. One of
these little pine nurseries is seen in Fig. 84, many
being planted in suitable places through the woods.
The lad led us to two such locations with whose whereabouts
he was evidently very familiar, although they were
considerable distance from the path and far from home.
These small trees are used in filling in places where
the volunteer growth has not been sufficiently close.
A strong herbaceous growth usually springs up quickly
on these newly cleared lands and this too is cut for
fuel or for use in making compost or as green manure.
  
The grass which grows on the grave lands, if not fed
off, is also cut and saved for fuel. We saw several
instances of this outside of Shanghai, one where a
mother with her daughter, provided with rake, sickle,
basket and bag, were gathering the dry stubble and
grass of the previous season, from the grave lands
where there was less than could be found on our closely
mowed meadows. In Fig. 85 may be seen a man who
has just returned with such a load, and in his hand
is the typical rake of the Far East, made by simply
bending bamboo splints, claw-shape, and securing them
as seen in the engraving.

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In the Shantung province, in Chihli and in Manchuria,
millet stems, especially those of the great kaoliang
or sorghum, are extensively used for fuel and for
building as well as for screens, fences and matting.
At Mukden the kaoliang was selling as fuel at $2.70
to $3.00, Mexican, for a 100-bundle load of stalks,
weighing seven catty to the bundle. The yield
per acre of kaoliang fuel amounts to 5600 pounds and
the stalks are eight to twelve feet long, so that
when carried on the backs of mules or horses the animals
are nearly hidden by the load. The price paid
for plant stem fuel from agricultural crops, in different
parts of China and Japan, ranged from $1.30 to $2.85,
U. S. currency, per ton. The price of anthracite
coal at Nanking was $7.76 per ton. Taking the
weight of dry oak wood at 3500 pounds per cord, the
plant stem fuel, for equal weight, was selling at
$2.28 to $5.00.
  
Large amounts of wood are converted into charcoal
in these countries and sent to market baled in rough
matting or in basketwork cases woven from small brush
and holding two to two and a half bushels. When
such wood is not converted into charcoal it is sawed
into one or two-foot lengths, split and marketed tied
in bundles, as seen in Fig. 77.
  
Along the Mukden-Antung railway in Manchuria fuel
was also being shipped in four-foot lengths, in the
form of cordwood. In Korea cattle were provided
with a peculiar saddle for carrying wood in four-foot
sticks laid blanket-fashion over the animal, extending
far down on their sides. Thus was it brought
from the hills to the railway station. This wood,
as in Manchuria, was cut from small trees. In
Korea, as in most parts of China where we visited,
the tree growth over the hills was generally scattering
and thin on the ground wherever there was not individual
ownership in small holdings. Under and among
the scattering pine there were oak in many cases,
but these were always small, evidently not more than
two or three years standing, and appearing to have
been repeatedly cut back. It was in Korea that
we saw so many instances of young leafy oak boughs
brought to the rice fields and used as green manure.
  
There was abundant evidence of periodic cutting between
Mukden and Antung in Manchuria; between Wiju and Fusan
in Korea; and throughout most of our journey in Japan;
from Nagasaki to Moji and from Shimonoseki to Yokohama.
In all of these countries afforestation takes place
quickly and the cuttings on private holdings are made
once in ten, twenty or twenty-five years. When
the wood is sold to those coming for it the takers
pay at the rate of 40 sen per one horse load of forty
kan, or 330 pounds, such as is seen in Fig. 87.
Director Ono, of the Akashi Experiment station, informed
us that such fuel loads in that prefecture, where
the wood is cut once in ten years, bring returns amounting
to about $40 per acre for the ten-year crop.
This land was worth $40 per acre but when they are
suitable for orange groves they sell for $600 per acre.
Mushroom culture is extensively practiced under the
shade of some of these wooded areas, yielding under
favorable conditions at the rate of $100 per acre.

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The forest covered area in Japan exclusive of Formosa
and Karafuto, amounts to a total of 54,196,728 acres,
less than twenty millions of which are in private
holdings, the balance belonging to the state and to
the Imperial Crown.
  
In all of these countries there has been an extensive
general use of materials other than wood for building
purposes and very many of the substitutes for lumber
are products grown on the cultivated fields.
The use of rice straw for roofing, as seen in the Hakone
village, Fig. 8, is very general throughout the rice
growing districts, and even the sides of houses may
be similarly thatched, as was observed in the Canton
delta region, such a construction being warm for winter
and cool for summer. The life of these thatched
roofs, however, is short and they must be renewed
as often as every three to five years but the old
straw is highly prized as fertilizer for the fields
on which it is grown, or it may serve as fuel, the
ashes only going to the fields.
  
Burned clay tile, especially for the cities and public
buildings, are very extensively used for roofing,
clay being abundant and near at hand. In Chihli
and in Manchuria millet and sorghum stems, used alone
or plastered, as in Fig. 88, with a mud mortar, sometimes
mixed with lime, cover the roofs of vast numbers of
the dwellings outside the larger cities.
  
At Chiao Tou in Manchuria we saw the building of the
thatched millet roofs and the use of kaoliang stems
as lumber. Rafters were set in the usual way
and covered with a layer about two inches thick of
the long kaoliang stems stripped of their leaves and
tops. These were tied together and to the rafters
with twine, thus forming a sort of matting. A
layer of thin clay mortar was then spread over the
surface and well trowelled until it began to show on
the under side. Over this was applied a thatch
of small millet stems bound in bundles eight inches
thick, cut square across the butts to eighteen inches
in length. They were dipped in water and laid
in courses after the manner of shingles but the butts
of the stems are driven forward to a slope which obliterates
the shoulder, making the courses invisible. In
the better houses this thatching may be plastered
with earth mortar or with an earth-lime mortar, which
is less liable to wash in heavy rain.
  
The walls of the house we saw building were also sided
with the long, large kaoliang stems. An ordinary
frame with posts and girts about three feet apart
had been erected, on sills and with plates carrying
the roof. Standing vertically against the girts
and tied to them, forming a close layer, were the
kaoliang stems. These were plastered outside
and in with a layer of thin earth mortar. A similar
layer of stems, set up on the inside of the girts and
similarly plastered, formed the inner face of the wall
of the house, leaving dead air spaces between the
girts.

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Brick made from earth are very extensively used for
house building, chaff and short straw being used as
a binding material, the brick being simply dried in
the sun, as seen in Fig. 89. A house in the process
of building, where the brick were being used, is seen
in Fig. 90. The foundation of the dwelling, it
will be observed, was laid with well-formed hard-burned
brick, these being necessary to prevent capillary
moisture from the ground being drawn up and soften
the earth brick, making the wall unsafe.
  
Several kilns for burning brick, built of clay and
earth, were passed in our journey up the Pei ho, and
stacked about them, covering an area of more than
eight hundred feet back from the river were bundles
of the kaoliang stems to serve as fuel in the kilns.
  
The extensive use of the unburned brick is necessitated
by the difficulty of obtaining fuel, and various methods
are adopted to reduce the number of burned brick required
in construction. One of these devices is shown
in Fig. 79, where the city wall surrounding Kashing
is constructed of alternate courses of four layers
of burned brick separated by layers of simple earth
concrete.
  
In addition to the multiple-function, farm-gown crops
used for food, fuel and building material, there is
a large acreage devoted to the growing of textile
and fiber products and enormous quantities of these
are produced annually. In Japan, where some fifty
millions of people are chiefly fed on the produce
of little more than 21,000 square miles of cultivated
land, there was grown in 1906 more than 75,500,000
pounds of cotton, hemp, flax and China grass textile
stock, occupying 76,700 acres of the cultivated land.
On 141,000 other acres there grew 115,000,000 pounds
of paper mulberry and Mitsumata, materials used in
the manufacture of paper. From still another
14,000 acres were taken 92,000,000 pounds of matting
stuff, while more than 957,000 acres were occupied
by mulberry trees for the feeding of silkworms, yielding
to Japan 22,389,798 pounds of silk. Here are
more than 300,000,000 pounds of fiber and textile
stuff taken from 1860 square miles of the cultivated
land, cutting down the food producing area to 19,263
square miles and this area is made still smaller by
devoting 123,000 acres to tea, these producing in
1906 58,900,000 pounds, worth nearly five million dollars.
Nor do these statements express the full measure of
the producing power of the 21,321 square miles of
cultivated land, for, in addition to the food and
other materials named, there were also made $2,365,000
worth of braid from straw and wood shavings; $6,000,000
worth of rice straw bags, packing cases and matting;
and $1,085,000 worth of wares from bamboo, willow
and vine. As illustrating the intense home industry
of these people we may consider the fact that the 5,453,309
households of farmers in Japan produced in 1906, in
their homes as subsidiary work, $20,527,000 worth
of manufactured articles. If correspondingly
exact statistical data were available from China and
Korea a similarity full utilization of cultural possibilities
would be revealed there.

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This marvelous heritage of economy, industry and thrift,
bred of the stress of centuries, must not be permitted
to lose virility through contact with western wasteful
practices, now exalted to seeming virtues through
the dazzling brilliancy of mechanical achievements.
More and more must labor be dignified in all homes
alike, and economy, industry and thrift become inherited
impulses compelling and satisfying.
  
Cheap, rapid, long distance transportation, already
well started in these countries, will bring with it
a fuller utilization of the large stores of coal and
mineral wealth and of the enormous available water
power, and as a result there will come some temporary
lessening of the stress for fuel and with better forest
management some relief along the lines of building
materials. But the time is not a century distant
when, throughout the world, a fuller, better development
must take place along the lines of these most far-reaching
and fundamental practices so long and so effectively
followed by the Mongolian races in China, Korea and
Japan. When the enormous water-power of these
countries has been harnessed and brought into the
foot-hills and down upon the margins of the valleys
and plains in the form of electric current, let it,
if possible, be in a large measure so distributed as
to become available in the country village homes to
lighten the burden and lessen the human drudgery and
yet increase the efficiency of the human effort now
so well bestowed upon subsidiary manufactures under
the guidance and initiative of the home, where there
may be room to breathe and for children to come up
to manhood and womanhood in the best conditions possible,
rather than in enormous congested factories.

**VIII**

**TRAMPS AFIELD**  
On March 31st we took the 8 A. M. train on the Shanghai-Nanking
railway for Kunshan, situated thirty-two miles west
from Shanghai, to spend the day walking in the fields.
The fare, second class, was eighty cents, Mexican.
A third class ticket would have been forty cents and
a first class, $1.60, practically two cents, one cent
and half a cent, our currency, per mile. The
second class fare to Nanking, a distance of 193 miles,
was $1.72, U. S. currency, or a little less than one
cent per mile. While the car seats were not upholstered,
the service was good. Meals were served on the
train in either foreign or Chinese style, and tea,
coffee or hot water to drink. Hot, wet face cloths
were regularly passed and many Chinese daily newspapers
were sold on the train, a traveler often buying two.
  
In the vicinity of Kunshan a large area of farm land
had been acquired by the French catholic mission at
a purchase price of $40, Mexican, per mow, or at the
rate of $103.20 per acre. This they rented to
the Chinese.

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It was here that we first saw, at close range, the
details of using canal mud as a fertilizer, so extensively
applied in China. Walking through the fields
we came upon the scene in the middle section of Fig.
92 where, close on the right was such a reservoir as
seen in Fig. 58. Men were in it, dipping up the
mud which had accumulated over its bottom, pouring
it on the bank in a field of windsor beans, and the
thin mud was then over two feet deep at that side and
flowing into the beans where it had already spread
two rods, burying the plants as the engraving shows.
When sufficiently dry to be readily handled this would
be spread among the beans as we found it being done
in another field, shown in the upper section of the
illustration. Here four men were distributing
such mud, which had dried, between the rows, not to
fertilize the beans, but for a succeeding crop of
cotton soon to be planted between the rows, before
they were harvested. The owner of this piece of
land, with whom we talked and who was superintending
the work, stated that his usual yield of these beans
was three hundred catty per mow and that they sold
them green, shelled, at two cents, Mexican, per catty.
At this price and yield his return would be $15.48,
gold, per acre. If there was need of nitrogen
and organic matter in the soil the vines would be
pulled green, after picking the beans, and composted
with the wet mud. If not so needed the dried
stems would be tied in bundles and sold as fuel or
used at home, the ashes being returned to the fields.
The windsor beans are thus an early crop grown for
fertilizer, fuel and food.
  
This farmer was paying his laborers one hundred cash
per day and providing their meals, which he estimated
worth two hundred cash more, making twelve cents,
gold, for a ten-hour day. Judging from what we
saw and from the amount of mud carried per load, we
estimated the men would distribute not less than eighty-four
loads of eighty pounds each per day, an average distance
of five hundred feet, making the cost 3.57 cents,
gold, per ton for distribution.
  
The lower section of Fig. 92 shows another instance
where mud was being used on a narrow strip bordering
the path along which we walked, the amount there seen
having been brought more than four hundred feet, by
one man before 10 A. M. on the morning the photograph
was taken. He was getting it from the bottom of
a canal ten feet deep, laid bare by the out-going
tide. Already he had brought more than a ton
to his field.
  
The carrying baskets used for this work were in the
form of huge dustpans suspended from the carrying
poles by two cords attached to the side rims, and
steadied by the hand grasping a handle provided in
the back for this purpose and for emptying the baskets
by tipping. With this construction the earth
was readily raked upon the basket and very easily
emptied from it by simply raising the hands when the
destination was reached. No arrangement could
be more simple, expeditious or inexpensive for this
man with his small holding. In this simple manner
has nearly all of the earth been moved in digging
the miles of canal and in building the long sea walls.
In Shanghai the mud carried through the storm sewers
into Soochow creek we saw being removed in the same
manner during the intervals when the tide was out.

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In still another field, seen in Fig. 93, the upper
portion shows where canal mud had been applied at
a rate exceeding seventy tons per acre, and we were
told that such dressings may be repeated as often
as every two years though usually at longer intervals,
if other and cheaper fertilizers could be obtained.
In the lower portion of the same illustration may
be seen the section of canal from which this mud was
taken up the three earthen stairways built of the
mud itself and permitted to dry before using.
Many such lines of stairway were seen during our trips
along the canals, only recently made or in the process
of building to be in readiness when the time for applying
the mud should arrive. To facilitate collecting
the mud from the shallow canals temporary dams may
be thrown across them at two places and the water
between either scooped or pumped out, laying the bottom
bare, as is often done also for fishing. The
earth of the large grave mound seen across a canal
in the center background of the upper portion of the
engraving had been collected in a similar manner.
  
In the Chekiang province canal mud is extensively
used in the mulberry orchards as a surface dressing.
We have referred to this practice in southern China,
and Fig. 94 is a view taken south of Kashing early
in April. The boat anchored in front of the mulberry
orchard is the home of a family coming from a distance,
seeking employment during the season for picking mulberry
leaves to feed silkworms. We were much surprised,
on looking back at the boat after closing the camera,
to see the head of the family standing erect in the
center, having shoved back a section of the matting
roof.
  
The dressing of mud applied to this field formed a
loose layer more than two inches deep and when compacted
by the rains which would follow would add not less
than a full inch of soil over the entire orchard,
and the weight per acre could not be less than 120
tons.
  
Another equally, or even more, laborious practice
followed by the Chinese farmers in this province is
the periodic exchange of soil between mulberry orchards
and the rice fields, their experience being that soil
long used in the mulberry orchards improves the rice,
while soil from the rice fields is very helpful when
applied to the mulberry orchards. We saw many
instances, when traveling by boat-train between Shanghai,
Kashing and Hangchow, of soil being carried from rice
fields and either stacked on the banks or dropped
into the canal. Such soil was oftenest taken from
narrow trenches leading through the fields, laying
them off in beds. It is our judgment that the
soil thrown into the canals undergoes important changes,
perhaps through the absorption of soluble plant food
substances such as lime, phosphoric acid and potash
withdrawn from the water, or through some growth or
fermentation, which, in the judgment of the farmer,
makes the large labor involved in this procedure worth
while. The stacking of soil along the banks was
probably in preparation for its removal by boat to
some of the mulberry orchards.

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It is clearly recognized by the farmers that mud collected
from those sections of the canal leading through country
villages, such as that seen in Fig. 10, is both inherently
more fertile and in better physical condition than
that collected in the open country. They attribute
this difference to the effect of the village washing
in the canal, where soap is extensively used.
The storm waters of the city doubtless carry some
fertilizing material also, although sewage, as such,
never finds its way into the canals. The washing
would be very likely to have a decided flocculating
effect and so render this material more friable when
applied to the field.
  
One very important advantage which comes to the fields
when heavily dressed with such mud is that resulting
from the addition of lime which has become incorporated
with the silts through their flocculation and precipitation,
and that which is added in the form of snail shells
abounding in the canals. The amount of these may
be realized from the large numbers contained in the
mud recently thrown out, as seen in the upper section
of Fig. 95, where the pebbly appearance of the surface
is caused by snail shells. In the lower section
of the same illustration the white spots are snail
shells exposed in the soil of a recently spaded field.
The shells are by no means as numerous generally as
here seen but yet sufficient to maintain the supply
of lime.
  
Several species of these snails are collected in quantities
and used as food. Piles containing bushels of
the empty shells were seen along the canals outside
the villages. The snails are cooked in the shell
and often sold by measure to be eaten from the hand,
as we buy roasted peanuts or popcorn. When a
purchase is made the vender clips the spiral point
from each shell with a pair of small shears. This
admits air and permits the snail to be readily removed
by suction when the lips are applied to the shell.
In the canals there are also large numbers of fresh
water eel, shrimp and crabs as well as fish, all of
which are collected and used for human food. It
is common, when walking through the canal country,
to come upon groups of gleaners busy in the bottoms
of the shallow agricultural canals, gathering anything
which may serve as food, even including small bulbs
or the fleshy roots of edible aquatic plants.
To facilitate the collection of such food materials
sections of the canal are often drained in the manner
already described, so that gleaning may be done by
hand, wading in the mud. Families living in houseboats
make a business of fishing for shrimp. They trail
behind the houseboat one or two other boats carrying
hundreds of shrimp traps cleverly constructed in such
manner that when they are trailed along the bottom
and disturb the shrimps they dart into the holes in
the trap, mistaking them for safe hiding places.

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On the streets, especially during festival days, one
may see young people and others in social intercourse,
busying their fingers and their teeth eating cooked
snails or often watermelon seeds, which are extensively
sold and thus eaten. This custom we saw first
in the streets of a city south of Kashing on the line
of the new railway between Hangchow and Shanghai.
The first passenger train over the line had been run
the day before our visit, which was a festival day
and throngs of people were visiting the nine-story
pagoda standing on a high hill a mile outside the
city limits. The day was one of great surprises
to these people who had never before seen a passenger
train, and my own person appeared to be a great curiosity
to many. No boy ever scrutinized the face of a
caged chimpanzee closer, with purer curiosity, or
with less consideration for his feelings than did
a woman of fifty scrutinize mine, standing close in
front, not two feet distant, even bending forward as
I sat upon a bench writing at the railway station.
People would pass their hands along my coat sleeve
to judge the cloth, and a boy felt of my shoes.
Walking through the street we passed many groups gathered
about tables and upon seats, visiting or in business
conference, their fingers occupied with watermelon
seeds or with packages of cooked snails. Along
the pathway leading to the pagoda beggars had distributed
themselves, one in a place, at intervals of two or
three hundred feet, asking alms, most of them infirm
with age or in some other way physically disabled.
We saw but one who appeared capable of earning a living.
  
Travel between Shanghai and Hangchow at this time
was heavy. Three companies were running trains,
of six or more houseboats, each towed by a steam launch,
and these were daily crowded with passengers.
Our train left Shanghai at 4:30 P. M., reaching Hangchow
at 5:30 P. M. the following day, covering a distance
along the canal of something more than 117 miles.
We paid $5.16, gold, for the exclusive use of a first-cabin,
five-berth stateroom for myself and interpreter.
It occupied the full width of the boat, lacking about
fourteen inches of footway, and could be entered from
either side down a flight of five steps. The
berths were flat, naked wooden shelves thirty inches
wide, separated by a partition headboard six inches
high and without railing in front. Each traveler
provided his own bedding. A small table upon
which meals were served, a mirror on one side and a
lamp on the other, set in an opening in the partition,
permitting it to serve two staterooms, completed the
furnishings. The roof of the staterooms was covered
with an awning and divided crosswise into two tiers
of berths, each thirty inches wide, by board partitions
six inches high. In these sections passengers
spread their beds, sleeping heads together, separated
only by a headboard six inches high. The awning
was only sufficiently high to permit passengers to
sit erect. Ventilation was ample but privacy was
nil. Curtains could be dropped around the sides
in stormy weather.

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Meals were served to each passenger wherever he might
be. Dinner consisted of hot steamed rice brought
in very heavy porcelain bowls set inside a covered,
wet, steaming hot wooden case. With the rice
were tiny dishes, butterchip size, of green clover,
nicely cooked and seasoned; of cooked bean curd served
with shredded bamboo sprouts; of tiny pork strips
with bean curd; of small bits of liver with bamboo
sprouts; of greens, and hot water for tea. If
the appetite is good one may have a second helping
of rice and as much hot water for tea as desired.
There was no table linen, no napkins and everything
but the tea had to be negotiated with chop sticks,
or, these failing, with the fingers. When the
meal was finished the table was cleared and water,
hot if desired, was brought for your hand basin, which
with tea, teacup and bedding, constitute part of the
traveler’s outfit. At frequent intervals,
up to ten P. M., a crier walked about the deck with
hot water for those who might desire an extra cup
of tea, and again in the early morning.
  
At this season of the year Chinese incubators were
being run to their full capacity and it was our good
fortune to visit one of these, escorted by Rev. R.
A. Haden, who also acted as interpreter. The
art of incubation is very old and very extensively
practiced in China. An interior view of one of
these establishments is shown in Fig. 96, where the
family were hatching the eggs of hens, ducks and geese,
purchasing the eggs and selling the young as hatched.
As in the case of so many trades in China, this family
was the last generation of a long line whose lives
had been spent in the same work. We entered through
their store, opening on the street of the narrow village
seen in Fig. 10. In the store the eggs were purchased
and the chicks were sold, this work being in charge
of the women of the family. It was in the extreme
rear of the home that thirty incubators were installed,
all doing duty and each having a capacity of 1,200
hens’ eggs. Four of these may be seen in
the illustration and one of the baskets which, when
two-thirds filled with eggs, is set inside of each
incubator.
  
Each incubator consists of a large earthenware jar
having a door cut in one side through which live charcoal
may be introduced and the fire partly smothered under
a layer of ashes, this serving as the source of heat.
The jar is thoroughly insulated, cased in basketwork
and provided with a cover, as seen in the illustration.
Inside the outer jar rests a second of nearly the
same size, as one teacup may in another. Into
this is lowered the large basket with its 600 hens’
eggs, 400 ducks’ eggs or 175 geese’ eggs,
as the case may be. Thirty of these incubators
were arranged in two parallel rows of fifteen each.
Immediately above each row, and utilizing the warmth
of the air rising from them, was a continuous line
of finishing hatchers and brooders in the form of
woven shallow trays with sides warmly padded with
cotton and with the tops covered with sets of quilts
of different thickness.

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After a basket of hens’ eggs has been incubated
four days it is removed and the eggs examined by lighting,
to remove those which are infertile before they have
been rendered unsalable. The infertile eggs go
to the store and the basket is returned to the incubator.
Ducks’ eggs are similarly examined after two
days and again after five days incubation; and geese’
eggs after six days and again after fourteen days.
Through these precautions practically all loss from
infertile eggs is avoided and from 95 to 98 per cent
of the fertile eggs are hatched, the infertile eggs
ranging from 5 to 25 per cent.
  
After the fourth day in the incubator all eggs are
turned five times in twenty-four hours. Hens’
eggs are kept in the lower incubator eleven days;
ducks’ eggs thirteen days, and geese’ eggs
sixteen days, after which they are transferred to
the trays. Throughout the incubation period the
most careful watch and control is kept over the temperature.
No thermometer is used but the operator raises the
lid or quilt, removes an egg, pressing the large end
into the eye socket. In this way a large contact
is made where the skin is sensitive, nearly constant
in temperature, but little below blood heat and from
which the air is excluded for the time. Long practice
permits them thus to judge small differences of temperature
expeditiously and with great accuracy; and they maintain
different temperatures during different stages of
the incubation. The men sleep in the room and
some one is on duty continuously, making the rounds
of the incubators and brooders, examining and regulating
each according to its individual needs, through the
management of the doors or the shifting of the quilts
over the eggs in the brooder trays where the chicks
leave the eggs and remain until they go to the store.
In the finishing trays the eggs form rather more than
one continuous layer but the second layer does not
cover more than a fifth or a quarter of the area.
Hens’ eggs are in these trays ten days, ducks’
and geese’ eggs, fourteen days.
  
After the chickens have been hatched sufficiently
long to require feeding they are ready for market
and are then sorted according to sex and placed in
separate shallow woven trays thirty inches in diameter.
The sorting is done rapidly and accurately through
the sense of touch, the operator recognizing the sex
by gently pinching the anus. Four trays of young
chickens were in the store fronting on the street
as we entered and several women were making purchases,
taking five to a dozen each. Dr. Haden informed
me that nearly every family in the cities, and in
the country villages raise a few, but only a few,
chickens and it is a common sight to see grown chickens
walking about the narrow streets, in and out of the
open stores, dodging the feet of the occupants and
passers-by. At the time of our visit this family
was paying at the rate of ten cents, Mexican, for
nine hens’ and eight ducks’ eggs, and were
selling their largest strong chickens at three cents
each. These figures, translated into our currency,
make the purchase price for eggs nearly 48 cents, and
the selling price for the young chicks $1.29, per hundred,
or thirteen eggs for six cents and seven chickens
for nine cents.

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It is difficult even to conceive, not to say measure,
the vast import of this solution of how to maintain,
in the millions of homes, a constantly accessible
supply of absolutely fresh and thoroughly sanitary
animal food in the form of meat and eggs. The
great density of population in these countries makes
the problem of supplying eggs to the people very different
from that in the United States. Our 250,600,000
fowl in 1900 was at the rate of three to each person
but in Japan, with her 16,500,000 fowl, she had in
1906 but one for every three people. Her number
per square mile of cultivated land however was 825,
while in the United States, in 1900, the number of
fowls per square mile of improved farm land was but
387. To give to Japan three fowls to each person
there would needs be an average of about nine to each
acre of her cultivated land, whereas in the United
States there were in 1900 nearly two acres of improved
farm land for each fowl. We have no statistics
regarding the number of fowl in China or the number
of eggs produced but the total is very large and she
exports to Japan. The large boat load of eggs
seen in Fig. 97 had just arrived from the country,
coming into Shanghai in one of her canals.
  
Besides applying canal mud directly to the fields
in the ways described there are other very extensive
practices of composting it with organic matter of
one or another kind and of then using the compost
on the fields. The next three illustrations show
some of the steps and something of the tremendous
labor of body, willingly and cheerfully incurred,
and something of the forethought practiced, that homes
may be maintained and that grandparents, parents, wives
and children need neither starve nor beg. We had
reached a place seen in Fig. 98, where eight bearers
were moving winter compost to a recently excavated
pit in an adjoining field shown in Fig. 99.
  
Four months before the camera fixed the activity shown,
men had brought waste from the stables of Shanghai
fifteen miles by water, depositing it upon the canal
bank between layers of thin mud dipped from the canal,
and left it to ferment. The eight men were removing
this compost to the pit seen in Fig. 99, then nearly
filled. Near by in the same field was a second
pit seen in Fig. 100, excavated three feet deep and
rimmed about with the earth removed, making it two
feet deeper.
  
After these pits had been filled the clover which
was in blossom beyond the pits would be cut and stacked
upon them to a height of five to eight feet and this
also saturated, layer by layer, with mud brought from
the canal, and allowed to ferment twenty to thirty
days until the juices set free had been absorbed by
the winter compost beneath, helping to carry the ripening
of that still further, and until the time had arrived
for fitting the ground for the next crop. This
organic matter, fermented with the canal mud, would
then be distributed by the men over the field, carried
a third time on their shoulders, notwithstanding its
weight was many tons.

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This manure had been collected, loaded and carried
fifteen miles by water; it had been unloaded upon
the bank and saturated with canal mud; the field had
been fitted for clover the previous fall and seeded;
the pits had been dug in the fields; the winter compost
had been carried and placed in the pits; the clover
was to be cut, carried by the men on their shoulders,
stacked layer by layer and saturated with mud dipped
from the canal; the whole would later be distributed
over the field and finally the earth removed from the
pits would be returned to them, that the service of
no ground upon which a crop might grow should be lost.
  
Such are the tasks to which Chinese farmers hold themselves,
because they are convinced desired results will follow,
because their holdings are so small and their families
so large. These practices are so extensive in
China and so fundamental in the part they play in
the maintenance of high productive power in their soils
that we made special effort to follow them through
different phases. In Fig. 101 we saw the preparation
being made to build one of the clover compost stacks
saturated with canal mud. On the left the thin
mud had been dipped from the canal; way-farers in
the center were crossing the foot-bridge of the country
by-way; and beyond rises the conical thatch to shelter
the water buffalo when pumping for irrigating the
rice crop to be fed with this plant food in preparation.
On the right were two large piles of green clover
freshly cut and a woman of the family at one of them
was spreading it to receive the mud, while the men-folk
were coming from the field with more clover on their
carrying poles. We came upon this scene just
before the dinner hour and after the workers had left
another photograph was taken at closer range and from
a different side, giving the view seen in Fig. 102.
The mud had been removed some days and become too
stiff to spread, so water was being brought from the
canal in the pails at the right for reducing its consistency
to that of a thin porridge, permitting it to more
completely smear and saturate the clover. The
stack grew, layer by layer, each saturated with the
mud, tramped solid with the bare feet, trousers rolled
high. Provision had been made here for building
four other stacks.
  
Further along we came upon the scene in Fig. 103 where
the building of the stack of compost and the gathering
of the mud from the canal were simultaneous.
On one side of the canal the son, using a clam-shell
form of dipper made of basket-work, which could be
opened and shut with a pair of bamboo handles, had
nearly filled the middle section of his boat with
the thin ooze, while on the other side, against the
stack which was building, the mother was emptying a
similar boat, using a large dipper, also provided with
a bamboo handle. The man on the stack is a good
scale for judging its size.
  
We came next upon a finished stack on the bank of
another canal, shown in Fig. 104, where our umbrella
was set to serve as a scale. This stack measured
ten by ten feet on the ground, was six feet high and
must have contained more than twenty tons of the green
compost. At the same place, two other stacks
had been started, each about fourteen by fourteen
feet, and foundations were laid for six others, nine
in all.

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During twenty or more days this green nitrogenous
organic matter is permitted to lie fermenting in contact
with the fine soil particles of the ooze with which
it had been charged. This is a remarkable practice
in that it is a very old, intensive application of
an important fundamental principle only recently understood
and added to the science of agriculture, namely, the
power of organic matter, decaying rapidly in contact
with soil, to liberate from it soluble plant food;
and so it would be a great mistake to say that these
laborious practices are the result of ignorance, of
a lack of capacity for accurate thinking or of power
to grasp and utilize. If the agricultural lands
of the United States are ever called upon to feed
even 1200 millions of people, a number proportionately
less than one-half that being fed in Japan today,
very different practices from those we are now following
will have been adopted. We can believe they will
require less human bodily effort and be more efficient.
But the knowledge which can make them so is not yet
in the possession of our farmers, much less the conviction
that plant feeding and more persistent and better
directed soil management are necessary to such yields
as will then be required.
  
Later, just before the time for transplanting rice,
we returned to the same district to observe the manner
of applying this compost to the field, and Fig. 105
is prepared from photographs taken then, illustrating
the activities of one family, as seen during the morning
of May 28th. Their home was in a near-by village
and their holding was divided into four nearly rectangular
paddies, graded to water level, separated by raised
rims, and having an area of nearly two acres.
Three of these little fields are partly shown in the
illustration, and the fourth in Fig. 160. In the
background of the upper section of Fig. 105, and under
the thatched shelter, was a native Chinese cow, blindfolded
and hitched to the power-wheel of a large wooden-chain
pump, lifting water from the canal and flooding the
field in the foreground, to soften the soil for plowing.
Riding on the power-wheel was a girl of some twelve
years, another of seven and a baby. They were
there for entertainment and to see that the cow kept
at work. The ground had been sufficiently softened
so that the father had begun plowing, the cow sinking
to her knees as she walked. In the same paddy,
but shown in the section below, a boy was spreading
the clover compost with his hands, taking care that
it was finely divided and evenly scattered. He
had been once around before the plowing began.
This compost had been brought from a stack by the
side of a canal, and two other men were busy still
bringing the material to one of the other paddies,
one of whom, with his baskets on the carrying pole
appears in the third section. Between these two
paddies was the one seen at the bottom of the illustration,
which had matured a crop of rape that had been pulled
and was lying in swaths ready to be moved. Two
other men were busy here, gathering the rape into
large bundles and carrying it to the village home,
where the women were threshing out the seed, taking
care not to break the stems which, after threshing,
were tied into bundles for fuel. The seed would
be ground and from it an oil expressed, while the
cake would be used as a fertilizer.

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This crop of rape is remarkable for the way it fits
into the economies of these people. It is a near
relative of mustard and cabbage; it grows rapidly
during the cooler portions of the season, the spring
crop ripening before the planting of rice and cotton;
its young shoots and leaves are succulent, nutritious,
readily digested and extensively used as human food,
boiled and eaten fresh, or salted for winter use,
to be served with rice; the mature stems, being woody,
make good fuel; and it bears a heavy crop of seed,
rich in oil, which has been extensively used for lights
and in cooking, while the rape seed cake is highly
prized as a manure and very extensively so used.
  
In the early spring the country is luxuriantly green
with the large acreage of rape, later changing to
a sea of most brilliant yellow and finally to an ashy
grey when the leaves fall and the stems and pods ripen.
Like the dairy cow, rape produces a fat, in the ratio
of about forty pounds of oil to a hundred pounds of
seed, which may be eaten, burned or sold without materially
robbing the soil of its fertility if the cake and
the ashes from the stems are returned to the fields,
the carbon, hydrogen and oxygen of which the oil is
almost wholly composed coming from the atmosphere rather
than from the soil.
  
In Japan rape is grown as a second crop on both the
upland and paddy fields, and in 1906 she produced
more than 5,547,000 bushels of the seed; $1,845,000
worth of rape seed cake, importing enough more to
equal a total value of $2,575,000, all of which was
used as a fertilizer, the oil being exported.
The yield of seed per acre in Japan ranges between
thirteen and sixteen bushels, and the farmer whose
field was photographed estimated that his returns from
the crop would be at the rate of 640 pounds of seed
per acre, worth $6.19, and 8,000 pounds of stems worth
as fuel $5.16 per acre.

**IX**

**THE UTILIZATION OF WASTE**  
One of the most remarkable agricultural practices
adopted by any civilized people is the centuries-long
and well nigh universal conservation and utilization
of all human waste in China, Korea and Japan, turning
it to marvelous account in the maintenance of soil
fertility and in the production of food. To understand
this evolution it must be recognized that mineral
fertilizers so extensively employed in modern western
agriculture, like the extensive use of mineral coal,
had been a physical impossibility to all people alike
until within very recent years. With this fact
must be associated the very long unbroken life of
these nations and the vast numbers their farmers have
been compelled to feed.
  
When we reflect upon the depleted fertility of our
own older farm lands, comparatively few of which have
seen a century’s service, and upon the enormous
quantity of mineral fertilizers which are being applied
annually to them in order to secure paying yields,
it becomes evident that the time is here when profound
consideration should be given to the practices the
Mongolian race has maintained through many centuries,
which permit it to be said of China that one-sixth
of an acre of good land is ample for the maintenance
of one person, and which are feeding an average of
three people per acre of farm land in the three southernmost
of the four main islands of Japan.

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From the analyses of mixed human excreta made by Wolff
in Europe and by Kellner in Japan it appears that,
as an average, these carry in every 2000 pounds 12.7
pounds of nitrogen, 4 pounds of potassium and 1.7
pounds of phosphorus. On this basis and that of
Carpenter, who estimates the average amount of excreta
per day for the adult at 40 ounces, the average annual
production per million of adult population is 5,794,300
pounds of nitrogen; 1,825,000 pounds of potassium,
and 775,600 pounds of phosphorus carried in 456,250
tons of excreta. The figures which Hall cites
in Fertilizers and Manures, would make these amounts
7,940,000 pounds of nitrogen; 3,070,500 pounds of
potassium, and 1,965,600 pounds of phosphorus, but
the figures he takes and calls high averages give
12,000,000 of nitrogen; 4,151,000 pounds of potassium,
and 3,057,600 pounds of phosphorus.
  
In 1908 the International Concessions of the city
of Shanghai sold to one Chinese contractor for $31,000,
gold, the privilege of collecting 78,000 tons of human
waste, under stipulated regulations, and of removing
it to the country for sale to farmers. The flotilla
of boats seen in Fig. 106 is one of several engaged
daily in Shanghai throughout the year in this service.
  
Dr. Kawaguchi, of the National Department of Agriculture
and Commerce, taking his data from their records,
informed us that the human manure saved and applied
to the fields of Japan in 1908 amounted to 23,850,295
tons, which is an average of 1.75 tons per acre of
their 21,321 square miles of cultivated land in their
four main islands.
  
On the basis of the data of Wolff, Kellner and Carpenter,
or of Hall, the people of the United States and of
Europe are pouring into the sea, lakes or rivers and
into the underground waters from 5,794,300 to 12,000,000
pounds of nitrogen; 1,881,900 to 4,151,000 pounds
of potassium, and 777,200 to 3,057,600 pounds of phosphorus
per million of adult population annually, and this
waste we esteem one of the great achievements of our
civilization. In the Far East, for more than
thirty centuries, these enormous wastes have been
religiously saved and today the four hundred million
of adult population send back to their fields annually
150,000 tons of phosphorus; 376,000 tons of potassium,
and 1,158,000 tons of nitrogen comprised in a gross
weight exceeding 182 million tons, gathered from every
home, from the country villages and from the great
cities like Hankow-Wuchang-Hanyang with its 1,770,000
people swarming on a land area delimited by a radius
of four miles.
  
Man is the most extravagant accelerator of waste the
world has ever endured. His withering blight
has fallen upon every living thing within his reach,
himself not excepted; and his besom of destruction
in the uncontrolled hands of a generation has swept
into the sea soil fertility which only centuries of
life could accumulate, and yet this fertility is the
substratum of all that is living. It must be

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recognized that the phosphate deposits which we are
beginning to return to our fields are but measures
of fertility lost from older soils, and indices of
processes still in progress. The rivers of North
America are estimated to carry to the sea more than
500 tons of phosphorus with each cubic mile of water.
To such loss modern civilization is adding that of
hydraulic sewage disposal through which the waste
of five hundred millions of people might be more than
194,300 tons of phosphorus annually, which could not
be replaced by 1,295,000 tons of rock phosphate, 75
per cent pure. The Mongolian races, with a population
now approaching the figure named; occupying an area
little more than one-half that of the United States,
tilling less than 800,000 square miles of land, and
much of this during twenty, thirty or perhaps forty
centuries; unable to avail themselves of mineral fertilizers,
could not survive and tolerate such waste. Compelled
to solve the problem of avoiding such wastes, and
exercising the faculty which is characteristic of the
race, they “cast down their buckets where they
were”, as
 *A ship lost at sea for many days suddenly sighted
a friendly vessel. From the mast of the unfortunate
vessel was seen a signal, “Water, water; we
die of thirst!” The answer from the friendly
vessel at once came back, “Cast down your bucket
where you are.” A second time the signal,
“Water, water; Send us water!” ran up from
the distressed vessel, and was answered, “Cast
down your bucket where you are.” And a
third and fourth signal for water was answered, “Cast
down your bucket where you are.” The captain
of the distressed vessel, at last heeding the injunction,
cast down his bucket, and it came up full of fresh
sparkling water from the mouth of the Amazon river.*Booker T. Washington, Atlanta address.
  
Not even in great cities like Canton, built in the
meshes of tideswept rivers and canals; like Hankow
on the banks of one of the largest rivers in the world;
nor yet in modern Shanghai, Yokohama or Tokyo, is
such waste permitted. To them such a practice
has meant race suicide and they have resisted the
temptation so long that it has ceased to exist.
  
Dr. Arthur Stanley, Health officer of the city of
Shanghai, in his annual report for 1899, considering
this subject as a municipal problem, wrote:
  
“Regarding the bearing on the sanitation of
Shanghai of the relationship between Eastern and Western
hygiene, it may be said, that if prolonged national
life is indicative of sound sanitation, the Chinese
are a race worthy of study by all who concern themselves
with Public Health. Even without the returns of
a Registrar-General it is evident that in China the
birth rate must very considerably exceed the death
rate, and have done so in an average way during the
three or four thousand years that the Chinese nation
has existed. Chinese hygiene, when compared with
medieval English, appears to advantage. The main

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problem of sanitation is to cleanse the dwelling day
by day, and if this can be done at a profit so much
the better. While the ultra-civilized Western
elaborates destructors for burning garbage at a financial
loss and turns sewage into the sea, the Chinaman uses
both for manure. He wastes nothing while the sacred
duty of agriculture is uppermost in his mind.
And in reality recent bacterial work has shown that
faecal matter and house refuse are best destroyed
by returning them to clean soil, where natural purification
takes place. The question of destroying garbage
can, I think, under present conditions in Shanghai,
be answered in a decided negative. While to adopt
the water-carriage system for sewage and turn it into
the river, whence the water supply is derived, would
be an act of sanitary suicide. It is best, therefore,
to make use of what is good in Chinese hygiene, which
demands respect, being, as it is, the product of an
evolution extending from more than a thousand years
before the Christian era.”
  
The storage of such waste in China is largely in stoneware
receptacles such as are seen in Fig. 109, which are
hard-burned, glazed terra-cotta urns, having capacities
ranging from 500 to 1000 pounds. Japan more often
uses sheltered cement-lined pits such as are seen
in Fig. 110.
  
In the three countries the carrying to the fields
is oftenest in some form of pail, as seen in Fig.
111, a pair of which are borne swinging from the carrying
pole. In applying the liquid to the field or
garden the long handle dipper is used, seen in Fig.
112.
  
We are beginning to husband with some economy the
waste from our domestic animals but in this we do
not approach that of China, Korea and Japan.
People in China regularly search for and collect droppings
along the country and caravan roads. Repeatedly,
when walking through city streets, we observed such
materials quickly and apparently eagerly gathered,
to be carefully stored under conditions which ensure
small loss from either leaching or unfavorable fermentation.
In some mulberry orchards visited the earth had been
carefully hoed back about the trunks of trees to a
depth of three or four inches from a circle having
a diameter of six to eight feet, and upon these areas
were placed the droppings of silkworms, the moulted
skins, together with the bits of leaves and stem left
after feeding. Some disposition of such waste
must be made. They return at once to the orchard
all but the silk produced from the leaves; unnecessary
loss is thus avoided and the material enters at once
the service of forcing the next crop of leaves.

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On the farm of Mrs. Wu, near Kashing, while studying
the operation of two irrigation pumps driven by two
cows, lifting water to flood her twenty-five acres
of rice field preparatory to transplanting, we were
surprised to observe that one of the duties of the
lad who had charge of the animals was to use a six-quart
wooden dipper with a bamboo handle six feet long to
collect all excreta, before they fell upon the ground,
and transfer them to a receptacle provided for the
purpose. There came a flash of resentment that
such a task was set for the lad, for we were only
beginning to realize to what lengths the practice
of economy may go, but there was nothing irksome suggested
in the boy’s face. He performed the duty
as a matter of course and as we thought it through
there was no reason why it should have been otherwise.
In fact, the only right course was being taken.
Conditions would have been worse if the collection
had not been made. It made possible more rice.
Character of substantial quality was building in the
lad which meant thrift in the growing man and continued
life for the nation.
  
We have adverted to the very small number of flies
observed anywhere in the course of our travel, but
its significance we did not realize until near the
end of our stay. Indeed, for some reason, flies
were more in evidence during the first two days on
the steamship, out from Yokohama on our return trip
to America, than at any time before on our journey.
It is to be expected that the eternal vigilance which
seizes every waste, once it has become such, putting
it in places of usefulness, must contribute much toward
the destruction of breeding places, and it may be
these nations have been mindful of the wholesomeness
of their practice and that many phases of the evolution
of their waste disposal system have been dictated by
and held fast to through a clear conception of sanitary
needs.
  
Much intelligence and the highest skill are exhibited
by these old-world farmers in the use of their wastes.
In Fig. 113 is one of many examples which might be
cited. The man walking down the row with his
manure pails swinging from his shoulders informed us
on his return that in his household there were twenty
to be fed; that from this garden of half an acre of
land he usually sold a product bringing in $400, Mexican,—­$172,
gold. The crop was cucumbers in groups of two
rows thirty inches apart and twenty-four inches between
the groups. The plants were eight to ten inches
apart in the row. He had just marketed the last
of a crop of greens which occupied the space between
the rows of cucumbers seen under the strong, durable,
light and very readily removable trellises. On
May 28 the vines were beginning to run, so not a minute
had been lost in the change of crop. On the contrary
this man had added a month to his growing season by
over-lapping his crops, and the trellises enabled
him to feed more plants of this type than there was
room for vines on the ground. With ingenuity

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and much labor he had made his half acre for cucumbers
equivalent to more than two. He had removed the
vines entirely from the ground; had provided a travel
space two feet wide, down which he was walking, and
he had made it possible to work about the roots of
every plant for the purpose of hoeing and feeding.
Four acres of cucumbers handled by American field methods
would not yield more than this man’s one, and
he grows besides two other crops the same season.
  
The difference is not so much in activity of muscle
as it is in alertness and efficiency of the grey matter
of the brain. He sees and treats each plant individually,
he loosens the ground so that his liquid manure drops
immediately beneath the surface within reach of the
active roots. If the rainfall has been scanty
and the soil is dry he may use ten of water to two
of night soil, not to supply water but to make certain
sufficiently deep penetration. If the weather
is rainy and the soil over wet, the food is applied
more concentrated, not to lighten the burden but to
avoid waste by leaching and over saturation.
While ever crowding growth he never overfeeds.
Forethought, after-thought and the mind focused on
the work in hand are characteristic of these people.
We do not recall to have seen a man smoking while
at work. They enjoy smoking, but prefer to do
this also with the attention undivided and thus get
more for their money.
  
On another date earlier in May we were walking in
the fields without an interpreter. For half an
hour we stood watching an old gardener fitting the
soil with his spading hoe in the manner seen in Fig.
26, where the graves of his ancestors occupy a part
of the land. Angleworms were extremely numerous,
as large around as an ordinary lead pencil and, when
not extended, two-thirds as long, decidedly greenish
in color. Nearly every stroke of the spade exposed
two to five of these worms but so far as we observed,
and we watched the man closely, pulverizing the soil,
he neither injured nor left uncovered a single worm.
While he seemed to make no effort to avoid injuring
them or to cover them with earth, and while we could
not talk with him, we are convinced that his action
was continually guarded against injuring the worms.
  
They certainly were subsoiling his garden deeply and
making possible a freer circulation of air far below
the surface. Their great abundance proved a high
content of organic matter present in the soil and,
as the worms ate their way through it, passing the
soil through their bodies, the yearly volume of work
done by them was very great. In the fields flooded
preparatory to fitting them for rice these worms are
forced to the surface in enormous numbers and large
flocks of ducks are taken to such fields to feed upon
them.

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In another field a crop of barley was nearing maturity.
An adjacent strip of land was to be fitted and planted.
The leaning barley heads were in the way. Not
one must be lost and every inch of ground must be
put to use. The grain along the margin, for a
breadth of sixteen inches, had been gathered into
handfuls and skillfully tied, each with an unpulled
barley stem, without breaking the straw, thus permitting
even the grains in that head to fill and be gathered
with the rest, while the tying set all straws well
aslant, out of the way, and permitted the last inch
of naked ground to be fitted without injuring the
grain.
  
In still another instance a man was growing Irish
potatoes to market when yet small. He had enriched
his soil; he would apply water if the rains were not
timely and sufficient, and had fed the plants.
He had planted in rows only twelve to fourteen inches
apart with a hill every eight inches in the row.
The vines stood strong, straight, fourteen inches
high and as even as a trimmed hedge. The leaves
and stems were turgid, the deepest green and as prime
and glossy as a prize steer. So close were the
plants that there was leaf surface to intercept the
sunshine falling on every square inch of the patch.
There were no potato beetles and we saw no signs of
injury but the gardener was scanning the patch with
the eye of a robin. He spied the slightest first
drooping of leaves in a stem; went after the difficulty
and brought and placed in our hand a cutworm, a young
tuber the size of a marble and a stem cut half off,
which he was willing to sacrifice because of our evident
interest. But the two friends who had met were
held apart by the babel of tongues.
  
Nothing is costing the world more; has made so many
enemies, and has so much hindered the forming of friendships
as the inability to fully understand; hence the dove
that brings world peace must fly on the wings of a
common language, and the bright star in the east is
world commerce, rising on rapidly developing railway
and steamship lines, heralded and directed by electric
communication. With world commerce must come
mutual confidence and friendship requiring a full
understanding and therefore a common tongue. Then
world peace will be permanently assured. It is
coming inevitably and faster than we think. Once
this desired end is seriously sought, the carrying
of three generations of children through the public
schools where the world language is taught together
with the mother tongue, and the passing of the parents
and grandparents, would effect the change.
  
The important point regarding these Far East people,
to which attention should be directed, is that effective
thinking, clear and strong, prevails among the farmers
who have fed and are still feeding the dense populations
from the products of their limited areas. This
is further indicated in the universal and extensive
use of plant ashes derived from fuel grown upon cultivated
fields and upon the adjacent hill and mountain lands.

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We were unable to secure exact data regarding the
amount of fuel burned annually in these countries,
and of ashes used as fertilizer, but a cord of dry
oak wood weighs about 3500 pounds, and the weight
of fuel used in the home and in manufactures must exceed
that of two cords per household. Japan has an
average of 5.563 people per family. If we allow
but 1300 pounds of fuel per capita, Japan’s
consumption would be 31,200,000 tons. In view
of the fact that a very large share of the fuel used
in these countries is either agricultural plant stems,
with an average ash content of 5 per cent, or the
twigs and even leaves of trees, as in the case of pine
bough fuel, 4.5 per cent of ash may be taken as a
fair estimate. On this basis, and with a content
of phosphorus equal to .5 per cent, and of potassium
equal to 5 per cent, the fuel ash for Japan would amount
to 1,404,000 tons annually, carrying 7020 tons of phosphorus
and 70,200 tons of potassium, together with more than
400,000 tons of limestone, which is returned annually
to less than 21,321 square miles of cultivated land.
  
In China, with her more than four hundred millions
of people, a similar rate of fuel consumption would
make the phosphorus and potassium returned to her
fields more than eight times the amounts computed
for Japan. On the basis of these statements Japan’s
annual saving of phosphorus from the waste of her
fuel would be equivalent to more than 46,800 tons
of rock phosphate having a purity of 75 per cent,
or in the neighborhood of seven pounds per acre.
If this amount, even with the potash and limestone
added, appears like a trifling addition of fertility
it is important for Americans to remember that even
if this is so, these people have felt compelled to
make the saving.
  
In the matter of returning soluble potassium to the
cultivated fields Japan would be applying with her
ashes the equivalent of no less than 156,600 tons
of pure potassium sulphate, equal to 23 pounds per
acre; while the lime carbonate so applied annually
would be some 62 pounds per acre.
  
In addition to the forest lands, which have long been
made to contribute plant food to the cultivated fields
through fuel ashes, there are large areas which contribute
green manure and compost material. These are
chiefly hill lands, aggregating some twenty per cent
of the cultivated fields, which bear mostly herbaceous
growth. Some 2,552,741 acres of these lands may
be cut over three times each season, yielding, in
1903, an average of 7980 pounds per acre. The
first cutting of this hill herbage is mainly used on
the rice fields as green manure, it being tramped
into the mud between the rows after the manner seen
in Fig. 114.

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This man had been with basket and sickle to gather
green herbage wherever he could and had brought it
to his rice paddy. The day in July was extremely
sultry. We came upon him wading in the water half
way to his knees, carefully laying the herbage he had
gathered between alternate rows of his rice, one handful
in a place, with tips overlapping. This done
he took the attitude seen in the illustration and,
gathering the materials into a compact bunch, pressed
it beneath the surface with his foot. The two
hands smoothed the soft mud over the grass and righted
the disturbed spears of rice in the two adjacent hills.
Thus, foot following foot, one bare length ahead,
the succeeding bunches of herbage were submerged until
the last had been reached, following between alternate
rows only a foot apart, there being a hill every nine
to ten inches in the row and the hands grasping and
being drawn over every one in the paddy.
  
He was renting the land, paying therefor forty kan
of rice per tan, and his usual yield was eighty kan.
This is forty-four bushels of sixty pounds per acre.
In unfavorable seasons his yield might be less but
still his rent would be forty kan per tan unless it
was clear that he had done all that could reasonably
be expected of him in securing the crop. It is
difficult for Americans to understand how it is possible
for the will of man, even when spurred by the love
of home and family, to hold flesh to tasks like these.
  
The second and third cuttings of herbage from the
genya lands in Japan are used for the preparation
of compost applied on the dry-land fields in the fall
or in the spring of the following season. Some
of these lands are pastured, but approximately 10,185,500
tons of green herbage grown and gathered from the hills
contributes much of its organic matter and all of its
ash to enrich the cultivated fields. Such wild
growth areas in Japan are the commons of the near
by villages, to which the people are freely admitted
for the purpose of cutting the herbage. A fixed
time may be set for cutting and a limit placed upon
the amount which may be carried away, which is done
in the manner seen in Fig. 115. It is well recognized
by the people that this constant cutting and removal
of growth from the hill lands, with no return, depletes
the soils and reduces the amount of green herbage
they are able to secure.
  
Through the kindness of Dr. Daikuhara of the Imperial
Agricultural Experiment Station at Tokyo we are able
to give the average composition of the green leaves
and young stems of five of the most common wild species
of plants cut for green manure in June. In each
1000 pounds the amount of water is 562.18 pounds; of
organic matter, 382.68 pounds; of ash, 55.14 pounds;
nitrogen, 4.78 pounds; potassium, 2.407 pounds, and
phosphorus, .34 pound. On the basis of this composition
and an aggregate yield of 10,185,500 tons, there would
be annually applied to the cultivated fields 3463 tons
of phosphorus and 24,516 tons of potassium derived
from the genya lands.

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In addition to this the run-off from both the mountain
and the genya lands is largely used upon the rice
fields, more than sixteen inches of water being applied
annually to them in some prefectures. If such
waters have the composition of river waters in North
America, twelve inches of water applied to the rice
fields of the three main islands would contribute
no less than 1200 tons of phosphorus and 19,000 tons
of potassium annually.
  
Dr. Kawaguchi, of the National Department of Agriculture
and Commerce, informed us that in 1908 Japanese farmers
prepared and applied to their fields 22,812,787 tons
of compost manufactured from the wastes of cattle,
horses, swine and poultry, combined with herbage,
straw and other similar wastes and with soil, sod or
mud from ditches and canals. The amount of this
compost is sufficient to apply 1.78 tons per acre
of cultivated land of the southern three main islands.
  
From data obtained at the Nara Experiment Station,
the composition of compost as there prepared shows
it to contain, in each 2000 pounds, 550 pounds of
organic matter; 15.6 pounds of nitrogen; 8.3 pounds
of potassium, and 5.24 pounds of phosphorus. On
this basis 22,800,000 tons of compost will carry 59,700
tons of phosphorus and 94,600 tons of potassium.
The construction of compost houses is illustrated
in Fig. 116, reproduced from a large circular sent
to farmers from the Nara Experiment Station, and an
exterior of one at the Nara Station is given in Fig.
117.
  
This compost house is designed to serve two and a
half acres. Its floor is twelve by eighteen feet,
rendered watertight by a mixture of clay, lime and
sand. The walls are of earth, one foot thick,
and the roof is thatched with straw. Its capacity
is sixteen to twenty tons, having a cash value of
60 yen, or $30. In preparing the stack, materials
are brought daily and, spread over one side of the
compost floor until the pile has attained a height
of five feet. After one foot in depth has been
laid and firmed, 1.2 inches of soil or mud is spread
over the surface and the process repeated until full
height has been attained. Water is added sufficient
to keep the whole saturated and to maintain the temperature
below that of the body. After the compost stacks
have been completed they are permitted to stand five
weeks in summer, seven weeks in winter, when they are
forked over and transferred to the opposite side of
the house.
  
If we state in round numbers the total nitrogen, phosphorus
and potassium thus far enumerated which Japanese farmers
apply or return annually to their twenty or twenty-one
thousand square miles of cultivated fields, the case
stands 385,214 tons of nitrogen, 91,656 tons of phosphorus
and 255,778 tons of potassium. These values are
only approximations and do not include the large volume
and variety of fertilizers prepared from fish, which
have long been used. Neither do they include
the very large amount of nitrogen derived directly

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from the atmosphere through their long, extensive and
persistent cultivation of soy beans and other legumes.
Indeed, from 1903 to 1906 the average area of paddy
field upon which was grown a second crop of green
manure in the form of some legume was 6.8 per cent
of the total area of such fields aggregating 11,000
square miles. In 1906 over 18 per cent of the
upland fields also produced some leguminous crop,
these fields aggregating between 9,000 and 10,000
square miles.
  
While the values which have been given above, expressing
the sum total of nitrogen, phosphorus and potassium
applied annually to the cultivated fields of Japan
may be somewhat too high for some of the sources named,
there is little doubt that Japanese farmers apply to
their fields more of these three plant food elements
annually than has been computed. The amounts
which have been given are sufficient to provide annually,
for each acre of the 21,321 square miles of cultivated
land, an application of not less than 56 pounds of
nitrogen, 13 pounds of phosphorus and 37 pounds of
potassium. Or, if we omit the large northern
island of Hokkaido, still new in its agriculture and
lacking the intensive practices of the older farm
land, the quantities are sufficient for a mean application
of 60, 14 and 40 pounds respectively of nitrogen,
phosphorus and potassium per acre, and yet the maturing
of 1000 pounds of wheat crop, covering grain and straw
as water-free substance, removes from the soil but
13.9 pounds of nitrogen, 2.3 pounds of phosphorus and
8.4 pounds of potassium, from which it may be computed
that the 60 pounds of nitrogen added is sufficient
for a crop yielding 31 bushels of wheat; the phosphorus
is sufficient for a crop of 44 bushels, and the potassium
for a crop of 35 bushels per acre. Dr. Hopkins,
in his recent valuable work on “Soil Fertility
and Permanent Agriculture” gives, on page 154,
a table from which we abstract the following data:
*Approximate* *amounts* *of* *nitrogen*, *phosphorus* *and* *potassium* *removableper* *acre* *annually* *by*
Nitrogen, Phosphorus, Potassium,
pounds. pounds. pounds.
100 bush. crop of corn 148 23 71
100 bush. crop of oats 97 16 68
50 bush. crop of wheat 96 16 58
25 bush. crop of soy beans 159 21 73
100 bush. crop of rice 155 18 95
3 ton crop of timothy hay 72 9 71
4 ton crop of clover hay 160 20 120
3 ton crop of cow pea hay 130 14 98
8 ton crop of alfalfa hay 400 36 192
7000 lb. crop of cotton 168 29.4 82
400 bush. crop of potatoes 84 17.3 120
20 ton crop of sugar beets 100 18 157
Annually applied in Japan, more than 60 14 40

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We have inserted in this table, for comparison, the
crop of rice, and have increased the crop of potatoes
from three hundred bushels to four hundred bushels
per acre, because such a yield, like all of those
named, is quite practicable under good management and
favorable seasons, notwithstanding the fact that much
smaller yields are generally attained through lack
of sufficient plant food or water. From this
table, assuming that a crop of matured grain contains
11 per cent of water and the straw 15 per cent, while
potatoes contain 79 per cent and beets 87 per cent,
the amounts of the three plant food elements removable
annually by 1000 pounds of crop have been calculated
and stated in the next table.
 *Approximate* *amounts* *ofnitrogen*, *phosphorus* *and* *potassium  
removable* *annually* *per* 1,0000 *poundsof* *dry* *crop* *substance*  
Nitrogen, Phosphorus, Potassium,  
pounds. pounds.
pounds.   
Cereals.   
Wheat 13.873 2.312
8.382 Oats 13.666 2.254
9.580 Corn 13.719 2.149
6.676  
Legumes.   
Soy beans 30.807 4.070 14.147
Cow peas 25.490 2.745 19.216
Clover 23.529 2.941 17.647
Alfalfa 29.411 2.647 14.118  
Roots.   
Beets 19.213 3.462 30.192
Potatoes 15.556 3.210 22.222  
Grass.   
Timothy 14.117 1.765 13.922
Rice 9.949 1.129 6.089
  
From the amounts of nitrogen, phosphorus and potassium
applied annually to the cultivated fields of Japan
and from the data in these two tables it may be readily
seen that these people are now and probably long have
been applying quite as much of these three plant food
elements to their fields with each planting as are
removed with the crop, and if this is true in Japan
it must also be true in China. Moreover there
is nothing in American agricultural practice which
indicates that we shall not ultimately be compelled
to do likewise.

**X**

**IN THE SHANTUNG PROVINCE**  
On May 15th we left Shanghai by one of the coastwise
steamers for Tsingtao, some three hundred miles farther
north, in the Shantung Province, our object being
to keep in touch with methods of tillage and fertilization,
corresponding phases of which would occur later in
the season there.
  
The Shantung province is in the latitude of North
Carolina and Kentucky, or lies between that of San
Francisco and Los Angeles. It has an area of
nearly 56,000 square miles, about that of Wisconsin.
Less than one-half of this area is cultivated land
yet it is at the present time supporting a population
exceeding 38,000,000 of people. New York state
has today less than ten millions and more than half
of these are in New York city.

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It was in this province that Confucius was born 2461
years ago, and that Mencius, his disciple, lived.
Here, too, seventeen hundred years before Confucius’
time, after one of the great floods of the Yellow
river, 2297 B. C., and more than 4100 years ago, the
Great Yu was appointed “Superintendent of Public
Works” and entrusted with draining off the flood
waters and canalizing the rivers.
  
Here also was the beginning of the Boxer uprising.
Tsingtao sits at the entrance of Kiaochow Bay.
Following the war of Japan with China this was seized
by Germany, November 14, 1897, nominally to indemnify
for the murder of two German missionaries which had
occurred in Shantung, and March 6th, 1898, this bay,
to the high water line, its islands and a “Sphere
of Influence” extending thirty miles in all
directions from the boundary, together with Tsingtao,
was leased to Germany for ninety-nine years. Russia
demanded and secured a lease of Port Arthur at the
same time. Great Britain obtained a similar lease
of Weihaiwei in Shantung, while to France Kwangchow-wan
in southern China, was leased. But the “encroachments”
of European powers did not stop with these leases and
during the latter part of 1898 the “Policy of
Spheres of Influence” culminated in the international
rivalry for railway concessions and mining. These
greatly alarmed China and uprisings broke out very
naturally first in Shantung, among the people nearest
of kin to the founders of the Empire. As might
have been expected of a patriotic, even though naturally
peaceful people, they determined to defend their country
against such encroachments and the Boxer troubles followed.
  
Tsingtao has a deep, commodious harbor always free
from ice and Germany is constructing here very extensive
and substantial harbor improvements which will be
of lasting benefit to the province and the Empire.
A pier four miles in length encloses the inner wharf,
and a second wharf is nearing completion. Germany
is also maintaining a meteorological observatory here
and has established a large, comprehensive Forest
Garden, under excellent management, which is showing
remarkable developments for so short a time.
  
Our steamer entered the harbor during the night and,
on going ashore, we soon found that only Chinese and
German were generally spoken; but through the kind
assistance of Rev. W. H. Scott, of the American Presbyterian
Mission, an interpreter promised to call at my hotel
in the evening, although he failed to appear.
The afternoon was spent at the Forest Garden and on
the reforestation tract, which are under the supervision
of Mr. Haas. The Forest Garden covers two hundred
and seventy acres and the reforestation tract three
thousand acres more. In the garden a great variety
of forest and fruit trees and small fruits are being
tried out with high promise of the most valuable results.

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It was in the steep hills about Tsingtao that we first
saw at close range serious soil erosion in China;
and the returning of forest growth on hills nearly
devoid of soil was here remarkable, in view of the
long dry seasons which prevail from November to June,
and Fig. 118 shows how destitute of soil the crests
of granite hills may become and yet how the coming
back of the forest growth may hasten as soon as it
is no longer cut away. The rock going into decay,
where this view was taken, is an extremely coarse crystalline
granite, as may be seen in contrast with the watch,
and it is falling into decay at a marvelous rate.
Disintegration has penetrated the rock far below the
surface and the large crystals are held together with
but little more tenacity than prevails in a bed of
gravel. Moisture and even roots penetrate it deeply
and readily and the crystals fall apart with thrusts
of the knife blade, the rock crumbling with the greatest
freedom. Roadways have been extensively carved
along the sides of the hills with the aid of only
pick and shovel. Close examination of the rock
shows that layers of sediment exist between the crystal
faces, either washed down by percolating rain or formed
through decomposition of the crystals in place.
The next illustration, Fig. 119, shows how large the
growth on such soils may be, and in Fig. 120 the vegetation
and forest growth are seen coming back, closely covering
just such soil surfaces and rock structure as are
indicated in Figs. 118 and 119.
  
These views are taken on the reforestation tract at
Tsingtao but most of the growth is volunteer, standing
now protected by the German government in their effort
to see what may be possible under careful supervision.
  
The loads of pine bough fuel represented in Fig. 80
were gathered from such hills and from such forest
growth as are here represented, but on lands more
distant from the city. But Tsingtao, with its
forty thousand Chinese, and Kiaochow across the bay,
with its one hundred and twenty thousand more, and
other villages dotting the narrow plains, maintain
a very great demand for such growth on the hill lands.
The wonder is that forest growth has persisted at all
and has contributed so much in the way of fuel.
  
Growing in the Forest Garden was a most beautiful
wild yellow rose, native to Shantung, being used for
landscape effect in the parking, and it ought to be
widely introduced into other countries wherever it
will thrive. It was growing as heavy borders and
massive clumps six to eight feet high, giving a most
wonderful effect, with its brilliant, dense cloud
of the richest yellow bloom. The blossoms are
single, fully as large as the Rosa rugosa, with the
tips of the petals shading into the most dainty light
straw yellow, while the center is a deep orange, the
contrast being sufficient to show in the photograph
from which Fig. 121 was prepared. Another beautiful
and striking feature of this rose is the clustering
of the blossoms in one-sided wreath-like sprays, sometimes
twelve to eighteen inches long, the flowers standing
close enough to even overlap.

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The interpreter engaged for us failed to appear as
per agreement so the next morning we took the early
train for Tsinan to obtain a general view of the country
and to note the places most favorable as points for
field study. We had resolved also to make an effort
to secure an interpreter through the American Presbyterian
College at Tsinan. Leaving Tsingtao, the train
skirts around the Kiaochow bay for a distance of nearly
fifty miles, where we pass the city of the same name
with its population of 120,000, which had an import
and export trade in 1905 valued at over $24,000,000.
At Sochen we passed through a coal mining district
where coal was being brought to the cars in baskets
carried by men. The coal on the loaded open cars
was sprinkled with whitewash, serving as a seal to
safe-guard against stealing during transit, making
it so that none could be removed without the fact
being revealed by breaking the seal. This practice
is general in China and is applied to many commodities
handled in bulk. We saw baskets of milled rice
carried by coolies sealed with a pattern laid over
the surface by sprinkling some colored powder upon
it. Cut stone, corded for the market, was whitewashed
in the same manner as the coal.
  
As we were approaching Weihsien, another city of 100,000
people, we identified one of the deeply depressed,
centuries-old roadways, worn eight to ten feet deep,
by chancing to see half a dozen teams passing along
it as the train crossed. We had passed several
and were puzzling to account for such peculiar erosion.
The teams gave the explanation and thus connected
our earlier reading with the concrete. Along
these deep-cut roadways caravans may pass, winding
through the fields, entirely unobserved unless one
chances to be close along the line or the movement
is discovered by clouds of dust, one of the methods
that has produced them, and we would not be surprised
if gathering manure from them has played a large part
also.
  
Weihsien is near one of the great commercial highways
of China and in the center of one of the coal mining
regions of the province. Still further along
towards Tsinan we passed Tsingchowfu, another of the
large cities of the province, with 150,000 population.
All day we rode through fields of wheat, always planted
in rows, and in hills in the row east of Kaumi, but
in single or double continuous drills westward from
here to Tsinan. Thousands of wells used for irrigation,
of the type seen in Fig. 123, were passed during the
day, many of them recently dug to supply water for
the barley suffering from the severe drought which
was threatening the crop at the time.

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It was 6:30 P. M. before our train pulled into the
station at Tsinan; 7:30 when we had finished supper
and engaged a ricksha to take us to the American Presbyterian
College in quest of an interpreter. We could
not speak Chinese, the ricksha boy could neither speak
nor understand a word of English, but the hotel proprietor
had instructed him where to go. We plunged into
the narrow streets of a great Chinese city, the boy
running wherever he could, walking where he must on
account of the density of the crowds or the roughness
of the stone paving. We had turned many corners,
crossed bridges and passed through tunneled archways
in sections of the massive city walls, until it was
getting dusk and the ricksha man purchased and lighted
a lantern. We were to reach the college in thirty
minutes but had been out a full hour. A little
later the boy drew up to and held conference with
a policeman. The curious of the street gathered
about and it dawned upon us that we were lost in the
night in the narrow streets of a Chinese city of a
hundred thousand people. To go further would
be useless for the gates of the mission compound would
be locked. We could only indicate by motions our
desire to return, but these were not understood.
On the train a thoughtful, kindly old German had recognized
a stranger in a foreign land and volunteered useful
information, cutting from his daily paper an advertisement
describing a good hotel. This gave the name of
the hotel in German, English and in Chinese characters.
We handed this to the policeman, pointing to the name
of the hotel, indicating by motions the desire to
return, but apparently he was unable to read in either
language and seemed to think we were assuming to direct
the way to the college. A man and boy in the crowd
apparently volunteered to act as escort for us.
The throng parted and we left them, turned more corners
into more unlighted narrow alleyways, one of which
was too difficult to permit us to ride. The escorts,
if such they were, finally left us, but the dark alley
led on until it terminated at the blank face, probably
of some other portion of the massive city wall we
had thrice threaded through lighted tunnels.
Here the ricksha boy stopped and turned about but the
light from his lantern was too feeble to permit reading
the workings of his mind through his face, and our
tongues were both utterly useless in this emergency,
so we motioned for him to turn back and by some route
we reached the hotel at 11 P. M.
  
We abandoned the effort to visit the college, for
the purpose of securing an interpreter, and took the
early train back to Tsingtao, reaching there in time
to secure the very satisfactory service of Mr. Chu
Wei Yung, through the further kind offices of Mr. Scott.
We had been twice over the road between the two cities,
obtaining a general idea of the country and of the
crops and field operations at this season. The
next morning we took an early train to Tsangkau and
were ready to walk through the fields and to talk with

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the last generations of more than forty unbroken centuries
of farmers who, with brain and brawn, have successfully
and continuously sustained large families on small
areas without impoverishing their soil. The next
illustration is from a photograph taken in one of these
fields. We astonished the old farmer by asking
the privilege of holding his plow through one round
in his little field, but he granted the privilege
readily. Our furrow was not as well turned as
his, nor as well as we could have done with a two-handled
Oliver or John Deere, but it was better than the old
man had expected and won his respect.
  
This plow had a good steel point, as a separate, blunt,
V-shaped piece, and a moldboard of cast steel with
a good twist which turned the soil well. The
standard and sole were of wood and at the end of the
beam was a block for gauging the depth of furrow.
The cost of this plow, to the farmer, was $2.15, gold,
and when the day’s work is done it is taken
home on the shoulders, even though the distance may
be a mile or more, and carefully housed. Chinese
history states that the plow was invented by Shennung,
who lived 2737-2697 B. C. and “taught the art
of agriculture and the medical use of herbs”.
He is honored as the “God of Agriculture and
Medicine.”
  
Through my interpreter we learned that there were
twelve in this man’s family, which he maintained
on fifteen mow of land, or 2.5 acres, together with
his team, consisting of a cow and small donkey, besides
feeding two pigs. This is at the rate of 192 people,
16 cows, 16 donkeys and 32 pigs on a forty-acre farm;
and of a population density equivalent to 3072 people,
256 cows, 256 donkeys and 512 swine per square mile
of cultivated field.
  
On another small holding we talked with the farmer
standing at the well in Fig. 27, where he was irrigating
a little piece of barley 30 feet wide and 138 feet
long. He owned and was cultivating but one and
two-thirds acres of land and yet there were ten in
his family and he kept one donkey and usually one
pig. Here is a maintenance capacity at the rate
of 240 people, 24 donkeys and 24 pigs on a forty-acre
farm; and a population density of 3840 people, 384
donkeys and 384 pigs per square mile. His usual
annual sales in good seasons were equivalent in value
to $73, gold.
  
In both of these cases the crops grown were wheat,
barley, large and small millet, sweet potatoes and
soy beans or peanuts. Much straw braid is manufactured
in the province by the women and children in their
homes, and the cargo of the steamer on which we returned
to Shanghai consisted almost entirely of shelled peanuts
in gunny sacks and huge bales of straw braid destined
for the manufacture of hats in Europe and America.
  
Shantung has only moderate rainfall, little more than
24 inches annually, and this fact has played an important
part in determining the agricultural practices of
these very old people. In Fig. 123 is a closer
view than Fig. 27 of the farmer watering his little
field of barley. The well had just been dug over
eight feet deep, expressly and solely to water this
one piece of grain once, after which it would be filled
and the ground planted.

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The season had been unusually dry, as had been the
one before, and the people were fearing famine.
Only 2.44 inches of rain had fallen at Tsingtao between
the end of the preceding October and our visit, May
21st, and hundreds of such temporary wells had been
or were being dug all along both sides of the two
hundred and fifty miles of railway, and nearly all
to be filled when the crop on the ground was irrigated,
to release the land for one to follow. The homes
are in villages a mile or more apart and often the
holdings or rentals are scattered, separated by considerable
distances, hence easy portability is the key-note
in the construction of this irrigating outfit.
The bucket is very light, simply a woven basket waterproofed
with a paste of bean flour. The windlass turns
like a long spool on a single pin and the standard
is a tripod with removable legs. Some wells we
saw were sixteen or twenty feet deep and in these the
water was raised by a cow walking straight away at
the end of a rope.
  
The amount and distribution of rainfall in this province,
as indicated by the mean of ten years’ records
at Tsingtao, obtained at the German Meteorological
Observatory through the courtesy of Dr. B. Meyermanns,
are given in the table in which the rainfall of Madison,
Wisconsin, is inserted for comparison.
Mean monthly rainfall. Mean rainfall In 10 days.
Tsingtao, Madison, Tsingtao, Madison,
Inches. Inches. Inches. Inches.
January .394 1.56 .131 .520
February .240 1.50 .080 .500
March .892 2.12 .297 .707
April 1.240 2.62 .413 .840
May 1.636 3.62 .545 1.207
June 2.702 4.10 .901 1.866
July 6.637 3.90 2.212 1.300
August 5.157 3.21 1.719 1.070
September 2.448 3.15 .816 1.050
October 2.258 2.42 .753 .807
November .398 1.78 .132 .593
December .682 1.77 .227 .590
------------
Total 24.682 31.65
  
While Shantung receives less than 25 inches of rain
during the year, against Wisconsin’s more than
31 inches, the rainfall during June, July and August
in Shantung is nearly 14.5 inches, while Wisconsin
receives but 11.2 inches. This greater summer
rainfall, with persistent fertilization and intense
management, in a warm latitude, are some of the elements
permitting Shantung today to feed 38,247,900 people
from an area equal to that upon which Wisconsin is
yet feeding but 2,333,860. Must American agriculture
ultimately feed sixteen people where it is now feeding
but one? If so, correspondingly more intense
and effective practices must follow, and we can neither
know too well nor too early what these Old World people
have been driven to do; how they have succeeded, and
how we and they may improve upon their practices and
lighten the human burdens by more fully utilizing
physical forces and mechanical appliances.

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As we passed on to other fields we found a mother
and daughter transplanting sweet potatoes on carefully
fitted ridges of nearly air-dry soil in a little field,
the remnant of a table on a deeply eroded hillside,
Fig. 124. The husband was bringing water for
moistening the soil from a deep ravine a quarter of
a mile distant, carrying it on his shoulder in two
buckets, Fig. 125, across an intervening gulch.
He had excavated four holes at intervals up the gulch
and from these, with a broken gourd dipper mended with
stitches, he filled his pails, bailing in succession
from one to the other in regular rotation.
  
The daughter was transplanting. Holding the slip
with its tip between thumb and fingers, a strong forward
stroke plowed a furrow in the mellow, dry soil; then,
with a backward movement and a downward thrust, planted
the slip, firmed the soil about it, leaving a depression
in which the mother poured about a pint of water from
another gourd dipper. After this water had soaked
away, dry earth was drawn about the slip and firmed
and looser earth drawn over this, the only tools being
the naked hands and dipper.
  
The father and mother were dressed in coarse garb
but the daughter was neatly clad, with delicate hands
decorated with rings and a bracelet. Neither
of the women had bound feet. There were ten in
his family; and on adjacent similar areas they had
small patches of wheat nearly ready for the harvest,
all planted in hills, hoed, and in astonishingly vigorous
condition considering the extreme drought which prevailed.
The potatoes were being planted under these extreme
conditions in anticipation of the rainy season which
then was fully due. The summer before had been
one of unusual drought, and famine was threatened.
The government had recently issued an edict that no
sheep should be sold from the province, fearing they
might be needed for food. An old woman in one
of the villages came out, as we walked through, and
inquired of my interpreter if we had come to make it
rain. Such was the stress under which we found
these people.
  
One of the large farmers, owning ten acres, stated
that his usual yield of wheat in good season was 160
catty per mow, equivalent to 21.3 bushels per acre.
He was expecting the current season not more than
one half this amount. As a fertilizer he used
a prepared earth compost which we shall describe later,
mixing it with the grain and sowing in the hills with
the seed, applying about 5333 pounds per acre, which
he valued, in our currency, at $8.60, or $3.22 per
ton. A pile of such prepared compost is seen
in Fig. 126, ready to be transferred to the field.
The views show with what cleanliness the yard is kept
and with what care all animal waste is saved.
The cow and donkey are the work team, such as was
being used by the plowman referred to in Fig. 122.
The mounds in the background of the lower view are
graves; the fence behind the animals is made from the
stems of the large millet, kaoliang, while that at
the right of the donkey is made of earth, both indicative
of the scarcity of lumber. The buildings, too,
are thatched and their walls are of earth plastered
with an earthen mortar worked up with chaff.

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In another field a man plowing and fertilizing for
sweet potatoes had brought to the field and laid down
in piles the finely pulverized dry compost. The
father was plowing; his son of sixteen years was following
and scattering, from a basket, the pulverized dry
compost in the bottom of the furrow. The next
furrow covered the fertilizer, four turned together
forming a ridge upon which the potatoes were to be
planted after a second and older son had smoothed
and fitted the crest with a heavy hand rake. The
fertilizer was thus applied directly beneath the row,
at the rate of 7400 pounds per acre, valued at $7.15,
our currency, or $1.93 per ton.
  
We were astonished at the moist condition of the soil
turned, which was such as to pack in the hand notwithstanding
the extreme drought prevailing and the fact that standing
water in the ground was more than eight feet below
the surface. The field had been without crop
and cultivated. To the question, “What yield
of sweet potatoes do you expect from this piece of
land?” he replied, “About 4000 catty,”
which is 440 bushels of 56 pounds per acre. The
usual market price was stated to be $1.00, Mexican,
per one hundred catty, making the gross value of the
crop $79.49, gold, per acre. His land was valued
at $60, Mexican, per mow, or $154.80 per acre, gold.
  
My interpreter informed me that the average well-to-do
farmers in this part of Shantung own from fifteen
to twenty mow of land and this amount is quite ample
to provide for eight people. Such farmers usually
keep two cows, two donkeys and eight or ten pigs.
The less well-to-do or small farmers own two to five
mow and act as superintendents for the larger farmers.
Taking the largest holding, of twenty mow per family
of eight people, as a basis, the density per square
mile would be 1536 people, and an area of farm land
equal to the state of Wisconsin would have 86,000,000
people; 21,500,000 cows; 21,500,000 donkeys and 86,000,000
swine. These observations apply to one of the
most productive sections of the province, but very
large areas of land in the province are not cultivable
and the last census showed the total population nearly
one-half of this amount. It is clear, therefore,
that either very effective agricultural methods are
practiced or else extreme economy is exercised.
Both are true.
  
On this day in the fields our interpreter procured
his dinner at a farm house, bringing us four boiled
eggs, for which he paid at the rate of 8.3 cents of
our money, but his dinner was probably included in
the price. The next table gives the prices for
some articles obtained by inquiry at the Tsingtao
market, May 23rd, 1909, reduced to our currency.
Cents
Old potatoes, per lb 2.18
New potatoes, per lb 2.87
Salted turnip, per lb .86
Onions, per lb 4.10
Radishes, bunch of 10 1.29
String beans, per lb 11.46
Cucumbers, per lb 5.78  
The only items which are low compared with our own
prices are salted turnips, radishes and eggs.
Most of the articles listed were out of season for
the locality and were imported for the foreigners,
turnips, radishes, pork, fish and eggs being the exceptions.
Prof. Ross informs us that he found eggs selling
in Shensi at four for one cent of our money.
  
Our interpreter asked a compensation of one dollar,
Mexican, or 43 cents, U. S. currency, per day, he
furnishing his own meals. The usual wage for
farm labor here was $8.60, per year, with board and
lodging. We have referred to the wages paid by
missionaries for domestic service. As servants
the Chinese are considered efficient, faithful and
trustworthy. It was the custom of Mr. and Mrs.
League to intrust them with the purse for marketing,
feeling that they could be depended upon for the closest
bargaining. Commonly, when instructed to procure
a certain article, if they found the price one or
two cash higher than usual they would select a cheaper
substitute. If questioned as to why instructions
were not followed the reply would be “Too high,
no can afford.”
  
Mrs. League recited her experience with her cook regarding
his use of our kitchen appliances. After fitting
the kitchen with a modern range and cooking utensils,
and working with him to familiarize him with their
use, she was surprised, on going into the kitchen a
few days later, to find that the old Chinese stove
had been set on the range and the cooking being done
with the usual Chinese furniture. When asked
why he was not using the stove his reply was “Take
too much fire.” Nothing jars on the nerves
of these people more than incurring of needless expense,
extravagance in any form, or poor judgment in making
purchases.
  
Daily we became more and more impressed by the evidence
of the intense and incessant stress imposed by the
dense populations of centuries, and how, under it,
the laws of heredity have wrought upon the people,
affecting constitution, habits and character.
Even the cattle and sheep have not escaped its irresistible
power. Many times in this province we saw men
herding flocks of twenty to thirty sheep along the
narrow unfenced pathways winding through the fields,
and on the grave lands. The prevailing drought
had left very little green to be had from these places
and yet sheep were literally brushing their sides
against fresh green wheat and barley, never molesting
them. Time and again the flocks were stampeded
into the grain by an approaching train, but immediately
they returned to their places without taking a nibble.
The voice of the shepherd and an occasional well aimed
lump of earth only being required to bring them back
to their uninviting pastures.

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In Kiangsu and Chekiang provinces a line of half a
dozen white goats were often seen feeding single file
along the pathways, held by a cord like a string of
beads, sometimes led by a child. Here, too, one
of the most common sights was the water buffalo grazing
unattended among the fields along the paths and canal
banks, with crops all about, One of the most memorable
shocks came to us in Chekiang, China, when we had
fallen into a revery while gazing at the shifting
landscape from the doorway of our low-down Chinese
houseboat. Something in the sky and the vegetation
along the canal bank had recalled the scenes of boyhood
days and it seemed, as we looked aslant up the bank
with its fringe of grass, that we were gliding along
Whitewater creek through familiar meadows and that
standing up would bring the old home in sight.
That instant there glided into view, framed in the
doorway and projected high against the tinted sky
above the setting sun, a giant water buffalo standing
motionless as a statue on the summit of a huge grave
mound, lifted fully ten feet above the field.
But in a flash this was replaced by a companion scene,
and with all its beautiful setting, which had been
as suddenly fixed on the memory fourteen years before
in the far away Trossachs when our coach, hurriedly
rounding a sharp turn in the hills, suddenly exposed
a wild ox of Scotland similarly thrust against the
sky from a small but isolated rocky summit, and then,
outspeeding the wireless, recollection crossed two
oceans and an intervening continent, bringing us back
to China before a speed of five miles, per hour could
move the first picture across the narrow doorway.
  
It was through the fields about Tsangkow that the
stalwart freighters referred to, Fig. 32, passed us
on one of the paths leading from Kiaochow through
unnumbered country villages, already eleven miles
on their way with their wheelbarrows loaded with matches
made in Japan. Many of the wheelbarrow men seen
in Shanghai and other cities are from Shantung families,
away for employment, expecting to return. During
the harvest season, too, many of these people go west
and north into Manchuria seeking employment, returning
to their homes in winter. Alexander Hosie, in
his book on Manchuria, states that from Chefoo alone
more than 20,000 Chinese laborers cross to Newchwang
every spring by steamer, others finding their way
there by junks or other means, so that after the harvest
season 8,000 more return by steamer to Chefoo than
left that way in the spring, from which he concludes
that Shantung annually supplies Manchuria with agricultural
labor to the extent of 30,000 men.
  
About the average condition of wheat in Shantung during
this dry season, and nearing maturity, is seen in
Fig. 127, standing rather more than three feet high,
as indicated by our umbrella between the rows.
Beyond the wheat and to the right, grave mounds serrate
the sky line, no hills being in sight, for we were
in the broad plain built up from the sea between the
two mountain islands forming the highlands of Shantung.

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On May 22nd we were in the fields north of Kiaochow,
some sixty miles by rail west from Tsingtao, but within
the neutral zone extending thirty miles back from
the high water line of the bay of the same name.
Here the Germans had built a broad macadam road after
the best European type but over it were passing the
vehicles of forty centuries seen in Figs. 128 and
129. It is doubtful if the resistance to travel
experienced by these men on the better road was enough
less than that on the old paths they had left to convince
them that the cost of construction and maintenance
would be worth while until vehicles and the price
of labor change. It may appear strange that with
a nation of so many millions and with so long a history,
roads have persisted as little more than beaten foot-paths;
but modern methods of transportation have remained
physical impossibilities to every people until the
science of the last century opened the way. Throughout
their history the burdens of these people have been
carried largely on foot, mostly on the feet of men,
and of single men wherever the load could be advantageously
divided. Animals have been supplemental burden
bearers but, as with the men, they have carried the
load directly on their own feet, the mode least disturbed
by inequalities of road surface.
  
For adaptability to the worst road conditions no vehicle
equals the wheelbarrow, progressing by one wheel and
two feet. No vehicle is used more in China, if
the carrying pole is excepted, and no wheelbarrow
in the world permits so high an efficiency of human
power as the Chinese, as must be clear from Figs. 32
and 61, where nearly the whole load is balanced on
the axle of a high, massive wheel with broad tire.
A shoulder band from the handles of the barrow relieves
the strain on the hands and, when the load or the
road is heavy, men or animals may aid in drawing, or
even, when the wind is favorable, it is not unusual
to hoist a sail to gain propelling power. It
is only in northern China, and then in the more level
portions, where there are few or no canals, that carts
have been extensively used, but are more difficult
to manage on bad roads. Most of the heavy carts,
especially those in Manchuria, seen in Fig. 203, have
the wheels framed rigidly to the axle which revolves
with them, the bearing being in the bed of the cart.
But new carts of modern type are being introduced.
  
In the extent of development and utilization of inland
waterways no people have approached the Chinese.
In the matter of land transportation they have clearly
followed the line of least resistance for individual
initiative, so characteristic of industrial China.
  
There are Government courier or postal roads which
connect Peking with the most distant parts of the
Empire, some twenty-one being usually enumerated.
These, as far as practicable, take the shortest course,
are often cut into the mountain sides and even pass
through tunnels. In the plains regions these
roads may be sixty to seventy-five feet wide, paved
and occasionally bordered by rows of trees. In
some cases, too, signal towers are erected at intervals
of three miles and there are inns along the way, relay
posts and stations for soldiers.

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We have spoken of planting grain in rows and in hills
in the row. In Fig. 130 is a field with the rows
planted in pairs, the members being 16 inches apart,
and together occupying 30 inches. The space between
each pair is also 30 inches, making five feet in all.
This makes frequent hoeing practicable, which is begun
early in the spring and is repeated after every rain.
It also makes it possible to feed the plants when
they can utilize food to the best advantage and to
repeat the feeding if desirable. Besides, the
ground in the wider space may be fitted, fertilized
and another crop planted before the first is removed.
The hills alternate in the rows and are 24 to 26 inches
from center to center.
  
The planting may be done by hand or with a drill such
as that in Fig. 131, ingenious in the simple mechanism
which permits planting in hills. The husbandman
had just returned from the field with the drill on
his shoulder when we met at the door of his village
home, where he explained to us the construction and
operation of the drill and permitted the photograph
to be taken, but turning his face aside, not wishing
to represent a specific character, in the view.
In the drill there was a heavy leaden weight swinging
free from a point above the space between the openings
leading to the respective drill feet. When planting,
the operator rocks the drill from side to side, causing
the weight to hang first over one and then over the
other opening, thus securing alternation of hills in
each pair of rows.
  
Counting the heads of wheat in the hill in a number
of fields showed them ranging between 20 and 100,
the distance between the rows and between the hills
as stated above. There were always a larger number
of stalks per hill where the water capacity of the
soil was large, where the ground water was near the
surface, and where the soil was evidently of good
quality. This may have been partly the result
of stooling but we have little doubt that judgment
was exercised in planting, sowing less seed on the
lighter soils where less moisture was available.
In the piece just referred to, in the illustration,
an average hill contained 46 stalks and the number
of kernels in a head varied between 20 and 30.
Taking Richardson’s estimate of 12,000 kernels
of wheat to the pound, this field would yield about
twelve bushels of wheat per acre this unusually dry
season. Our interpreter, whose parents lived
near Kaomi, four stations further west, stated that
in 1901, one of their best seasons, farmers there
secured yields as high as 875 catty per legal mow,
which is at the rate of 116 bushels per acre.
Such a yield on small areas highly fertilized and
carefully tilled, when the rainfall is ample or where
irrigation is practiced, is quite possible and in the
Kiangsu province we observed individual small fields
which would certainly approach close to this figure.

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Further along in our journey of the day we came upon
a field where three, one of them a boy of fourteen
years, were hoeing and thinning millet and maize.
In China, during the hot weather, the only garment
worn by the men in the field, was their trousers, and
the boy had found these unnecessary, although he slipped
into them while we were talking with his father.
The usual yield of maize was set at 420 to 480 catty
per mow, and that of millet at 600 catty, or 60 to
68.5 bushels of maize and 96 bushels of millet, of
fifty pounds, per acre, and the usual price would
make the gross earnings $23.48 to $26.83 per acre
for the maize, and $30.96, gold, for the millet.
  
It was evident when walking through these fields that
the fall-sowed grain was standing the drought far
better than the barley planted in the spring, quite
likely because of the deeper and stronger development
of root system made possible by the longer period of
growth, and partly because the wheat had made much
of its growth utilizing water that had fallen before
the barley was planted and which would have been lost
from the soil through percolation and surface evaporation.
Farmers here are very particular to hoe their grain,
beginning in the early spring, and always after rains,
thoroughly appreciating the efficiency of earth mulches.
Their hoe, seen in Fig. 132, is peculiarly well adapted
to its purpose, the broad blade being so hung that
it draws nearly parallel with the surface, cutting
shallow and permitting the soil to drop practically
upon the place from which it was loosened. These
hoes are made in three parts; a wooden handle, a long,
strong and heavy iron socket shank, and a blade of
steel. The blade is detachable and different
forms and sizes of blades may be used on the same shank.
The mulch-producing blades may have a cutting edge
thirteen inches long and a width of nine inches.
  
At short intervals on either hand, along the two hundred
and fifty miles of railway between Tsingtao and Tsinan,
were observed many piles of earth compost distributed
in the fields. One of these piles is seen in
Fig. 133. They were sometimes on unplanted fields,
in other cases they occurred among the growing crops
soon to be harvested, or where another crop was to
be planted between the rows of one already on the
ground. Some of these piles were six feet high.
All were built in cubical form with flat top and carefully
plastered with a layer of earth mortar which sometimes
cracked on drying, as seen in the illustration.
The purpose of this careful shaping and plastering
we did not learn although our interpreter stated it
was to prevent the compost from being appropriated
for use on adjacent fields. Such a finish would
have the effect of a seal, showing if the pile had
been disturbed, but we suspect other advantages are
sought by the treatment, which involves so large an
amount of labor.

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The amount of this earth compost prepared and used
annually in Shantung is large, as indicated by the
cases cited, where more than five thousand pounds,
in one instance, and seven thousand pounds in another,
were applied per acre for one crop. When two or
more crops are grown the same year on the same ground,
each is fertilized, hence from three to six or more
tons may be applied to each cultivated acre.
The methods of preparing compost and of fertilizing
in Kiangsu, Chekiang and Kwangtung provinces have been
described. In this part of Shantung, in Chihli
and north in Manchuria as far as Mukden, the methods
are materially different and if possible even more
laborious, but clearly rational and effective.
Here nearly if not all fertilizer compost is prepared
in the villages and carried to the fields, however
distant these may be.
  
Rev. T. J. League very kindly accompanied us to Chengyang
on the railway, from which we walked some two miles,
back to a prosperous rural village to see their methods
of preparing this compost fertilizer. It was
toward the close of the afternoon before we reached
the village, and from all directions husbandmen were
returning from the fields, some with hoes, some with
plows, some with drills over their shoulders and others
leading donkeys or cattle, and similar customs obtain
in Japan, as seen in Fig. 134. These were mostly
the younger men. When we reached the village
streets the older men, all bareheaded, as were those
returning from the fields, and usually with their
queues tied about the crown, were visiting, enjoying
their pipes of tobacco.
  
Opium is no longer used openly in China, unless it
be permitted to some well along in years with the
habit confirmed, and the growing of the poppy is prohibited.
The penalties for violating the law are heavy and
enforcement is said to be rigid and effective.
For the first violation a fine is imposed. If
convicted of a second violation the fine is heavier
with imprisonment added to help the victim acquire
self control, and a third conviction may bring the
death penalty. The eradication of the opium scourge
must prove a great blessing to China. But with
the passing of this most formidable evil, for whose
infliction upon China England was largely responsible,
it is a great misfortune that through the pitiless
efforts of the British-American Tobacco Company her
people are rapidly becoming addicted to the western
tobacco habit, selfish beyond excuse, filthy beyond
measure, and unsanitary in its polluting and oxygen-destroying
effect upon the air all are compelled to breathe.
It has already become a greater and more inexcusable
burden upon mankind than opium ever was.

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China, with her already overtaxed fields, can ill
afford to give over an acre to the cultivation of
this crop and she should prohibit the growing of tobacco
as she has that of the poppy. Let her take the
wise step now when she readily may, for all civilized
nations will ultimately be compelled to adopt such
a measure. The United States in 1902 had more
than a million acres growing tobacco, and harvested
821,000,000 pounds of leaf. This leaf depleted
those soils to the extent of more than twenty eight
million pounds of nitrogen, twenty-nine million pounds
of potassium and nearly two and a half million pounds
of phosphorus, all so irrecoverably lost that even
China, with her remarkable skill in saving and her
infinite patience with little things, could not recover
them for her soils. On a like area of field might
as readily be grown twenty million bushels of wheat
and if the twelve hundred million pounds of grain were
all exported it would deplete the soil less than the
tobacco crop in everything but phosphorus, and in
this about the same. Used at home, China would
return it all to one or another field. The home
consumption of tobacco in the United States averaged
seven pounds per capita in 1902. A like consumption
for China’s four hundred millions would call
for 2800 million pounds of leaf. If she grew it
on her fields two million acres would not suffice.
Her soils would be proportionately depleted and she
would be short forty million bushels of wheat; but
if China continues to import her tobacco the vast
sum expended can neither fertilize her fields nor feed,
clothe or educate her people, yet a like sum expended
in the importation of wheat would feed her hungry
and enrich her soils.
  
In the matter of conservation of national resources
here is one of the greatest opportunities open to
all civilized nations. What might not be done
in the United States with a fund of $57,000,000 annually,
the market price of the raw tobacco leaf, and the land,
the labor and the capital expended in getting the product
to the men who puff, breathe and perspire the noxious
product into the air everyone must breathe, and who
bespatter the streets, sidewalks, the floor of every
public place and conveyance, and befoul the million
spittoons, smoking rooms and smoking cars, all unnecessary
and should be uncalled for, but whose installation
and up-keep the non-user as well as the user is forced
to pay, and this in a country of, for and by the people.
This costly, filthy, selfish tobacco habit should
be outgrown. Let it begin in every new home, where
the mother helps the father in refusing to set the
example, and let its indulgence be absolutely prohibited
to everyone while in public school and to all in educational
institutions.

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Mr. League had been given a letter of introduction
to one of the leading farmers of the village and it
chanced that as we reached the entrance way to big
home we were met by his son, just returning from the
fields with his drill on his shoulder, and it is he
standing in the illustration, Fig. 131, holding the
letter of introduction in his hand. After we
had taken this photograph and another one looking
down the narrow street from the same point, we were
led to the small open court of the home, perhaps forty
by eighty feet, upon which all doors of the one-storied
structures opened. It was dry and bare of everything
green, but a row of very tall handsome trees, close
relatives of our cottonwood, with trunks thirty feet
to the limbs, looked down into the court over the
roofs of the low thatched houses. Here we met
the father and grandfather of the man with the drill,
so that, with the boy carrying the baby in his arms,
who had met his father in the street gateway, there
were four generations of males at our conference.
There were women and girls in the household but custom
requires them to remain in retirement on such occasions.
  
A low narrow four-legged bench, not unlike our carpenter’s
sawhorse, five feet long, was brought into the court
as a seat, which our host and we occupied in common.
We had been similarly received at the home of Mrs.
Wu in Chekiang province. On our right was the
open doorway to the kitchen in which stood, erect
and straight, the tall spare figure of the patriarch
of the household, his eyes still shining black but
with hair and long thin straggling beard a uniform
dull ashen gray. No Chinese hair, it seems, ever
becomes white with age. He seemed to have assumed
the duties of cook for while we were there be lighted
the fire in the kitchen and was busy, but was always
the final oracle on any matter of difference of opinion
between the younger men regarding answers to questions.
Two sleeping apartments adjoining the kitchen, through
whose wide kang beds the waste heat from the cooking
was conveyed, as described on page 142, completed
this side of the court. On our left was the main
street completely shut off by a solid earth wall as
high as the eaves of the house, while in front of
us, adjoining the street, was the manure midden, a
compost pit six feet deep and some eight feet square.
A low opening in the street wall permitted the pit
to be emptied and to receive earth and stubble or
refuse from the fields for composting, Against the
pit and without partition, but cut off from the court,
was the home of the pigs, both under a common roof
continuous with a closed structure joining with the
sleeping apartments, while behind us and along the
alley-way by which we had entered were other dwelling
and storage compartments. Thus was the large
family of four generations provided with a peculiarly
private open court where they could work and come
out for sun and air, both, from our standards, too
meagerly provided in the houses.

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We had come to learn more of the methods of fertilizing
practiced by these people. The manure midden
was before us and the piles of earth brought in from
the fields, for use in the process, were stacked in
the street, where we had photographed them at the entrance,
as seen in Fig. 135. There a father, with his
pipe, and two boys stand at the extreme left; beyond
them is a large pile of earth brought into the village
and carefully stacked in the narrow street; on the
other side of the street, at the corner of the first
building, is a pile of partly fermented compost thrown
from a pit behind the walls. Further along in
the street, on the same side, is a second large stack
of soil where two boys are standing at either end and
another little boy was in a near-by doorway.
In front of the tree, on the left side of the street,
stands a third boy, near him a small donkey and still
another boy. Beyond this boy stands a third large
stack of soil, while still beyond and across the way
is another pile partly composted. Notwithstanding
the cattle in the preceding illustration, the donkey,
the men, the boys, the three long high stacks of soil
and the two piles of compost, the ten rods of narrow
street possessed a width of available travelway and
a cleanliness which would appear impossible.
Each farmer’s household had its stack of soil
in the street, and in walking through the village we
passed dozens of men turning and mixing the soil and
compost, preparing it for the field.
  
The compost pit in front of where we sat was two-thirds
filled. In it had been placed all of the manure
and waste of the household and street, all stubble
and waste roughage from the field, all ashes not to
be applied directly and some of the soil stacked in
the street. Sufficient water was added at intervals
to keep the contents completely saturated and nearly
submerged, the object being to control the character
of fermentation taking place.
  
The capacity of these compost pits is determined by
the amount of land served, and the period of composting
is made as long as possible, the aim being to have
the fiber of all organic material completely broken
down, the result being a product of the consistency
of mortar.
  
When it is near the time for applying the compost
to the field, or of feeding it to the crop, the fermented
product is removed in waterproof carrying baskets
to the floor of the court, to the yard, such as seen
in Fig. 126, or to the street, where it is spread to
dry, to be mixed with fresh soil, more ashes, and repeatedly
turned and stirred to bring about complete aeration
and to hasten the processes of nitrification.
During all of these treatments, whether in the compost
pit or on the nitrification floor, the fermenting
organic matter in contact with the soil is converting
plant food elements into soluble plant food substances
in the form of potassium, calcium and magnesium nitrates
and soluble phosphates of one or another form, perhaps

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of the same bases and possibly others of organic type.
If there is time and favorable temperature and moisture
conditions for these fermentations to take place in
the soil of the field before the crop will need it,
the compost may be carried direct from the pit to
the field and spread broadcast, to be plowed under.
Otherwise the material is worked and reworked, with
more water added if necessary, until it becomes a rich
complete fertilizer, allowed to become dry and then
finely pulverized, sometimes using stone rollers drawn
over it by cattle, the donkey or by hand. The
large numbers of stacks of compost seen in the fields
between Tsingtao and Tsinan were of this type and thus
laboriously prepared in the villages and then transported
to the fields, stacked and plastered to be ready for
use at next planting.
  
In the early days of European history, before modern
chemistry had provided the cheaper and more expeditious
method of producing potassium nitrate for the manufacture
of gunpowder and fireworks, much land and effort were
devoted to niter-farming which was no other than a
specific application of this most ancient Chinese
practice and probably imported from China. While
it was not until 1877 to 1879 that men of science
came to know that the processes of nitrification,
so indispensable to agriculture, are due to germ life,
in simple justice to the plain farmers of the world,
to those who through all the ages from Adam down,
living close to Nature and working through her and
with her, have fed the world, it should be recognized
that there have been those among them who have grasped
such essential, vital truths and have kept them alive
in the practices of their day. And so we find
it recorded in history as far back as 1686 that Judge
Samuel Lewell copied upon the cover of his journal
a practical man’s recipe for making saltpeter
beds, in which it was directed, among other things,
that there should be added to it “mother of
petre”, meaning, in Judge Lewell’s understanding,
simply soil from an old niter bed, but in the mind
of the man who applied the maternity prefix,—­mother,—­it
must have meant a vital germ contained in the soil,
carried with it, capable of reproducing its kind and
of perpetuating its characteristic work, belonging
to the same category with the old, familiar, homely
germ, “mother” of vinegar. So, too,
with the old cheesemaker who grasped the conception
which led to the long time practice of washing the
walls of a new cheese factory with water from an old
factory of the same type, he must have been led by
analogies of experience with things seen to realize
that he was here dealing with a vital factor.
Hundreds, of course, have practiced empyrically, but
some one preceded with the essential thought and we
feel it is small credit to men of our time who, after
ten or twenty years of technical training, having
their attention directed to a something to be seen,
and armed with compound microscopes which permit them
to see with the physical eye the “mother of

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petre”, arrogate to themselves the discovery
of a great truth. Much more modest would it be
and much more in the spirit of giving credit where
credit is due to admit that, after long doubting the
existence of such an entity, we have succeeded in
confirming in fullness the truth of a great discovery
which belongs to an unnamed genius of the past, or
perhaps to a hundred of them who, working with life’s
processes and familiar with them through long intimate
association, saw in these invisible processes analogies
that revealed to them the essential truth in such
fullness as to enable them to build upon it an unfailing
practice.
  
There is another practice followed by the Chinese,
connected with the formation of nitrates in soils,
which again emphasizes the national trait of saving
and turning to use any and every thing worth while.
Our attention was called to this practice by Rev. A.
E. Evans of Shunking, Szechwan province. It rests
upon the tendency of the earth floors of dwellings
to become heavily charged with calcium nitrate through
the natural processes of nitrification. Calcium
nitrate being deliquescent absorbs moisture sufficiently
to dissolve and make the floor wet and sticky.
Dr. Evans’ attention was drawn to the wet floor
in his own house, which be at first ascribed to insufficient
ventilation, but which be was unable to remedy by
improving that. The father of one of his assistants,
whose business consisted in purchasing the soil of
such floors for producing potassium nitrate, used
so much in China in the manufacture of fireworks and
gunpowder, explained his difficulty and suggested the
remedy.
  
This man goes from house to house through the village,
purchasing the soil of floors which have thus become
overcharged. He procures a sample, tests it and
announces what he will pay for the surface two, three
or four inches, the price sometimes being as high as
fifty cents for the privilege of removing the top
layer of the floor, which the proprietors must replace.
He leaches the soil removed, to recover the calcium
nitrate, and then pours the leachings through plant
ashes containing potassium carbonate, for the purpose
of transforming the calcium nitrate into the potassium
nitrate or saltpeter. Dr. Evans learned that
during the four months preceding our interview this
man had produced sufficient potassium nitrate to bring
his sales up to $80, Mexican. It was necessary
for him to make a two-days journey to market his product.
In addition he paid a license fee of 80 cents per
month. He must purchase his fuel ashes and hire
the services of two men.
  
When the nitrates which accumulate in the floors of
dwellings are not collected for this purpose the soil
goes to the fields to be used directly as a fertilizer,
or it may be worked into compost. In the course
of time the earth used in the village walls and even
in the construction of the houses may disintegrate
so as to require removal, but in all such cases, as
with the earth brick used in the kangs, the value
of the soil has improved for composting and is generally
so used. This improvement of the soil will not
appear strange when it is stated that such materials
are usually from the subsoil, whose physical condition
would improve when exposed to the weather, converting
it in fact into an uncropped virgin soil.

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We were unable to secure definite data as to the chemical
composition of these composts and cannot say what amounts
of available plant food the Shantung farmers are annually
returning to their fields. There can be little
doubt, however, that the amounts are quite equal to
those removed by the crops. The soils appeared
well supplied with organic matter and the color of
the foliage and the general aspect of crops indicated
good feeding.
  
The family with whom we talked in the village place
their usual yields of wheat at 420 catty of grain
and 1000 catty of straw per mow,—­their
mow was four-thirds of the legal standard mow—­the
grain being worth 35 strings of cash and the straw
12 to 14 strings, a string of cash being 40 cents,
Mexican, at this time. Their yields of beans
were such as to give them a return of 30 strings of
cash for the grain and 8 to 10 strings for the straw.
Small millet usually yielded 450 catty of grain, worth
25 strings of cash, per mow, and 800 catty of straw
worth 10 to 11 strings of cash; while the yields of
large millet they placed at 400 catty per mow, worth
25 strings of cash, and 1000 catty of straw worth 12
to 14 strings of cash. Stating these amounts
in bushels per acre and in our currency, the yield
of wheat was 42 bushels of grain and 6000 pounds of
straw per acre, having a cash value of $27.09 for the
grain and $10.06 for the straw. The soy bean
crop follows the wheat, giving an additional return
of $23.22 for the beans and $6.97 for the straw, making
the gross earning for the two crops $67.34 per acre.
The yield of small millet was 54 bushels of seed and
4800 pounds of straw per acre, worth $27.09 and $8.12
for seed and straw respectively, while the kaoliang
or large millet gave a yield of 48 bushels of grain
and 6000 pounds of stalks per acre, worth $19.35 for
the grain, and $10.06 for the straw.
  
A crop of wheat like the one stated, if no part of
the plant food contained in the grain or straw were
returned to the field, would deplete the soil to the
extent of about 90 pounds of nitrogen, 15 pounds of
phosphorus and 65 pounds of potassium; and the crop
of soy beans, if it also were entirely removed, would
reduce these three plant food elements in the soil
to the extent of about 240 pounds of nitrogen, 33
pounds of phosphorus and 102 pounds of potassium, on
the basis of 45 bushels of beans and 5400 pounds of
stems and leaves per acre, assuming that the beans
added no nitrogen to the soil, which is of course
not true. This household of farmers, therefore,
in order to have maintained this producing power in
their soil, have been compelled to return to it annually,
in one form or another, not less than 48 pounds of
phosphorus and 167 pounds of potassium per acre.
The 330 pounds of nitrogen they would have to return
in the form of organic matter or accumulate it from
the atmosphere, through the instrumentality of their
soy bean crop or some other legume. It has already
been stated that they do add more than 5000 to 7000

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pounds of dry compost, which, repeated for a second
crop, would make an annual application of five to
seven tons of dry compost per acre annually.
They do use, in addition to this compost, large amounts
of bean and peanut cake, which carry all of the plant
food elements derived from the soil which are contained
in the beans and the peanuts. If the vines are
fed, or if the stems of the beaus are burned for fuel,
most of the plant food elements in these will be returned
to the field, and they have doubtless learned how to
completely restore the plant food elements removed
by their crops, and persistently do so.
  
The roads made by the Germans in the vicinity of Tsingtao
enabled us to travel by ricksha into the adjoining
country, and on one such trip we visited a village
mill for grinding soy beans and peanuts in the manufacture
of oil, and Fig. 136 shows the stone roller, four
feet in diameter and two feet thick, which is revolved
about a vertical axis on a circular stone plate, drawn
by a donkey, crushing the kernels partly by its weight
and partly by a twisting motion, for the arm upon
which the roller revolves is very short. After
the meal had been ground the oil was expressed in
essentially the same way as that described for the
cotton seed, but the bean and peanut cakes are made
much larger than the cotton seed cakes, about eighteen
inches in diameter and three to four inches thick.
Two of these cakes are seen in Fig. 137, standing
on edge outside the mill in an orderly clean court.
It is in this form that bean cake is exported in large
quantities to different parts of China, and to Japan
in recent years, for use as fertilizer, and very recently
it is being shipped to Europe for both stock food
and fertilizer.
  
Nowhere in this province, nor further north, did we
see the large terra cotta, receptacles so extensively
used in the south for storing human excreta.
In these dryer climates some method of desiccation
is practiced and we found the gardeners in the vicinity
of Tsingtao with quantities of the fertilizer stacked
under matting shelters in the desiccated condition,
this being finely pulverized in one or another way
before it was applied. The next illustration,
Fig. 138, shows one of these piles being fitted for
the garden, its thatched shelter standing behind the
grandfather of a household. His grandson was
carrying the prepared fertilizer to the garden area
seen in Fig. 139, where the father was working it into
the soil. The greatest pains is taken, both in
reducing the product to a fine powder and in spreading
and incorporating it with the soil, for one of their
maxims of soil management is to make each square foot
of field or garden the equal of every other in its
power to produce. In this manner each little
holding is made to yield the highest returns possible
under the conditions the husbandman is able to control.
  
From one portion of the area being fitted, a crop
of artemisia had been harvested, giving a gross return
at the rate of $73.19 per acre, and from another leeks
had been taken, bringing a gross return of $43.86
per acre. Chinese celery was the crop for which
the ground was being fitted.

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The application of soil as a fertilizer to the fields
of China, whether derived from the subsoil or from
the silts and organic matter of canals and rivers,
must have played an important part in the permanency
of agriculture in the Far East, for all such additions
have been positive accretions to the effective soil,
increasing its depth and carrying to it all plant food
elements. If not more than one-half of the weight
of compost applied to the fields of Shantung is highly
fertilized soil, the rates of application observed
would, in a thousand years, add more than two million
pounds per acre, and this represents about the volume
of soil we turn with the plow in our ordinary tillage
operations, and this amount of good soil may carry
more than 6000 pounds of nitrogen, 2000 pounds of
phosphorus and more than 60,000 pounds of potassium.
  
When we left our hotel by ricksha for the steamer,
returning to Shanghai, we soon observed a boy of thirteen
or fourteen years apparently following, sometimes
a little ahead, sometimes behind, usually keeping
the sidewalk but slackening his pace whenever the
ricksha man came to a walk. It was a full mile
to the wharf. The boy evidently knew the sailing
schedule and judged by the valise in front, that we
were to take the out-going steamer and that he might
possibly earn two cents, Mexican, the usual fee for
taking a valise aboard the steamer. Twenty men
at the wharf might be waiting for the job, but he
was taking the chance with the mile down and back thrown
in, and all for less than one cent in our currency,
equivalent at the time to about twenty “cash”.
As we neared the steamer the lad closed up behind
but strong and eager men were watching. Twice
he was roughly thrust aside and before the ricksha
stopped a man of stalwart frame seized the valise
and, had we not observed the boy thus unobtrusively
entering the competition, he would have had only his
trouble for his pains. Thus intense was the struggle
here for existence and thus did a mere lad put himself
effectively into it. True to breeding and example
he had spared no labor to win and was surprised but
grateful to receive more than he had expected.

**XI**

**ORIENTALS CROWD BOTH TIME AND SPACE**  
Time is a function of every life process, as it is
of every physical, chemical and mental reaction, and
the husbandman is compelled to shape his operations
so as to conform with the time requirements of his
crops. The oriental farmer is a time economizer
beyond any other. He utilizes the first and last
minute and all that are between. The foreigner
accuses the Chinaman of being always “long on
time”, never in a fret, never in a hurry.
And why should he be when he leads time by the forelock,
and uses all there is?

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The customs and practices of these Farthest East people
regarding their manufacture of fertilizers in the
form of earth composts for their fields, and their
use of altered subsoils which have served in their
kangs, village walls and dwellings, are all instances
where they profoundly shorten the time required in
the field to affect the necessary chemical, physical
and biological reactions which produce from them plant
food substances. Not only do they thus increase
their time assets, but they add, in effect, to their
land area by producing these changes outside their
fields, at the same time giving their crops the immediately
active soil products.
  
Their compost practices have been of the greatest
consequence to them, both in their extremely wet,
rice-culture methods, and in their “dry-farming”
practices, where the soil moisture is too scanty during
long periods to permit rapid fermentation under field
conditions. Western agriculturalists have not
sufficiently appreciated the fact that the most rapid
growth of plant food substances in the soil cannot
occur at the same time and place with the most rapid
crop increase, because both processes draw upon the
available soil moisture, soil air and soluble potassium,
calcium, phosphorus and nitrogen compounds. Whether
this fundamental principle of practical agriculture
is written in their literature or not it is most indelibly
fixed in their practice. If we and they can perpetuate
the essentials of this practice at a large saving of
human effort, or perpetually secure the final result
in some more expeditious and less laborious way, most
important progress will have been made.
  
When we went north to the Shantung province the Kiangsu
and Chekiang farmers were engaged in another of their
time saving practices, also involving a large amount
of human labor. This was the planting of cotton
in wheat fields before the wheat was quite ready to
harvest. In the sections of these two provinces
which we visited most of the wheat and barley were
sowed broadcast on narrow raised lands, some five
feet wide, with furrows between, after the manner seen
in Fig. 140, showing a reservoir in the immediate
foreground, on whose bank is installed one of the
four-man foot-power irrigation pumps in use to flood
the nursery rice bed close by on the right. The
narrow lands of broadcasted wheat extend back from
the reservoir toward the farmsteads which dot the
landscape, and on the left stands one of the pump
shelters near the canal bank.
  
To save time, or lengthen the growing season of the
cotton which was to follow, this seed was sown broadcast
among the grain on the surface, some ten to fifteen
days before the wheat would be harvested. To
cover the seed the soil in the furrows between the
beds had been spaded loose to a depth of four or five
inches, finely pulverized, and then with a spade was
evenly scattered over the bed, letting it sift down
among the grain, covering the seed. This loose

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earth, so applied, acts as a mulch to conserve the
capillary moisture, permitting the soil to become
sufficiently damp to germinate the seed before the
wheat is harvested. The next illustration, Fig.
141, is a closer view with our interpreter standing
in another field of wheat in which cotton was being
sowed April 22nd in the manner described, and yet
the stand of grain was very close and shoulder high,
making it not an easy task either to sow the seed
or to scatter sufficient soil to cover it.
  
When we had returned from Shantung this piece of grain
had been harvested, giving a yield of 95.6 bushels
of wheat and 3.5 tons of straw per acre, computed
from the statement of the owner that 400 catty of
grain and 500 catty of straw had been taken from the
beds measuring 4050 square feet. On the morning
of May 29th the photograph for Fig. 142 was taken,
showing the same area after the wheat had been harvested
and the cotton was up, the young plants showing slightly
through the short stubble. These beds had already
been once treated with liquid fertilizer. A little
later the plants would be hoed and thinned to a stand
of about one plant per each square foot of surface.
There were thirty-seven days between the taking of
the two photographs, and certainly thirty days had
been added to the cotton crop by this method of planting,
over what would have been available if the grain had
been first harvested and the field fitted before planting,
It will be observed that the cotton follows the wheat
without plowing, but the soil was deep, naturally
open, and a layer of nearly two inches of loose earth
had been placed over the seed at the time of planting.
Besides, the ground would be deeply worked with the
two or four tined hoe, at the time of thinning.
  
Starting cotton in the wheat in the manner described
is but a special case of a general practice widely
in vogue. The growing of multiple crops is the
rule throughout these countries wherever the climate
permits. Sometimes as many as three crops occupy
the same field in recurrent rows, but of different
dates of planting and in different stages of maturity.
Reference has been made to the overlapping and alternation
of cucumbers with greens. The general practice
of planting nearly all crops in rows lends itself readily
to systems of multiple cropping, and these to the fullest
possible utilization of every minute of the growing
season and of the time of the family in caring for
the crops. In the field, Fig. 143, a crop of
winter wheat was nearing maturity, a crop of windsor
beans was about two-thirds grown, and cotton had just
been planted, April 22nd. This field had been
thrown into ridges some five feet wide with a twelve
inch furrow between them. Two rows of wheat eight
inches wide, planted two feet between centers occupied
the crest of the ridge, leaving a strip sixteen inches
wide, seen in the upper section, (1) for tillage,
(2) then fertilization and (3) finally the row of
cotton planted just before the wheat was harvested.

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Against the furrow on each side was a row of windsor
beans, seen in the lower view, hiding the furrow,
which was matured some time after the wheat was harvested
and before the cotton was very large. A late
fall crop sometimes follows the windsor beans after
a period of tillage and fertilization, making four
in one year. With such a succession fertilization
for each crop, and an abundance of soil moisture are
required to give the largest returns from the soil.
  
In another plan winter wheat or barley may grow side
by side with a green crop, such as the “Chinese
clover” (Medicago denticulata, Willd.) for soil
fertilizer, as was the case in Fig. 144, to be turned
under and fertilize for a crop of cotton planted in
rows on either side of a crop of barley. After
the barley had been harvested the ground it occupied
would be tilled and further fertilized, and when the
cotton was nearing maturity a crop of rape might be
grown, from which “salted cabbage” would
be prepared for winter use.
  
Multiple crops are grown as far north in Chihli as
Tientsin and Peking, these being oftenest wheat, maize,
large and small millet and soy beans, and this, too,
where the soil is less fertile and where the annual
rainfall is only about twenty-five inches, the rainy
season beginning in late June or early July, and Fig.
145 shows one of these fields as it appeared June
14th, where two rows of wheat and two of large millet
were planted in alternating pairs, the rows being
about twenty-eight inches apart. The wheat was
ready to harvest but the straw was unusually short
because growing on a light sandy loam in a season
of exceptional drought, but little more than two inches
of rain having fallen after January 1st of that year.
  
The piles of pulverized dry-earth compost seen between
the rows had been brought for use on the ground occupied
by the wheat when that was removed. The wheat
would be pulled, tied in bundles, taken to the village
and the roots cut off, for making compost, as in Fig.
146, which shows the family engaged in cutting the
roots from the small bundles of wheat, using a long
straight knife blade, fixed at one end, and thrust
downward upon the bundle with lever pressure.
These roots, if not used as fuel, would be transferred
to the compost pit in the enclosure seen in Fig. 147,
whose walls were built of earth brick. Here,
with any other waste litter, manure or ashes, they
would be permitted to decay under water until the fiber
had been destroyed, thus permitting it to be incorporated
with soil and applied to the fields, rich in soluble
plant food and in a condition which would not interfere
with the capillary movement of soil moisture, the
work going on outside the field where the changes
could occur unimpeded and without interfering with
the growth of crops on the ground.

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In this system of combined intertillage and multiple
cropping the oriental farmer thus takes advantage
of whatever good may result from rotation or succession
of crops, whether these be physical, vito-chemical
or biological. If plants are mutually helpful
through close association of their root systems in
the soil, as some believe may be the case, this growing
of different species in close juxtaposition would
seem to provide the opportunity, but the other advantages
which have been pointed out are so evident and so
important that they, rather than this, have doubtless
led to the practice of growing different crops in
close recurrent rows.

**XII**

**RICE CULTURE IN THE ORIENT**  
The basal food crop of the people of China, Korea
and Japan is rice, and the mean consumption in Japan,
for the five years ending 1906, per capita and per
annum, was 302 pounds. Of Japan’s 175,428
square miles she devoted, in 1906, 12,856 to the rice
crop. Her average yield of water rice on 12,534
square miles exceeded 33 bushels per acre, and the
dry land rice averaged 18 bushels per acre on 321
square miles. In the Hokkaido, as far north as
northern Illinois, Japan harvested 1,780,000 bushels
of water rice from 53,000 acres.
  
In Szechwan province, China, Consul-General Hosie
places the yield of water rice on the plains land
at 44 bushels per acre, and that of the dry land rice
at 22 bushels. Data given us in China show an
average yield of 42 bushels of water rice per acre,
while the average yield of wheat was 25 bushels per
acre, the normal yield in Japan being about 17 bushels.
  
If the rice eaten per capita in China proper and Korea
is equal to that in Japan the annual consumption for
the three nations, using the round number 300 pounds
per capita per annum, would be:
  
 Population.
Consumption.   
 China 410,000,000 61,500,000
tons  
 Korea 12,000,000 1,800,000
tons  
 Japan 53,000,000 7,950
000 tons  
 -----------------------  
 Total 475,000,000 71,250,000
tons
  
If the ratio of irrigated to dry land rice in Korea
and China proper is the same as that in Japan, and
if the mean yield of rice per acre in these countries
were forty bushels for the water rice and twenty bushels
for the dry land rice, the acreage required to give
this production would be:
Area.
Water rice, Dry land rice,
sq. miles. sq. miles.
In China 78,073 4,004
In Korea 2,285 117
In Japan 12,534 321
------- ------
Sum 92,892 4,442
Total 97,334
  
Our observations along the four hundred miles of railway
in Korea between Antung, Seoul and Fusan, suggest
that the land under rice in this country must be more
rather than less than that computed, and the square
miles of canalized land in China, as indicated on pages
97 to 102, would indicate an acreage of rice for her
quite as large as estimated.

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In the three main islands of Japan more than fifty
per cent of the cultivated land produces a crop of
water rice each year and 7.96 per cent of the entire
land area of the Empire, omitting far-north Karafuto.
In Formosa and in southern China large areas produce
two crops each year. At the large mean yield
used in the computation the estimated acreage of rice
in China proper amounts to 5.93 per cent of her total
area and this is 7433 square miles greater than the
acreage of wheat in the United States in 1907.
Our yield of wheat, however, was but 19,000,000 tons,
while China’s output of rice was certainly double
and probably three times this amount from nearly the
same acreage of land; and notwithstanding this large
production per acre, more than fifty per cent, possibly
as high as seventy-five per cent, of the same land
matures at least one other crop the same year, and
much of this may be wheat or barley, both chiefly consumed
as human food.
  
Had the Mongolian races spread to and developed in
North America instead of, or as well as, in eastern
Asia, there might have been a Grand Canal, something
as suggested in Fig. 148, from the Rio Grande to the
mouth of the Ohio river and from the Mississippi to
Chesapeake Bay, constituting more than two thousand
miles of inland water-way, serving commerce, holding
up and redistributing both the run-off water and the
wasting fertility of soil erosion, spreading them
over 200,000 square miles of thoroughly canalized coastal
plains, so many of which are now impoverished lands,
made so by the intolerable waste of a vaunted civilization.
And who shall venture to enumerate the increase in
the tonnage of sugar, bales of cotton, sacks of rice,
boxes of oranges, baskets of peaches, and in the trainloads
of cabbage, tomatoes and celery such husbanding would
make possible through all time; or number the increased
millions these could feed and clothe? We may
prohibit the exportation of our phosphorus, grind
our limestone, and apply them to our fields, but this
alone is only temporizing with the future. The
more we produce, the more numerous our millions, the
faster must present practices speed the waste to the
sea, from whence neither money nor prayer can call
them back.
  
If the United States is to endure; if we shall project
our history even through four or five thousand years
as the Mongolian nations have done, and if that history
shall be written in continuous peace, free from periods
of wide-spread famine or pestilence, this nation must
orient itself; it must square its practices with a
conservation of resources which can make endurance
possible. Intensifying cultural methods but intensifies
the digestion, assimilation and exhaustion of the
surface soil, from which life springs. Multiple
cropping, closer stands on the ground and stronger
growth, all mean the transpiration of much more water
per acre through the crops, and this can only be rendered
possible through a redistribution of the run-off and

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the adoption of irrigation practices in humid climates
where water exists in abundance. Sooner or later
we must adopt a national policy which shall more completely
conserve our water resources, utilizing them not only
for power and transportation, but primarily for the
maintenance of soil fertility and greater crop production
through supplemental irrigation, and all these great
national interests should be considered collectively,
broadly, and with a view to the fullest and best possible
coordination. China, Korea and Japan long ago
struck the keynote of permanent agriculture but the
time has now come when they can and will make great
improvements, and it remains for us and other nations
to profit by their experience, to adopt and adapt
what is good in their practice and help in a world
movement for the introduction of new and improved
methods.
  
In selecting rice as their staple crop; in developing
and maintaining their systems of combined irrigation
and drainage, notwithstanding they have a large summer
rainfall; in their systems of multiple cropping; in
their extensive and persistent use of legumes; in
their rotations for green manure to maintain the humus
of their soils and for composting; and in the almost
religious fidelity with which they have returned to
their fields every form of waste which can replace
plant food removed by the crops, these nations have
demonstrated a grasp of essentials and of fundamental
principles which may well cause western nations to
pause and reflect.
  
While this country need not and could not now adopt
their laborious methods of rice culture, and while,
let us hope, those who come after us may never be
compelled to do so, it is nevertheless quite worth
while to study, for the sake of the principles involved,
the practices they have been led to adopt.
  
Great as is the acreage of land in rice in these countries
but little, relatively, is of the dry land type, and
the fields upon which most of the rice grows have
all been graded to a water level and surrounded by
low, narrow raised rims, such as may be seen in Fig.
149 and in Fig. 150, where three men are at work on
their foot-power pump, flooding fields preparatory
to transplanting the rice. If the country was
not level then the slopes have been graded into horizontal
terraces varying in size according to the steepness
of the areas in which they were cut. We saw these
often no larger than the floor of a small room, and
Professor Ross informed me that he walked past those
in the interior of China no larger than a dining table
and that he saw one bearing its crop of rice, surrounded
by its rim and holding water, yet barely larger than
a good napkin. The average area of the paddy
field in Japan is officially reported at 1.14 se,
or an area of but 31 by 40 feet. Excluding Hokkaido,
Formosa and Karafuto, fifty-three per cent of the
irrigated rice lands in Japan are in allotments smaller
than one-eighth of an acre, and seventy-four per cent

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of other cultivated lands are held in areas less than
one-fourth of an acre, and each of these may be further
subdivided. The next two illustrations, Figs.
151 and 152, give a good idea both of the small size
of the rice fields and of the terracing which has
been done to secure the water level basins. The
house standing near the center of Fig. 151 is a good
scale for judging both the size of the paddies and
the slope of the valley. The distance between
the rows of rice is scarcely one foot, hence counting
these in the foreground may serve as another measure.
There are more than twenty little fields shown in this
engraving in front of the house and reaching but half
way to it, and the house was less than five hundred
feet from the camera.
  
There are more than eleven thousand square miles of
fields thus graded in the three main islands of Japan,
each provided with rims, with water supply and drainage
channels, all carefully kept in the best of repair.
The more level areas, too, in each of the three countries,
have been similarly thrown into water level basins,
comparatively few of which cover large areas, because
nearly always the holdings are small. All of
the earth excavated from the canals and drainage channels
has been leveled over the fields unless needed for
levees or dikes, so that the original labor of construction,
added to that of maintenance, makes a total far beyond
our comprehension and nearly all of it is the product
of human effort.
  
The laying out and shaping of so many fields into
these level basins brings to the three nations an
enormous aggregate annual asset, a large proportion
of which western nations are not yet utilizing.
The greatest gain comes from the unfailing higher
yields made possible by providing an abundance of
water through which more plant food can be utilized,
thus providing higher average yields. The waters
used, coming as they do largely from the uncultivated
hills and mountain lands, carrying both dissolved
and suspended matters, make positive annual additions
of dissolved limestone and plant food elements to
the fields which in the aggregate have been very large,
through the persistent repetitions which have prevailed
for centuries. If the yearly application of such
water to the rice fields is but sixteen inches, and
this has the average composition quoted by Merrill
for rivers of North America, taking into account neither
suspended matter nor the absorption of potassium and
phosphorus by it, each ten thousand square miles would
receive, dissolved in the water, substances containing
some 1,400 tons of phosphorus; 23,000 tons of potassium;
27,000 tons of nitrogen; and 48,000 tons of sulphur.
In addition, there are brought to the fields some
216,000 tons of dissolved organic matter and a still
larger weight of dissolved limestone, so necessary
in neutralizing the acidity of soils, amounting to
1,221,000 tons; and such savings have been maintained
in China, Korea and Japan on more than five, and possibly
more than nine, times the ten thousand square miles,
through centuries. The phosphorus thus turned
upon ninety thousand square miles would aggregate
nearly thirteen million tons in a thousand years, which
is less than the time the practice has been maintained,
and is more phosphorus than would be carried in the
entire rock phosphate thus far mined in the United
States, were it all seventy-five per cent pure.

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The canalization of fifty thousand square miles of
our Gulf and Atlantic coastal plain, and the utilization
on the fields of the silts and organic matter, together
with the water, would mean turning to account a vast
tonnage of plant food which is now wasting into the
sea, and a correspondingly great increase of crop yield.
There ought, and it would seem there must some time
be provided a way for sending to the sandy plains
of Florida, and to the sandy lands between there and
the Mississippi, large volumes of the rich silt and
organic matter from this and other rivers, aside from
that which should be applied systematically to building
above flood plain the lands of the delta which are
subject to overflow or are too low to permit adequate
drainage.
  
It may appear to some that the application of such
large volumes of water to fields, especially in countries
of heavy rainfall, must result in great loss of plant
food through leaching and surface drainage. But
under the remarkable practices of these three nations
this is certainly not the case and it is highly important
that our people should understand and appreciate the
principles which underlie the practices they have
almost uniformly adopted on the areas devoted to rice
irrigation. In the first place, their paddy fields
are under-drained so that most of the water either
leaves the soil through the crop, by surface evaporation,
or it percolates through the subsoil into shallow
drains. When water is passed directly from one
rice paddy to another it is usually permitted some
time after fertilization, when both soil and crop have
had time to appropriate or fix the soluble plant food
substances. Besides this, water is not turned
upon the fields until the time for transplanting the
rice, when the plants are already provided with a strong
root system and are capable of at once appropriating
any soluble plant food which may develop about their
roots or be carried downward over them.
  
Although the drains are of the surface type and but
eighteen inches to three feet in depth, they are sufficiently
numerous and close so that, although the soil is continuously
nearly filled with water, there is a steady percolation
of the fresh, fully aerated water carrying an abundance
of oxygen into the soil to meet the needs of the roots,
so that watermelons, egg plants, musk melons and taro
are grown in the rotations on the small paddies among
the irrigated rice after the manner seen in the illustrations.
In Fig. 153 each double row of egg plants is separated
from the next by a narrow shallow trench which connects
with a head drain and in which water was standing
within fourteen inches of the surface. The same
was true in the case of the watermelons seen in Fig.
154, where the vines are growing on a thick layer
of straw mulch which holds them from the moist soil
and acts to conserve water by diminishing evaporation
and, through decay from the summer rains and leaching,
serves as fertilizer for the crop. In Fig. 155
the view is along a pathway separating two head ditches
between areas in watermelons and taro, carrying the
drainage waters from the several furrows into the main
ditches. Although the soil appeared wet the plants
were vigorous and healthy, seeming in no way to suffer
from insufficient drainage.

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These people have, therefore, given effective attention
to the matter of drainage as well as irrigation and
are looking after possible losses of plant food, as
well as ways of supplying it. It is not alone
where rice is grown that cultural methods are made
to conserve soluble plant food and to reduce its loss
from the field, for very often, where flooding is
not practiced, small fields and beds, made quite level,
are surrounded by low raised borders which permit
not only the whole of any rain to be retained upon
the field when so desired, but it is completely distributed
over it, thus causing the whole soil to be uniformly
charged with moisture and preventing washing from
one portion of the field to another. Such provisions
are shown in Figs. 133 and 138.
  
Extensive as is the acreage of irrigated rice in China,
Korea and Japan, nearly every spear is transplanted;
the largest and best crop possible, rather than the
least labor and trouble, as is so often the case with
us, determining their methods and practices. We
first saw the fitting of the rice nursery beds at
Canton and again near Kashing in Chekiang province
on the farm of Mrs. Wu, whose homestead is seen in
Fig. 156. She had come with her husband from Ningpo
after the ravages of the Taiping rebellion had swept
from two provinces alone twenty millions of people
and settled on a small area of then vacated land.
As they prospered they added to their holding by purchase
until about twenty-five acres were acquired, an area
about ten times that possessed by the usual prosperous
family in China. The widow was managing her place,
one of her sons, although married, being still in
school, the daughter-in-law living with her mother-in-law
and helping in the home. Her field help during
the summer consisted of seven laborers and she kept
four cows for the plowing and pumping of water for
irrigation. The wages of the men were at the
rate of $24, Mexican, for five summer months, together
with their meals which were four each day. The
cash outlay for the seven men was thus $14.45 of our
currency per month. Ten years before, such labor
had been $30 per year, as compared with $50 at the
time of our visit, or $12.90 and $21.50 of our currency,
respectively.
  
Her usual yields of rice were two piculs per mow,
or twenty-six and two-thirds bushels per acre, and
a wheat crop yielding half this amount, or some other,
was taken from part of the land the same season, one
fertilization answering for the two crops. She
stated that her annual expense for fertilizers purchased
was usually about $60, or $25.80 of our currency.
The homestead of Mrs. Wu, Fig. 156, consists of a
compound in the form of a large quadrangle surrounding
a court closed on the south by a solid wall eight feet
high. The structure is of earth brick with the
roof thatched with rice straw.

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Our first visit here was April 19th. The nursery
rice beds had been planted four days, sowing seed
at the rate of twenty bushels per acre. The soil
had been very carefully prepared and highly fertilized,
the last treatment being a dressing of plant ashes
so incompletely burned as to leave the surface coal
black. The seed, scattered directly upon the
surface, almost completely covered it and had been
gently beaten barely into the dressing of ashes, using
a wide, flat-bottom basket for the purpose. Each
evening, if the night was likely to be cool, water
was pumped over the bed, to be withdrawn the next
day, if warm and sunny, permitting the warmth to be
absorbed by the black surface, and a fresh supply of
air to be drawn into the soil.
  
Nearly a month later, May 14th, a second visit was
made to this farm and one of the nursery beds of rice,
as it then appeared, is seen in Fig. 159, the plants
being about eight inches high and nearing the stage
for transplanting. The field beyond the bed had
already been partly flooded and plowed, turning under
“Chinese clover” to ferment as green manure,
preparatory for the rice transplanting. On the
opposite side of the bed and in front of the residence,
Fig. 156, flooding was in progress in the furrows
between the ridges formed after the previous crop
of rice was harvested and upon which the crop of clover
for green manure was grown. Immediately at one
end of the two series of nursery beds, one of which
is seen in Fig. 159, was the pumping plant seen in
Fig. 157, under a thatched shelter, with its two pumps
installed at the end of a water channel leading from
the canal. One of these wooden pump powers, with
the blindfolded cow attached, is reproduced in Fig.
158 and just beyond the animal’s head may be
seen the long handle dipper to which reference has
been made, used for collecting excreta.
  
More than a month is saved for maturing and harvesting
winter and early spring crops, or in fitting the fields
for rice, by this planting in nursery beds. The
irrigation period for most of the land is cut short
a like amount, saving in both water and time.
It is cheaper and easier to highly fertilize and prepare
a small area for the nursery, while at the same time
much stronger and more uniform plants are secured
than would be possible by sowing in the field.
The labor of weeding and caring for the plants in the
nursery is far less than would be required in the
field. It would be practically impossible to
fit the entire rice areas as early in the season as
the nursery beds are fitted, for the green manure is
not yet grown and time is required for composting
or for decaying, if plowed under directly. The
rice plants in the nursery are carried to a stage when
they are strong feeders and when set into the newly
prepared, fertilized, clean soil of the field they
are ready to feed strongly under these most favorable
conditions Both time and strength of plant are thus
gained and these people are following what would appear
to be the best possible practices under their condition
of small holdings and dense population.

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With our broad fields, our machinery and few people,
their system appears to us crude and impossible, but
cut our holdings to the size of theirs and the same
stroke makes our machinery, even our plows, still
more impossible, and so the more one studies the environment
of these people, thus far unavoidable, their numbers,
what they have done and are doing, against what odds
they have succeeded, the more difficult it becomes
to see what course might have been better.
  
How full with work is the month which precedes the
transplanting of rice has been pointed out,—­the
making of the compost fertilizer; harvesting the wheat,
rape and beans; distributing the compost over the
fields, and their flooding and plowing. In Fig.
160 one of these fields is seen plowed, smoothed and
nearly ready for the plants. The turned soil
had been thoroughly pulverized, leveled and worked
to the consistency of mortar, on the larger fields
with one or another sort of harrow, as seen in Figs.
160 and 161. This thorough puddling of the soil
permits the plants to be quickly set and provides
conditions which ensure immediate perfect contact for
the roots.
  
When the fields are ready women repair to the nurseries
with their low four-legged bamboo stools, to pull
the rice plants, carefully rinsing the soil from the
roots, and then tie them into bundles of a size easily
handled in transplanting, which are then distributed
in the fields.
  
The work of transplanting may be done by groups of
families changing work, a considerable number of them
laboring together after the manner seen in Fig. 163,
made from four snap shots taken from the same point
at intervals of fifteen minutes. Long cords were
stretched in the rice field six feet apart and each
of the seven men was setting six rows of rice one
foot apart, six to eight plants in a hill, and the
hills eight or nine inches apart in the row. The,
bundle was held in one hand and deftly, with the other,
the desired number of plants were selected with the
fingers at the roots, separated from the rest and,
with a single thrust, set in place in the row.
There was no packing of earth about the roots, each
hill being set with a single motion, which followed
one another in quick succession, completing one cross
row of six hills after another. The men move
backward across the field, completing one entire section,
tossing the unused plants into the unset field.
Then reset the lines to cover another section.
We were told that the usual day’s work of transplanting,
for a man under these conditions, after the field is
fitted and the plants are brought to him, is two mow
or one-third of an acre. The seven men in this
group would thus set two and a third acres per day
and, at the wage Mrs. Wu was paying, the cash outlay,
if the help was hired, would be nearly 21 cents per
acre. This is more cheaply than we are able to
set cabbage and tobacco plants with our best machine
methods. In Japan, as seen in Figs. 164 and 165,
the women participate in the work of setting the plants
more than in China.

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After the rice has been transplanted its care, unlike
that of our wheat crop, does not cease. It must
be hoed, fertilized and watered. To facilitate
the watering all fields have been leveled, canals,
ditches and drains provided, and to aid in fertilizing
and hoeing, the setting has been in rows and in hills
in the row.
  
The first working of the rice fields after the transplanting,
as we saw it in Japan, consisted in spading between
the hills with a four-tined hoe, apparently more for
loosening the soil and aeration than for killing weeds.
After this treatment the field was gone over again
in the manner seen in Fig. 166, where the man is using
his bare hands to smooth and level the stirred soil,
taking care to eradicate every weed, burying them
beneath the mud, and to straighten each hill of rice
as it is passed. Sometimes the fingers are armed
with bamboo claws to facilitate the weeding. Machinery
in the form of revolving hand cultivators is recently
coming into use in Japan, and two men using these
are seen in Fig. 14. In these cultivators the
teeth are mounted on an axle so as to revolve as the
cultivator is pushed along the row.
  
Fertilization for the rice crop receives the greatest
attention everywhere by these three nations and in
no direction more than in maintaining the store of
organic matter in the soil. The pink clover,
to which reference has been made, Figs. 99 and 100,
is extensively sowed after a crop of rice is harvested
in the fall and comes into full bloom, ready to cut
for compost or to turn under directly when the rice
fields are plowed. Eighteen to twenty tons of
this green clover are produced per acre, and in Japan
this is usually applied to about three acres, the
stubble and roots serving for the field producing
the clover, thus giving a dressing of six to seven
tons of green manure per acre, carrying not less than
37 pounds of potassium; 5 pounds of phosphorus, and
58 pounds of nitrogen.
  
Where the families are large and the holdings small,
so they cannot spare room to grow the green manure
crop, it is gathered on the mountain, weed and hill
lands, or it may be cut in the canals. On our
boat trip west from Soochow the last of May, many boats
were passed carrying tons of the long green ribbon-like
grass, cut and gathered from the bottom of the canal.
To cut this grass men were working to their armpits
in the water of the canal, using a crescent-shaped
knife mounted like an anchor from the end of a 16-foot
bamboo handle. This was shoved forward along the
bottom of the canal and then drawn backward, cutting
the grass, which rose to the surface where it was
gathered upon the boats. Or material for green
manure may be cut on grave, mountain or hill lands,
as described under Fig. 115.
  
The straw of rice and other grain and the stems of
any plant not usable as fuel may also be worked into
the mud of rice fields, as may the chaff which is
often scattered upon the water after the rice is transplanted,
as in Fig. 168.

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Reference has been made to the utilization of waste
of various kinds in these countries to maintain the
productive power of their soils, but it is worth while,
in the interests of western nations, as helping them
to realize the ultimate necessity of such economies,
to state again, in more explicit terms, what Japan
is doing. Dr. Kawaguchi, of the National Department
of Agriculture and Commerce, taking his data from
their records, informed me that Japan produced, in
1908, and applied to her fields, 23,850,295 tons of
human manure; 22,812,787 tons of compost; and she
imported 753,074 tons of commercial fertilizers, 7000
of which were phosphates in one form or another.
In addition to these she must have applied not less
than 1,404,000 tons of fuel ashes and 10,185,500 tons
of green manure products grown on her hill and weed
lands, and all of these applied to less than 14,000,000
acres of cultivated field, and it should be emphasized
that this is done because as yet they have found no
better way of permanently maintaining a fertility capable
of feeding her millions.
  
Besides fertilizing, transplanting and weeding the
rice crop there is the enormous task of irrigation
to be maintained until the rice is nearly matured.
Much of the water used is lifted by animal power and
a large share of this is human. Fig. 169 shows
two Chinese men in their cool, capacious, nowhere-touching
summer trousers flinging water with the swinging basket,
and it is surprising the amount of water which may
be raised three to four feet by this means. The
portable spool windlass, in Figs. 27 and 123, has been
described, and Fig. 170 shows the quadrangular, cone-shaped
bucket and sweep extensively used in Chihli.
This man was supplying water sufficient for the irrigation
of half an acre, per day, lifting the water eight
feet.
  
The form of pump most used in China and the foot-power
for working it are seen in Fig. 171. Three men
working a similar pump are seen in Fig. 150, a closer
view of three men working the foot-power may be seen
in Fig. 42 and still another stands adjacent to a series
of flooded fields in Fig. 172. Where this view
was taken the old farmer informed us that two men,
with this pump, lifting water three feet, were able
to cover two mow of land with three inches of water
in two hours. This is at the rate of 2.5 acre-inches
of water per ten hours per man, and for 12 to 15 cents,
our currency, thus making sixteen acre-inches, or
the season’s supply of water, cost 77 to 96 cents,
where coolie labor is hired and fed. Such is the
efficiency of human power applied to the Chinese pump,
measured in American currency.

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This pump is simply an open box trough in which travels
a wooden chain carrying a series of loosely fitting
boards which raise the water from the canal, discharging
it into the field. The size of the trough and
of the buckets are varied to suit the power applied
and the amount of water to be lifted. Crude as
it appears there is nothing in western manufacture
that can compete with it in first cost, maintenance
or efficiency for Chinese conditions and nothing is
more characteristic of all these people than their
efficient, simple appliances of all kinds, which they
have reduced to the lowest terms in every feature
of construction and cost. The greatest results
are accomplished by the simplest means. If a canal
must be bridged and it is too wide to be covered by
a single span, the Chinese engineer may erect it at
some convenient place and turn the canal under it
when completed. This we saw in the case of a new
railroad bridge near Sungkiang. The bridge was
completed and the water had just been turned under
it and was being compelled to make its own excavation.
Great expense had been saved while traffic on the
canal had not been obstructed.
  
In the foot-power wheel of Japan all gearing is eliminated
and the man walks the paddles themselves, as seen
in Fig. 173. Some of these wheels are ten feet
in diameter, depending upon the height the water must
be lifted.
  
Irrigation by animal power is extensively practiced
in each of the three countries, employing mostly the
type of power wheel shown in Fig. 158. The next
illustration, Fig. 174, shows the most common type
of shelter seen in Chekiang and Kiangsu provinces,
which are there very numerous. We counted as
many as forty such shelters in a semi-circle of half
a mile radius. They provide comfort for the animals
during both sunshine and rain, for under no conditions
must the water be permitted to run low on the rice
fields, and everywhere their domestic animals receive
kind, thoughtful treatment.
  
In the less level sections, where streams have sufficient
fall, current wheels are in common use, carrying buckets
near their circumference arranged so as to fill when
passing through the water, and to empty after reaching
the highest level into a receptacle provided with
a conduit which leads the water to the field.
In Szechwan province some of these current wheels
are so large and gracefully constructed as to strongly
suggest Ferris wheels. A view of one of these
we are permitted to present in Fig. 175, through the
kindness of Rollin T. Chamberlin who took the photograph
from which the engraving was prepared. This wheel
which was some forty feet in diameter, was working
when the snap shot was taken, raising the water and
pouring it into the horizontal trough seen near the
top of the wheel, carried at the summit of a pair
of heavy poles standing on the far side of the wheel.
From this trough, leading away to the left above the
sky line, is the long pipe, consisting of bamboo stems
joined together, for conveying the water to the fields.

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When the harvest time has come, notwithstanding the
large acreage of grain, yielding hundreds of millions
of bushels, the small, widely scattered holdings and
the surface of the fields render all of our machine
methods quite impossible. Even our grain cradle,
which preceded the reaper, would not do, and the great
task is still met with the old-time sickle, as seen
in Fig. 176, cutting the rice hill by hill, as it
was transplanted.
  
Previous to the time for cutting, after the seed is
well matured, the water is drawn off and the land
permitted to dry and harden. The rainy season
is not yet over and much care must be exercised in
curing the crop. The bundles may be shocked in
rows along the margins of the paddies, as seen in
Fig. 176, or they may be suspended, heads down, from
bamboo poles as seen in Fig. 177.
  
The threshing is accomplished by drawing the heads
of the rice through the teeth of a metal comb mounted
as seen at the right in Fig. 178, near the lower corner,
behind the basket, where a man and woman are occupied
in winnowing the dust and chaff from the grain by
means of a large double fan. Fanning mills built
on the principle of those used by our farmers and
closely resembling them have long been used in both
China and Japan. After the rice is threshed the
grain must be hulled before it can serve as food,
and the oldest and simplest method of polishing used
by the Japanese is seen in, Fig. 179, where the friction
of the grain upon itself does the polishing.
A quantity of rice is poured into the receptacle when,
with heavy blows, the long-headed plunger is driven
into the mass of rice, thus forcing the kernels to
slide over one another until, by their abrasion, the
desired result is secured. The same method of
polishing, on a larger scale, is accomplished where
the plungers are worked by the weight of the body,
a series of men stepping upon lever handles of weighted
plungers, raising them and allowing them to fall under
the force of the weight attached. Recently, however,
mills worked by gasoline engines are in operation for
both hulling and polishing, in Japan.
  
The many uses to which rice straw is put in the economies
of these people make it almost as important as the
rice itself. As food and bedding for cattle and
horses; as thatching material for dwellings and other
shelters; as fuel; as a mulch; as a source of organic
matter in the soil, and as a fertilizer, it represents
a money value which is very large. Besides these
ultimate uses the rice straw is extensively employed
in the manufacture of articles used in enormous quantities.
It is estimated that not less than 188,700,000 bags
such as are seen in Figs. 180 and 181, worth $3,110,000
are made annually from the rice straw in Japan, for
handling 346,150,000 bushels of cereals and 28,190,000
bushels of beans; and besides these, great numbers
of bags are employed in transporting fish and other
prepared manures.

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In the prefecture of Hyogo, with 596 square miles
of farm land, as compared with Rhode Island’s
712 square miles, Hyogo farmers produced in 1906,
on 265,040 acres, 10,584,000 bushels of rice worth
$16,191,400, securing an average yield of almost forty
bushels per acre and a gross return of $61 for the
grain alone. In addition to this, these farmers
grew on the same land, the same season, at least one
other crop. Where this was barley the average
yield exceeded twenty-six bushels per acre, worth
$17.
  
In connection with their farm duties these Japanese
families manufactured, from a portion of their rice
straw, at night and during the leisure hours of winter,
8,980,000 pieces of matting and netting of different
kinds having a market value of $262,000; 4,838,000
bags worth $185,000; 8,742,000 slippers worth $34,000;
6,254,000 sandals worth $30,000; and miscellaneous
articles worth $64,000. This is a gross earning
of more than $21,000,000 from eleven and a half townships
of farm land and the labor of the farmers’ families,
an average earning of, $80 per acre on nearly three-fourths
of the farm land of this prefecture. At this rate
three of the four forties of our 160-acre farms should
bring a gross annual income of $9,600 and the fourth
forty should pay the expenses.
  
At the Nara Experiment Station we were informed that
the money value of a good crop of rice in that prefecture
should be placed at ninety dollars per acre for the
grain and eight dollars for the unmanufactured straw;
thirty-six dollars per acre for the crop of naked
barley and two dollars per acre for the straw.
The farmers here practice a rotation of rice and barley
covering four or five years, followed by a summer
crop of melons, worth $320 per acre and some other
vegetable instead of the rice on the fifth or sixth
year, worth eighty yen per tan, or $160 per acre.
To secure green manure for fertilizing, soy beans
are planted each year in the space between the rows
of barley, the barley being planted in November.
One week after the barley is harvested the soy beans,
which produce a yield of 160 kan per tan, or 5290
pounds per acre, are turned under and the ground fitted
for rice, At these rates the Nara farmers are producing
on four-fifths or five-sixths of their rice lands
a gross earning of $136 per acre annually, and on the
other fifth or sixth, an earning of $480 per acre,
not counting the annual crop of soy beans used in
maintaining the nitrogen and organic matter in their
soils, and not counting their earnings from home manufactures.
Can the farmers of our south Atlantic and Gulf Coast
states, which are in the same latitude, sometime attain
to this standard? We see no reason why they should
not, but only with the best of irrigation, fertilization
and proper rotation, with multiple cropping.

**XIII**

**SILK CULTURE**

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Another of the great and in some ways one of the most
remarkable industries of the Orient is that of silk
production, and its manufacture into the most exquisite
and beautiful fabrics in the world. Remarkable
for its magnitude; for having had its birthplace apparently
in oldest China, at least 2600 years B. C.; for having
been founded on the domestication of a wild insect
of the woods; and for having lived through more than
four thousand years, expanding until a $1,000,000
cargo of the product has been laid down on our western
coast at one time and rushed by special fast express
to New York City for the Christmas trade.
  
Japan produced in 1907 26,072,000 pounds of raw silk
from 17,154,000 bushels of cocoons, feeding the silkworms
from mulberry leaves grown on 957,560 acres.
At the export selling price of this silk in Japan
the crop represents a money value of $124,000,000,
or more than two dollars per capita for the entire
population of the Empire; and engaged in the care
of the silkworms, as seen in Figs. 184, 185, 186 and
187, there were, in 1906, 1,407,766 families or some
7,000,000 people.
  
Richard’s geography of the Chinese Empire places
the total export of raw silk to all countries, from
China, in 1905, at 30,413,200 pounds, and this, at
the Japanese export price, represents a value of $145,000,000.
Richard also states that the value of the annual Chinese
export of silk to France amounts to 10,000,000 pounds
sterling and that this is but twelve per cent of the
total, from which it appears that her total export
alone reaches a value near $400,000,000.
  
The use of silk in wearing apparel is more general
among the Chinese than among the Japanese, and with
China’s eightfold greater population, the home
consumption of silk must be large indeed and her annual
production must much exceed that of Japan. Hosie
places the output of raw silk in Szechwan at 5,439,500
pounds, which is nearly a quarter of the total output
of Japan, and silk is extensively grown in eight other
provinces, which together have an area nearly fivefold
that of Japan. It would appear, therefore, that
a low estimate of China’s annual production of
raw silk must be some 120,000,000 pounds, and this,
with the output of Japan and Korea, would make a product
for the three countries probably exceeding 150,000,000
pounds annually, representing a total value of perhaps
$700,000,000; quite equalling in value the wheat crop
of the United States, but produced on less than one-eighth
of the area.
  
According to the observations of Count Dandola, the
worms which contribute to this vast earning are so
small that some 700,000 of them weigh at hatching
only one pound, but they grow very rapidly, shed their
skins four times, weighing 15 pounds at the time of
the first moult, 94 pounds at the second, 400 pounds
at the third, 1628 pounds at the fourth moulting and
when mature have come to weigh nearly five tons—­9500
pounds. But in making this growth during about

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thirty-six days, according to Paton, the 700,000 worms
have eaten 105 pounds by the time of the first moult;
315 pounds by the second; 1050 pounds by the third;
3150 pounds by the fourth, and in the final period,
before spinning, 19,215 pounds, thus consuming in
all nearly twelve tons of mulberry leaves in producing
nearly five tons of live weight, or at the rate of
two and a half pounds of green leaf to one pound of
growth.
  
According to Paton, the cocoons from the 700,000 worms
would weigh between 1400 and 2100 pounds and these,
according to the observations of Hosie in the province
of Szechwan, would yield about one-twelfth their weight
of raw silk. On this basis the one pound of worms
hatched from the eggs would yield between 116 and 175
pounds of raw silk, worth, at the Japanese export
price for 1907, between $550 and $832, and 164 pounds
of green mulberry leaves would be required to produce
a pound of silk.
  
A Chinese banker in Chekiang province, with whom we
talked, stated that the young worms which would hatch
from the eggs spread on a sheet of paper twelve by
eighteen inches would consume, in coming to maturity,
2660 pounds of mulberry leaves and would spin 21.6
pounds of silk. This is at the rate of 123 pounds
of leaves to one pound of silk. The Japanese
crop for 1907, 26,072,000 pounds, produced on 957,560
acres, is a mean yield of 27.23 pounds of raw silk
per acre of mulberries, and this would require a mean
yield of 4465 pounds of green mulberry leaves per
acre, at the rate of 164 pounds per pound of silk.
  
Ordinary silk in these countries is produced largely
from three varieties of mulberries, and from them
there may be three pickings of leaves for the rearing
of a spring, summer and autumn crop of silk.
We learned at the Nagoya Experiment Station, Japan,
that there good spring yields of mulberry leaves are
at the rate of 400 kan, the second crop, 150 kan,
and the third crop, 250 kan per tan, making a total
yield of over thirteen tons of green leaves per acre.
This, however, seems to be materially higher than the
average for the Empire.
  
In Fig. 188 is a near view of a mulberry orchard in
Chekiang province, which has been very heavily fertilized
with canal mud, and which was at the stage for cutting
the leaves to feed the first crop of silkworms.
A bundle of cut limbs is in the crotch of the front
tree in the view. Those who raise mulberry leaves
are not usually the feeders of the silkworms and the
leaves from this orchard were being sold at one dollar,
Mexican, per picul, or 32.25 cents per one hundred
pounds. The same price was being paid a week later
in the vicinity of Nanking, Kiangsu province.

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The mulberry trees, as they appear before coming into
leaf in the early spring, may be seen in Fig. 189.
The long limbs are the shoots of the last year’s
growth, from which at least one crop of leaves had
been picked, and in healthy orchards they may have
a length of two to three feet. An orchard from
a portion of which the limbs had just been cut, presented
the appearance seen in Fig. 190. These trees
were twelve to fifteen years old and the enlargements
on the ends of the limbs resulted from the frequent
pruning, year after year, at nearly the same place.
The ground under these trees was thickly covered with
a growth of pink clover just coming into bloom, which
would be spaded into the soil, providing nitrogen and
organic matter, whose decay would liberate potash,
phosphorus and other mineral plant food elements for
the crop.
  
In Fig. 191 three rows of mulberry trees, planted
four feet apart, stand on a narrow embankment raised
four feet, partly through adjusting the surrounding
fields for rice, and partly by additions of canal
mud used as a fertilizer. On either side of the
mulberries is a crop of windsor beans, and on the
left a crop of rape, both of which would be harvested
in early June, the ground where they stand flooded,
plowed and transplanted to rice. This and the
other mulberry views were taken in the extensively
canalized portion of China represented in Fig. 52.
The farmer owning this orchard had just finished cutting
two large bundles of limbs for the sale of the leaves
in the village. He stated that his first crop
ordinarily yields from three to as many as twenty
piculs per mow, but that the second crop seldom exceeded
two to three piculs. The first and second crop
of leaves, if yielding together twenty-three piculs
per mow, would amount to 9.2 tons per acre, worth,
at the price named, $59.34. Mulberry leaves must
be delivered fresh as soon as gathered and must be
fed the same day, the limbs, when, stripped of their
leaves, at the place where these are sold, are tied
into bundles and reserved for use as fuel.
  
In the south of China the mulberry is grown from low
cuttings rooted by layering. We have before spoken
of our five hours ride in the Canton delta region,
on the steamer Nanning, through extensive fields of
low mulberry then in full leaf, which were first mistaken
for cotton nearing the blossom stage. This form
of mulberry is seen in Fig. 43, and the same method
of pruning is practiced in southern Japan. In
middle Japan high pruning, as in Chekiang and Kiangsu
provinces, is followed, but in northern Japan the leaves
are picked directly, as is the case with the last
crop of leaves everywhere, pruning not being practiced
in the more northern latitudes.
  
Not all silk produced in these northern countries
is from the domesticated Bombyx mori, large amounts
being obtained from the spinnings of wild silkworms
feeding upon the leaves of species of oak growing
on the mountain and hill lands in various parts of
China, Korea and Japan. In China the collections
in largest amount are reeled from the cocoons of the
tussur worm (Antheraea pernyi) gathered in Shantung,
Honan, Kweichow and Szechwan provinces. In the
hilly parts of Manchuria also this industry is attaining
large proportions, the cocoons being sent to Chefoo
in the Shantung province, to be woven into pongee
silk.

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M. Randot has estimated the annual crop of wild silk
cocoons in Szechwan at 10,180,000 pounds, although
in the opinion of Alexander Hosie much of this may
come from Kweichow. Richard places the export
of raw wild silk from the whole of China proper, in
1904, at 4,400,000 pounds. This would mean not
less than 75,300,000 pounds of wild cocoons and may
be less than half the home consumption.
  
From data collected by Alexander Hosie it appears
that in 1899 the export of raw tussur silk from Manchuria,
through the port of Newchwang by steamer alone, was
1,862,448 pounds, valued at $1,721,200, and the production
is increasing rapidly. The export from the same
port the previous year, by steamer, was 1,046,704
pounds. This all comes from the hilly and mountain
lands south of Mukden, lying between the Liao plain
on the west and the Yalu river on the east, covering
some five thousand square miles, which we crossed
on the Antung-Mukden railway.
  
There are two broods of these wild silkworms each
season, between early May and early October.
Cocoons of the fall brood are kept through the winter
and when the moths come forth they are caused to lay
their eggs on pieces of cloth and when the worms are
hatched they are fed until the first moult upon the
succulent new oak leaves gathered from the hills,
after which the worms are taken to the low oak growth
on the hills where they feed themselves and spin their
cocoons under the cover of leaves drawn about them.
  
The moths reserved from the first brood, after becoming
fertile, are tied by means of threads to the oak bushes
where they deposit the eggs which produce the second
crop of tussur silk. To maintain an abundance
of succulent leaves within reach the oaks are periodically
cut back.
  
Thus these plain people, patient, frugal, unshrinking
from toil, the basic units of three of the oldest
nations, go to the uncultivated hill lands and from
the wild oak and the millions of insects which they
help to feed upon it, not only create a valuable export
trade but procure material for clothing, fuel, fertilizer
and food, for the large chrysalides, cooked in the
reeling of the silk, may be eaten at once or are seasoned
with sauce to be used later. Besides this, the
last unreelable portion of each cocoon is laid aside
to be manufactured into silk wadding and into soft
mattresses for caskets upon which the wealthy lay
their dead.

**XIV**

**THE TEA INDUSTRY**  
The cultivation of tea in China and Japan is another
of the great industries of these nations, taking rank
with that of sericulture, if not above it, in the
important part it plays in the welfare of the people.
There is little reason to doubt that the industry has
its foundation in the need of something to render boiled
water palatable for drinking purposes. The drinking
of boiled water has been universally adopted in these
countries as an individually available, thoroughly
efficient and safe guard against that class of deadly
disease germs which it has been almost impossible to
exclude from the drinking water of any densely peopled
country.

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So far as may be judged from the success of the most
thorough sanitary measures thus far instituted, and
taking into consideration the inherent difficulties
which must increase enormously with increasing populations,
it appears inevitable that modern methods must ultimately
fail in sanitary efficiency and that absolute safety
must be secured in some manner having the equivalent
effect of boiling water, long ago adopted by the Mongolian
races, and which destroys active disease germs at
the latest moment before using. And it must not
be overlooked that the boiling of drinking water in
China and Japan has been demanded quite as much because
of congested rural populations as to guard against
such dangers in large cities, while as yet our sanitary
engineers have dealt only with the urban phases of
this most vital problem and chiefly, too, thus far,
only where it has been possible to procure the water
supply in comparatively unpopulated hill lands.
But such opportunities cannot remain available indefinitely,
any more than they did in China and Japan, and already
typhoid epidemics break out in our large cities and
citizens are advised to boil their drinking water.
  
If tea drinking in the family is to remain general
in most portions of the world, and especially if it
shall increase in proportion to population, there
is great industrial and commercial promise for China,
Korea and Japan in their tea industry if they will
develop tea culture still further over the extensive
and still unused flanks of the hill lands; improve
their cultural methods; their manufacture; and develop
their export trade. They have the best of climatic
and soil conditions and people sufficiently capable
of enormously expanding the industry. Both improvement
and expansion of methods along all essential lines,
are needed, enabling them to put upon the market pure
teas of thoroughly uniform grades of guaranteed quality,
and with these the maintenance of an international
code of rigid ethics which shall secure to all concerned
a square deal and a fair division of the profits.
  
The production of rice, silk and tea are three industries
which these nations are preeminently circumstanced
and qualified to economically develop and maintain.
Other nations may better specialize along other lines
which fitness determines, and the time is coming when
maximum production at minimum cost as the result of
clean robust living that in every way is worth while,
will determine lines of social progress and of international
relations. With the vital awakening to the possibility
of and necessity for world peace, it must be recognized
that this can be nothing less than universal, industrial,
commercial, intellectual and religious, in addition
to making impossible forever the bloody carnage that
has ravaged the world through all the centuries.

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With the extension of rapid transportation and more
rapid communication throughout the world, we are fast
entering the state of social development which will
treat the whole world as a mutually helpful, harmonious
industrial unit. It must be recognized that in
certain regions, because of peculiar fitness of soil,
climate and people, needful products can be produced
there better and enough more cheaply than elsewhere
to pay the cost of transportation. If China,
Korea and Japan, with parts of India, can and will
produce the best and cheapest silks, teas or rice,
it must be for the greatest good to seek a mutually
helpful exchange, and the erection of impassable tariff
barriers is a declaration of war and cannot make for
world peace and world progress.
  
The date of the introduction of tea culture into China
appears unknown. It was before the beginning
of the Christian era and tradition would place it
more than 2700 years earlier. The Japanese definitely
date its introduction into their islands as in the
year 805 A. D., and state its coming to them from
China. However and whenever tea growing originated
in these countries, it long ago attained and now maintains
large proportions. In 1907 Japan had 124,482
acres of land occupied by tea gardens and tea plantations.
These produced 60,877,975 pounds of cured tea, giving
a mean yield of 489 pounds per acre. Of the more
than sixty million pounds of tea produced annually
on nearly two hundred square miles in Japan, less
than twenty-two million pounds are consumed at home,
the balance being exported at a cash value, in 1907,
of $6,309,122, or a mean of sixteen cents per pound.
  
In China the volume of tea produced annually is much
larger than in Japan. Hosie places the annual
export from Szechwan into Tibet alone at 40,000,000
pounds and this is produced largely in the mountainous
portion of the province west of the Min river.
Richard places her direct export to foreign countries,
in 1905, at 176,027,255 pounds; and in 1906 at 180,271,000
pounds, so that the annual export must exceed 200,000,000
pounds, and her total product of cured tea must be
more than 400,000,000.
  
The general appearance of tea bushes as they are grown
in Japan is indicated in Fig. 192. The form of
the bushes, the shape and size of the leaves and the
dense green, shiny foliage quite suggests our box,
so much used in borders and hedges. When the bushes
are young, not covering the ground, other crops are
grown between the rows, but as the bushes attain their
full size, standing after trimming, waist to breast
high, the ground between is usually thickly covered
with straw, leaves or grass and weeds from the hill
lands, which serve as a mulch, as a fertilizer, as
a means of preventing washing on the hillsides, and
to force the rain to enter the soil uniformly where
it falls.
  
Quite a large per cent of the tea bushes are grown
on small, scattering, irregular areas about dwellings,
on land not readily tilled, but there are also many
tea plantations of considerable size, presenting the
appearance seen in Fig. 193. After each picking
of the leaves the bushes are trimmed back with pruning
shears, giving the rows the appearance of carefully
trimmed hedges.

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The tea leaves are hand picked, generally by women
and girls, after the manner seen in Fig. 194, where
they are gathering the tender, newly-formed leaves
into baskets to be weighed fresh, as seen in Fig.
195.
  
Three crops of leaves are usually gathered each season,
the first yielding in Japan one hundred kan per tan,
the second fifty kan and the third eighty kan per
tan. This is at the rate of 3307 pounds, 1653
pounds, and 2645 pounds per acre, making a total of
7605 pounds for the season, from which the grower
realizes from a little more than 2.2 to a little more
than 3 cents per pound of the green leaves, or a gross
earning of $167 to $209.50 per acre.
  
We were informed that the usual cost for fertilizers
for the tea orchards was 15 to 20 yen per tan, or
$30 to $40 per acre per annum, the fertilizer being
applied in the fall, in the early spring and again
after the first picking of the leaves. While the
tea plants are yet small one winter crop and one summer
crop of vegetables, beans or barley are grown between
the rows, these giving a return of some forty dollars
per acre. Where the plantations are given good
care and ample fertilization the life of a plantation
may be prolonged continuously, it is said, through
one hundred or more years.
  
During our walk from Joji to Kowata, along a country
road in one of the tea districts, we passed a tea-curing
house. This was a long rectangular, one-story
building with twenty furnaces arranged, each under
an open window, around the sides. In front of
each heated furnace with its tray of leaves, a Japanese
man, wearing only a breech cloth, and in a state of
profuse perspiration, was busy rolling the tea leaves
between the palms of his hands.
  
At another place we witnessed the making of the low
grade dust tea, which is prepared from the leaves
of bushes which must be removed or from those of the
prunings. In this case the dried bushes with their
leaves were being beaten with flails on a threshing
floor. The dust tea thus produced is consumed
by the poorer people.

**XV**

**ABOUT TIENTSIN**  
On the 6th of June we left central China for Tientsin
and further north, sailing by coastwise steamer from
Shanghai, again plowing through the turbid waters
which give literal exactness to the name Yellow Sea.
Our steamer touched at Tsingtao, taking on board a
body of German troops, and again at Chefoo, and it
was only between these two points that the sea was
not strongly turbid. Nor was this all. From
early morning of the 10th until we anchored at Tientsin,
2:30 P. M., our course up the winding Pei ho was against
a strong dust-laden wind which left those who had
kept to the deck as grey as though they had ridden
by automobile through the Colorado desert; so the
soils of high interior Asia are still spreading eastward
by flood and by wind into the valleys and far over
the coastal plains. Over large areas between
Tientsin and Peking and at other points northward
toward Mukden trees and shrubs have been systematically
planted in rectangular hedgerow lines, to check the
force of the winds and reduce the drifting of soils,
planted fields occupying the spaces between.

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It was on this trip that we met Dr. Evans of Shunking,
Szechwan province. His wife is a physician practicing
among the Chinese women, and in discussing the probable
rate of increase of population among the Chinese,
it was stated that she had learned through her practice
that very many mothers had borne seven to eleven children
and yet but one, two or at most three, were living.
  
It was said there are many customs and practices which
determine this high mortality among children, one
of which is that of feeding them meat before they
have teeth, the mother masticating for the children,
with the result that often fatal convulsions follow.
A Scotch physician of long experience in Shantung,
who took the steamer at Tsingtao, replied to my question
as to the usual size of families in his circuit, “I
do not know. It depends on the crops. In
good years the number is large; in times of famine
the girls especially are disposed of, often permitted
to die when very young for lack of care. Many
are sold at such times to go into other provinces.”
Such statements, however, should doubtless be taken
with much allowance. If all the details were
known regarding the cases which have served as foundations
for such reports, the matter might appear in quite
a different light from that suggested by such cold
recitals.
  
Although land taxes are high in China Dr. Evans informed
me that it is not infrequent for the same tax to be
levied twice and even three times in one year.
Inquiries regarding the land taxes among farmers in
different parts of China showed rates running from
three cents to a dollar and a half, Mexican, per mow;
or from about eight cents to $3.87 gold, per acre.
At these rates a forty acre farm would pay from $3.20
to $154.80, and a quarter section four times these
amounts. Data collected by Consul-General E. T.
Williams of Tientsin indicate that in Shantung the
land tax is about one dollar per acre, and in Chihli,
twenty cents. In Kiangsi province the rate is
200 to 300 cash per mow, and in Kiangsu, from 500
to 600 cash per mow, or, according to the rate of
exchange given on page 76, from 60 to 80 cents, or
90 cents to $1.20 per acre in Kiangsi; and $1.50 to
$2.00 or $1.80 to $2.40 in Kiangsu province.
The lowest of these rates would make the land tax
on 160 acres, $96, and the highest would place it
at $384, gold.
  
In Japan the taxes are paid quarterly and the combined
amount of the national, prefectural and village assessments
usually aggregates about ten per cent of the government
valuation placed on the land. The mean valuation
placed on the irrigated fields, excluding Formosa
and Karafuto, was in 1907, 35.35 yen per tan; that
of the upland fields, 9.40 yen, and the genya and
pasture lands were given a valuation of .22 yen per
tan. These are valuations of $70.70, $18.80 and
$.44, gold, per acre, respectively, and the taxes on
forty acres of paddy field would be $282.80; $75.20
on forty acres of upland field, and $1.76, gold, on
the same area of the genya and weed lands.

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In the villages, where work of one or another kind
is done for pay, Dr. Evans stated that a woman’s
wage might not exceed $8, Mexican, or $3.44, gold,
per year, and when we asked how it could be worth a
woman’s while to work a whole year for so small
a sum, his reply was, “If she did not do this
she would earn nothing, and this would keep her in
clothes and a little more.” A cotton spinner
in his church would procure a pound of cotton and
on returning the yarn would receive one and a quarter
pounds of cotton in exchange, the quarter pound being
her compensation.
  
Dr. Evans also described a method of rooting slips
from trees, practiced in various parts of China.
The under side of a branch is cut, bent upward and
split for a short distance; about this is packed a
ball of moistened earth wrapped in straw to retain
the soil and to provide for future watering; the whole
may then be bound with strips of bamboo for greater
stability. In this way slips for new mulberry
orchards are procured.
  
At eight o’clock in the morning we entered the
mouth of the Pei ho and wound westward through a vast,
nearly sea-level, desert plain and in both directions,
far toward the horizon, huge white stacks of salt
dotted the surface of the Taku Government salt fields,
and revolving in the wind were great numbers of horizontal
sail windmills, pumping sea water into an enormous
acreage of evaporation basins. In Fig. 196 may
be seen five of the large salt stacks and six of the
windmills, together with many smaller piles of salt.
Fig. 197 is a closer view of the evaporation basins
with piles of salt scraped from the surface after
the mother liquor had been drained away. The
windmills, which were working one, sometimes two, of
the large wooden chain pumps, were some thirty feet
in diameter and lifted the brine from tide-water basins
into those of a second and third higher level where
the second and final concentration occurred.
These windmills, crude as they appear in Fig. 198,
are nevertheless efficient, cheaply constructed and
easily controlled. The eight sails, each six
by ten feet, were so hung as to take the wind through
the entire revolution, tilting automatically to receive
the wind on the opposite face the moment the edge passed
the critical point. Some 480 feet of sail surface
were thus spread to the wind, working on a radius
of fifteen feet. The horizontal drive wheel had
a diameter of ten feet, carried eighty-eight wooden
cogs which engaged a pinion with fifteen leaves, and
there were nine arms on the reel at the other end
of the shaft which drove the chain. The boards
or buckets of the chain pump were six by twelve inches,
placed nine inches apart, and with a fair breeze the
pump ran full.
  
Enormous quantities of salt are thus cheaply manufactured
through wind, tide and sun power directed by the cheapest
human labor. Before reaching Tientsin we passed
the Government storage yards and counted two hundred
stacks of salt piled in the open, and more than a
third of the yard had been passed before beginning
the count. The average content of each stack
must have exceeded 3000 cubic feet of salt, and more
than 40,000,000 pounds must have been stored in the
yards. Armed guards in military uniform patrolled
the alleyways day and night. Long strips of matting
laid over the stacks were the only shelter against
rain.

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Throughout the length of China’s seacoast, from
as far north as beyond Shanhaikwan, south to Canton,
salt is manufactured from sea water in suitable places.
In Szechwan province, we learn from the report of
Consul-General Hosie, that not less than 300,000 tons
of salt are annually manufactured there, largely from
brine raised by animal power from wells seven hundred
to more than two thousand feet deep.
  
Hosie describes the operations at a well more than
two thousand feet deep, at Tzeliutsing. In the
basement of a power-house which sheltered forty water
buffaloes, a huge bamboo drum twelve feet high, sixty
feet in circumference, was so set as to revolve on
a vertical axis propelled by four cattle drawing from
its circumference. A hemp rope was wound about
this drum, six feet from the ground, passing out and
under a pulley at the well, then up and around a wheel
mounted sixty feet above and descended to the bucket
made from bamboo stems four inches in diameter and
nearly sixty feet long, which dropped with great speed
to the bottom of the well as the rope unwound.
When the bucket reached the bottom four attendants,
each with a buffalo in readiness, hitched to the drum
and drove at a running pace, during fifteen minutes,
or until the bucket was raised from the well.
The buffalo were then unhitched and, while the bucket
was being emptied and again dropped to the bottom
of the well, a fresh relay were brought to the drum.
In this way the work continued night and day.
  
The brine, after being raised from the well, was emptied
into distributing reservoirs, flowing thence through
bamboo pipes to the evaporating sheds where round
bottomed, shallow iron kettles four feet across were
set in brick arches in which jets of natural gas were
burning.
  
Within an area some sixty miles square there are more
than a thousand brine and twenty fire wells from which
fuel gas is taken. The mouths of the fire wells
are closed with masonry, out from which bamboo conduits
coated with lime lead to the various furnaces, terminating
with iron burners beneath the kettles. Remarkable
is the fact that in the city of Tzeliutsing, both
these brine and the fire wells have been operated
in the manufacture of salt since before Christ was
born.
  
The forty water buffalo are worth $30 to $40 per head
and their food fifteen to twenty cents per day.
The cost of manufacturing this salt is placed at thirteen
to fourteen cash per catty, to which the Government
adds a tax of nine cash more, making the cost at the
factory from 82 cents to $1.15, gold, per hundred pounds.
Salt manufacture is a Government monopoly and the
product must be sold either to Government officials
or to merchants who have bought the exclusive right
to supply certain districts. The importation of
salt is prohibited by treaties. For the salt
tax collection China is divided into eleven circuits
each having its own source of supply and transfer
of salt from one circuit to another is forbidden.

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The usual cost of salt is said to vary between one
and a half and four cash per catty. The retail
price of salt ranges from three-fourths to three cents
per pound, fully twelve to fifteen times the cost
of manufacture. The annual production of salt
in the Empire is some 1,860,000 tons, and in 1901
salt paid a tax close to ten million dollars.
  
Beyond the salt fields, toward Tientsin, the banks
of the river were dotted at short intervals with groups
of low, almost windowless houses, Fig. 199, built
of earth brick plastered with clay on sides and roof,
made more resistant to rain by an admixture of chaff
and cut straw, and there was a remarkable freshness
of look about them which we learned was the result
of recent preparations made for the rainy season about
to open. Beyond the first of these villages came
a stretch of plain dotted thickly and far with innumerable
grave mounds, to which reference has been made.
For nearly an hour we had traveled up the river before
there was any material vegetation, the soil being
too saline apparently to permit growth, but beyond
this, crops in the fields and gardens, with some fruit
and other trees, formed a fringe of varying width
along the banks. Small fields of transplanted
rice on both banks were frequent and often the land
was laid out in beds of two levels, carefully graded,
the rice occupying the lower areas, and wooden chain
pumps were being worked by hand, foot and animal power,
irrigating both rice and garden crops.
  
In the villages were many stacks of earth compost,
of the Shantung type; manure middens were common and
donkeys drawing heavy stone rollers followed by men
with large wooden mallets, were going round and round,
pulverizing and mixing the dry earth compost and the
large earthen brick from dismantled kangs, preparing
fertilizer for the new series of crops about to be
planted, following the harvest of wheat and barley.
Large boatloads of these prepared fertilizers were
moving on the river and up the canals to the fields.
  
Toward the coast from Tientsin, especially in the
country, traversed by the railroad, there was little
produced except a short grass, this being grazed at
the time of our visit and, in places, cut for a very
meagre crop of hay. The productive cultivated
lands lie chiefly along the rivers and canals or other
water courses, where there is better drainage as well
as water for irrigation. The extensive, close
canalization that characterizes parts of Kiangsu and
Chekiang provinces is lacking here and for this reason,
in part, the soil is not so productive. The fuller
canalization, the securing of adequate drainage and
the gaining of complete control of the flood waters
which flow through this vast plain during the rainy
season constitute one of China’s most important
industrial problems which, when properly solved, must
vastly increase her resources. During our drive
over the old Peking-Taku road saline deposits were
frequently observed which had been brought to the

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surface during the dry season, and the city engineer
of Tientsin stated that in their efforts at parking
portions of the foreign concessions they had found
the trees dying after a few years when their roots
began to penetrate the more saline subsoil, but that
since they had opened canals, improving the drainage,
trees were no longer dying. There is little doubt
that proper drainage by means of canals, and the irrigation
which would go with it, would make all of these lands,
now more or less saline, highly productive, as are
now those contiguous to the existing water courses.
  
It had rained two days before our drive over the Taku
road and when we applied for a conveyance, the proprietor
doubted whether the roads were passible, as he had
been compelled to send out an extra team to assist
in the return of one which had been stalled during
the previous night. It was finally arranged to
send an extra horse with us. The rainy season
had just begun but the deep trenching of the roads
concentrates the water in them and greatly intensifies
the trouble. In one of the little hamlets through
which we passed the roadway was trenched to a depth
of three to four feet in the middle of the narrow
street, leaving only five feet for passing in front
of the dwellings on either side, and in this trench
our carriage moved through mud and water nearly to
the hubs.
  
Between Tientsin and Peking, in the early morning
after a rain of the night before, we saw many farmers
working their fields with the broad hoes, developing
an earth mulch at the first possible moment to conserve
their much needed moisture. Men were at work,
as seen in Figs. 200 and 201, using long handled hoes,
with blades nine by thirteen inches, hung so as to
draw just under the surface, doing very effective
work, permitting them to cover the ground rapidly.
  
Walking further, we came upon six women in a field
of wheat, gleaning the single heads which had prematurely
ripened and broken over upon the ground between the
rows soon to be harvested. Whether they were
doing this as a privilege or as a task we do not know;
they were strong, cheerful, reasonably dressed, hardly
past middle life and it was nearly noon, yet not one
of them had collected more straws than she could readily
grasp in one hand. The season in Chihli as in
Shantung, had been one of unusual drought, making the
crop short and perhaps unusual frugality was being
practiced; but it is in saving that these people excel
perhaps more than in producing. These heads of
wheat, if left upon the ground, would be wasted and
if the women were privileged gleaners in the fields
their returns were certainly much greater than were
those of the very old women we have seen in France
gathering heads of wheat from the already harvested
fields.

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In the fields between Tientsin and Peking all wheat
was being pulled, the earth shaken from the roots,
tied in small bundles and taken to the dwellings,
sometimes on the heavy cart drawn by a team consisting
of a small donkey and cow hitched tandem, as seen in
Fig. 202. Millet had been planted between the
rows of wheat in this field and was already up.
When the wheat was removed the ground would be fertilized
and planted to soy beans. Because of the dry season
this farmer estimated his yield would be but eight
to nine bushels per acre. He was expecting to
harvest thirteen to fourteen bushels of millet and
from ten to twelve bushels of soy beans per acre from
the same field. This would give him an earning,
based on the local prices, of $10.36, gold, for the
wheat; $6.00 for the beans, and $5.48 per acre for
the millet. This land was owned by the family
of the Emperor and was rented at $1.55, gold, per
acre. The soil was a rather light sandy loam,
not inherently fertile, and fertilizers to the value
of $3.61 gold, per acre, had been applied, leaving
the earning $16.71 per acre.
  
Another farmer with whom we talked, pulling his crop
of wheat, would follow this with millet and soy beans
in alternate rows. His yield of wheat was expected
to be eleven to twelve bushels per acre, his beans
twenty-one bushels and his millet twenty-five bushels
which, at the local prices for grain and straw, would
bring a gross earning of $35, gold, per acre.
  
Before reaching the end of our walk through the fields
toward the next station we came across another of
the many instances of the labor these people are willing
to perform for only a small possible increase in crop.
The field was adjacent to one of the windbreak hedges
and the trees had spread their roots far afield and
were threatening his crop through the consumption
of moisture and plant food. To check this depletion
the farmer had dug a trench twenty inches deep the
length of his field, and some twenty feet from the
line of trees, thereby cutting all of the surface roots
to stop their draft on the soil. The trench was
left open and an interesting feature observed was
that nearly every cut root on the field side of the
trench had thrown up one or more shoots bearing leaves,
while the ends still connected with the trees showed
no signs of leaf growth.
  
In Chihli as elsewhere the Chinese are skilled gardeners,
using water for irrigation whenever it is advantageous.
One gardener was growing a crop of early cabbage,
followed by one of melons, and these with radish the
same season. He was paying a rent of $6.45, gold,
per acre; was applying fertilizer at a cost of nearly
$8 per acre for each of the three crops, making his
cash outlay $29.67 per acre. His crop of cabbage
sold for $103, gold; his melons for $77, and his radish
for something more than $51, making a total of $232.20
per acre, leaving him a net value of $202.53.

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A second gardener, growing potatoes, obtained a yield,
when sold new, of 8,000 pounds per acre; and of 16,000
pounds when the crop was permitted to mature.
The new potatoes were sold so as to bring $51.60 and
the mature potatoes $185.76 per acre, making the earning
for the two crops the same season a total of $237.36,
gold. By planting the first crop very early these
gardeners secure two crops the same season, as far
north as Columbus, Ohio, and Springfield, Illinois,
the first crop being harvested when the tubers are
about the size of walnuts. The rental and fertilizers
in this case amounted to $30.96 per acre.
  
Still another gardener growing winter wheat followed
by onions, and these by cabbage, both transplanted,
realized from the three crops a gross earning of $176.73,
gold, per acre, and incurred an expense of $31.73
per acre for fertilizer and rent, leaving him a net
earning of $145 per acre.
  
These old people have acquired the skill and practice
of storing and preserving such perishable fruits as
pears and grapes so as to enable them to keep them
on the markets almost continuously. Pears were
very common in the latter part of June, and Consul-General
Williams informed me that grapes are regularly carried
into July. In talking with my interpreter as
to the methods employed I could only learn that the
growers depend simply upon dry earth cellars which
can be maintained at a very uniform temperature, the
separate fruits being wrapped in paper. No foreigner
with whom we talked knew their methods.
  
Vegetables are carried through the winter in such
earth cellars as are seen in Fig. 88, page 161, these
being covered after they are filled.
  
As to the price of labor in this part of China, we
learned through Consul-General Williams that a master
mechanic may receive 50 cents, Mexican, per day, and
a journeyman 18 cents, or at a rate of 21.5 cents
and 7.75 cents, gold. Farm laborers receive from
$20 to $30, Mexican, or $8.60 to $12.90, gold, per
year, with food, fuel and presents which make a total
of $17.20 to $21.50. This is less for the year
than we pay for a month of probably less efficient
labor. There is relatively little child labor
in China and this perhaps should be expected when
adult labor is so abundant and so cheap.

**XVI**

**MANCHURIA AND KOREA**  
The 39th parallel of latitude lies just south of Tientsin;
followed westward, it crosses the toe of Italy’s
boot, leads past Lisbon in Portugal, near Washington
and St. Louis and to the north of Sacramento on the
Pacific. We were leaving a country with a mean
July temperature of 80 deg F., and of 21 deg in January,
but where two feet of ice may form; a country where
the eighteen year mean maximum temperature is 103.5
deg and the mean minimum 4.5 deg; where twice in this
period the thermometer recorded 113 deg above zero,
and twice 7 deg below, and yet near the coast and in

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the latitude of Washington; a country where the mean
annual rainfall is 19.72 inches and all but 3.37 inches
falls in June, July, August and September. We
had taken the 5:40 A. M. Imperial North-China train,
June 17th, to go as far northward as Chicago,—­to
Mukden in Manchuria, a distance by rail of some four
hundred miles, but all of the way still across the
northward extension of the great Chinese coastal plain.
Southward, out from the coldest quarter of the globe,
where the mean January temperature is more than 40
deg below zero, sweep northerly winds which bring
to Mukden a mean January temperature only 3 deg above
zero, and yet there the July temperature averages
as high as 77 deg and there is a mean annual rainfall
of but 18.5 inches, coming mostly in the summer, as
at Tientsin.
  
Although the rainfall of the northern extension of
China’s coastal plain is small, its efficiency
is relatively high because of its most favorable distribution
and the high summer temperatures. In the period
of early growth, April, May and June, there are 4.18
inches; but in the period of maximum growth, July
and August, the rainfall is 11.4 inches; and in the
ripening period, September and October, it is 3.08
inches, while during the rest of the year but 1.06
inch falls. Thus most of the rain comes at the
time when the crops require the greatest daily consumption
and it is least in mid-winter, during the period of
little growth.
  
As our train left Tientsin we traveled for a long
distance through a country agriculturally poor and
little tilled, with surface flat, the soil apparently
saline, and the land greatly in need of drainage.
Wherever there were canals the crops were best, apparently
occupying more or less continuous areas along either
bank. The day was hot and sultry but laborers
were busy with their large hoes, often with all garments
laid aside except a short shirt or a pair of roomy
trousers.
  
In the salt district about the village of Tangku there
were huge stacks of salt and smaller piles not yet
brought together, with numerous windmills, constituting
most striking features in the landscape, but there
was almost no agricultural or other vegetation.
Beyond Pehtang there are other salt works and a canal
leads westward to Tientsin, on which the salt is probably
taken thither, and still other salt stacks and windmills
continued visible until near Hanku, where another
canal leads toward Peking. Here the coast recedes
eastward from the railway and beyond the city limits
many grave mounds dot the surrounding plains where
herds of sheep were grazing.

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As we hurried toward the delta region of the Lwan
ho, and before reaching Tangshan, a more productive
country was traversed. Thrifty trees made the
landscape green, and fields of millet, kaoliang and
wheat stretched for miles together along the track
and back over the flat plain beyond the limit of vision.
Then came fields planted with two rows of maize alternating
with one row of soy beans, but not over twenty-eight
inches apart, one stalk of corn in a place every sixteen
to eighteen inches, all carefully hoed, weedless and
blanketed with an excellent earth mulch; but still
the leaves were curling in the intense heat of the
sun. Tangshan is a large city, apparently of
recent growth on the railroad in a country where isolated
conical hills rise one hundred or two hundred feet
out of the flat, plains. Cart loads of finely
pulverized earth compost were here moving to the fields
in large numbers, being laid in single piles of five
hundred to eight hundred pounds, forty to sixty feet
apart. At Kaiping the country grows a little rolling
and we passed through the first railway cuts, six
to eight feet deep, and the water in the streams is
running ten to twelve feet below the surface of the
fields. On the right and beyond Kuyeh there are
low hills, and here we passed enormous quantities
of dry, finely powdered earth compost, distributed
on narrow unplanted area over the fields. What
crop, if indeed any, had occupied these areas this
season, we could not judge. The fertilization
here is even more extensive and more general than
we found it in the Shantung province, and in places
water was being carried in pails to the fields for
use either in planting or in transplanting, to ensure
the readiness of the new crops to utilize the first
rainfall when it comes.
  
Then the bed of a nearly dry stream some three hundred
feet wide was crossed and beyond it a sandy plain
was planted in long narrow fields between windbreak
hedges. The crops were small but evidently improved
by the influence of the shelter. The sand in places
had drifted into the hedges to a height of three feet.
At a number of other places along the way before Mukden
was reached such protected areas were passed and oftenest
on the north side of wide, now nearly dry, stream
channels.
  
As we passed on toward Shanhaikwan we were carried
over broad plains even more nearly level and unobstructed
than any to be found in the corn belt of the middle
west, and these too planted with corn, kaoliang, wheat
and beans, and with the low houses hidden in distant
scattered clusters of trees dotting the wide plain
on either side, with not a fence, and nothing to suggest
a road anywhere in sight. We seemed to be moving
through one vast field dotted with hundreds of busy
men, a plowman here, and there a great cart hopelessly
lost in the field so far as one could see any sign
of road to guide their course.
  
Some early crop appeared to have been harvested from
areas alternating with those on the ground, and these
were dotted with piles of the soil and manure compost,
aggregating hundreds of tons, distributed over the
fields but no doubt during the next three or four
days these thousands of piles would have been worked
into the soil and vanished from sight, to reappear
after another crop and another year.

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It was at Lwanchow that we met the out-going tide
of soy beans destined for Japan and Europe, pouring
in from the surrounding country in gunny sacks brought
on heavy carts drawn by large mules, as seen in Fig.
203, and enormous quantities had been stacked in the
open along the tracks, with no shelter whatever, awaiting
the arrival of trains to move them to export harbors.
  
The planting here, as elsewhere, is in rows, but not
of one kind of grain. Most frequently two rows
of maize, kaoliang or millet alternated with the soy
beans and usually not more than twenty-eight inches
apart, sharp high ridge cultivation being the general
practice. Such planting secures the requisite
sunshine with a larger number of plants on the field;
it secures a continuous general distribution of the
roots of the nitrogen-fixing soy beans in the soil
of all the field every season, and permits the soil
to be more continuously and more completely laid under
tribute by the root systems. In places where
the stand of corn or millet was too open the gaps
were filled with the soy beans. Such a system
of planting possibly permits a more immediate utilization
of the nitrogen gathered from the soil air in the
root nodules, as these die and undergo nitrification
during the same season, while the crops are yet on
the ground, and so far as phosphorus and potassium
compounds are liberated by this decay, they too would
become available to the crops.
  
The end of the day’s journey was at Shanhaikwan
on the boundary between Chihli and Manchuria, the
train stopping at 6:20 P. M. for the night. Stepping
upon the veranda from our room on the second floor
of a Japanese inn in the early morning, there stood
before us, sullen and grey, the eastern terminus of
the Great Wall, winding fifteen hundred miles westward
across twenty degrees of longitude, having endured
through twenty-one centuries, the most stupendous
piece of construction ever conceived by man and executed
by a nation. More than twenty feet thick at the
base and than twelve feet on the top; rising fifteen
to thirty feet above the ground with parapets along
both faces and towers every two hundred yards rising
twenty feet higher, it must have been, for its time
and the methods of warfare then practiced, when defended
by their thousands, the boldest and most efficient
national defense ever constructed. Nor in the
economy of construction and maintenance has it ever
been equalled.
  
Even if it be true that 20,000 masons toiled through
ten years in its building, defended by 400,000 soldiers,
fed by a commissariat of 20,000 more and supported
by 30,000 others in the transport, quarry and potters’
service, she would then have been using less than eight
tenths per cent of her population, on a basis of 60,000,000
at the time; while according to Edmond Théry’s
estimate, the officers and soldiers of Europe today,
in time of peace, constitute one per cent of a population
of 400,000,000 of people, and these, at only one dollar

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each per day for food, clothing and loss of producing
power would cost her nations, in ten years, more than
$14,000 million. China, with her present habits
and customs, would more easily have maintained her
army of 470,000 men on thirty cents each per day, or
for a total ten-year cost of but $520,000,000.
The French cabinet in 1900 approved a naval program
involving an expenditure of $600,000,000 during the
next ten years, a tax of more than $15 for every man,
woman and child in the Republic.
  
Leaving Shanhaikwan at 5:20 in the morning and reaching
Mukden at 6:30 in the evening, we rode the entire
day through Manchurian fields. Manchuria has
an area of 363,700 square miles, equal to that of
both Dakotas, Minnesota, Nebraska and Iowa combined.
It has roughly the outline of a huge boot and could
one slide it eastward until Port Arthur was at Washington,
Shanhaikwan would fall well toward Pittsburgh, both
at the tip of the broad toe to the boot. The
foot would lie across Pennsylvania, New York, New Jersey
and all of New England, extending beyond New Brunswick
with the heel in the Gulf of St. Lawrence. Harbin,
at the instep of the boot, would lie fifty miles east
of Montreal and the expanding leg would reach northwestward
nearly to James Bay, entirely to the north of the
Ottawa river and the Canadian Pacific, spanning a thousand
miles of latitude and nine hundred miles of longitude.
  
The Liao plain, thirty miles wide, and the central
Sungari plain, are the largest in Manchuria, forming
together a long narrow valley floor between two parallel
mountain systems and extending northeasterly from
the Liao gulf, between Port Arthur and Shanhaikwan,
up the Liao river and down the Sungari to the Amur,
a distance of eight hundred or more miles. These
plains have a fertile, deep soil and it is on them
and other lesser river bottoms that Manchurian agriculture
is developed, supporting eight or nine million people
on a cultivated, acreage possibly not greater than
25,000 square miles.
  
Manchuria has great forest and grazing possibilities
awaiting future development, as well as much mineral
wealth. The population of Tsitsihar, in the latitude
of middle North Dakota, swells from thirty thousand
to seventy thousand during September and October,
when the Mongols bring in their cattle to market.
In the middle province, at the head of steam navigation
on the Sungari, because of the abundance and cheapness
of lumber, Kirin has become a shipbuilding center
for Chinese junks. The Sungari-Milky-river, is
a large stream carrying more water at flood season
than the Amur above its mouth, the latter being navigable
450 miles for steamers drawing twelve feet of water,
and 1500 miles for those drawing four feet, so that
during the summer season the middle and northern provinces
have natural inland waterways, but the outlet to the
sea is far to the north and closed by ice six months
of the year.

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Not far beyond the Great Wall of China, fast falling
into ruin, partly through the appropriation of its
material for building purposes now that it has outlived
its usefulness, another broad, nearly dry stream bed
was crossed. There, in full bloom, was what appeared
to be the wild white rose seen earlier, further south,
west of Suchow, having a remarkable profusion of small
white bloom in clusters resembling the Rambler rose.
One of these bushes growing wild there on the bank
of the canal had over spread a clump of trees one
of which was thirty feet in height, enveloping it in
a mantle of bloom, as seen in the upper section of
Fig. 204. The lower section of the illustration
is a closer view showing the clusters. The stem
of this rose, three feet above the ground, measured
14.5 inches in circumference. If it would thrive
in this country nothing could be better for parks
and pleasure drives. Later on our journey we saw
it many times in bloom along the railway between Mukden
and Antung, but nowhere attaining so large growth.
The blossoms are scant three-fourths inch in diameter,
usually in compact clusters of three to eleven, sometimes
in twos and occasionally standing singly. The
leaves are five-foliate, sometimes trifoliate; leaflets
broadly lanceolate, accuminate and finely serrate;
thorns minute, recurrent and few, only on the smaller
branches.
  
In a field beyond, a small donkey was drawing a stone
roller three feet long and one foot in diameter, firming
the crests of narrow, sharp, recently formed ridges,
two at a time. Millet, maize and kaoliang were
here the chief crops. Another nearly dry stream
was crossed, where the fields became more rolling
and much cut by deep gullies, the first instances
we had seen in China except on the steep hillsides
about Tsingtao. Not all of the lands here were
cultivated, and on the untilled areas herds of fifty
to a hundred goats, pigs, cattle, horses and donkeys
were grazing.
  
Fields in Manchuria are larger than in China and some
rows were a full quarter of a mile long, so that cultivation
was being done with donkeys and cattle, and large
numbers of men were working in gangs of four, seven,
ten, twenty, and in one field as high as fifty, hoeing
millet. Such a crew as the largest mentioned could
probably be hired at ten cents each, gold, per day,
and were probably men from the thickly settled portions
of Shantung who had left in the spring, expecting
to return in September or October. Both laborers
and working animals were taking dinner in the fields,
and earlier in the day we had seen several instances
where hay and feed were being taken to the field on
a wooden sled, with the plow and other tools.
At noon this was serving as manger for the cattle,
mules or donkeys.
  
In fields where the close, deep furrowing and ridging
was being done the team often consisted of a heavy
ox and two small donkeys driven abreast, the three
walking in adjacent rows, the plow following the ox,
or a heavy mule instead.

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The rainy season had not begun and in many fields
there was planting and transplanting where water was
used in separate hills, sometimes brought in pails
from a nearby stream, and in other cases on carts
provided with tanks. Holes were made along the
crests of the ridges with the blade of a narrow hoe
and a little water poured in each hill, from a dipper,
before planting or setting. These must have been
other instances where the farmers were willing to incur
additional labor to save time for the maturing of the
crop by assisting germination in a soil too dry to
make it certain until the rains came.
  
It appears probable that the strong ridging and the
close level rows so largely adopted here must have
marked advantages in utilizing the rainfall, especially
the portions coming early, and that later also if
it should come in heavy showers. With steep narrow
ridging, heavy rains would be shed at once to the
bottom of the deep furrows without over-saturating
the ridges, while the wet soil in the bottom of the
furrows would favor deep percolation with lateral capillary
flow taking place strongly under the ridges from the
furrows, carrying both moisture and soluble plant
food where they will be most completely and quickly
available. When the rain comes in heavy showers
each furrow may serve as a long reservoir which will
prevent washing and at the same time permit quick
penetration; the ridges never becoming flooded or
puddled, permit the soil air to escape readily as
the water from the furrows sinks, as it cannot easily
do in flat fields when the rains fall rapidly and
fill all of the soil pores, thus closing them to the
escape of air from below, which must take place before
the water can enter.
  
When rows are only twenty-four to twenty-eight inches
apart, ridging is not sufficiently more wasteful of
soil moisture, through greater evaporation because
of increased surface, to compensate for the other
advantages gained, and hence their practice, for their
conditions, appears sound.
  
The application of finely pulverized earth compost
to fields to be planted, and in some cases where the
fields were already planted, continued general after
leaving Shanhailkwan as it had been before. Compost
stacks were common in yards wherever buildings were
close enough to the track to be seen. Much of
the way about one-third of the fields were yet to
be, or had just been, planted and in a great majority
of these compost fertilizer had been laid down for
use on them, or was being taken to them in large heavy
carts drawn sometimes by three mules. Between
Sarhougon and Ningyuenchow fourteen fields thus fertilized
were counted in less than half a mile; ten others
in the next mile; eleven in the mile and a quarter
following. In the next two miles one hundred fields
were counted and just before reaching the station
we counted during five minutes, with watch in hand,
ninety-five fields to be planted, upon which this
fertilizer had been brought. In some cases the
compost was being spread in furrows between the rows
of a last year’s crop, evidently to be turned
under, thus reversing the position of the ridges.

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After passing Lienshan, where, the railway runs near
the sea, a sail was visible on the bay and many stacks
of salt piled about the evaporation fields were associated
with the revolving sail windmills already described.
Here, too, large numbers of cattle, horses, mules
and donkeys were grazing on the untilled low lands,
beyond which we traversed a section where all fields
were planted, where no fertilizer was piled in the
field but where many groups of men were busy hoeing,
sometimes twenty in a gang.
  
Chinese soldiers with bayonetted guns stood guard
at every railway station between Shanhaikwan and Mukden,
and from Chinchowfu our coach was occupied by some
Chinese official with guests and military attendants,
including armed soldiers. The official and his
guests were an attractive group of men with pleasant
faces and winning manners, clad in many garments of
richly figured silk of bright, attractive, but unobtrusive,
colors, who talked, seriously or in mirth, almost
incessantly. They took the train about one o’clock
and lunch was immediately served in Chinese style,
but the last course was not brought until nearly four
o’clock. At every station soldiers stood
in line in the attitude of salute until the official
car had passed.
  
Just before reaching Chinchowfu we saw the first planted
fields littered with stubble of the previous crop,
and in many instances such stubble was being gathered
and removed to the villages, large stacks having been
piled in the yards to be used either as fuel or in
the production of compost. As the train approached
Taling ho groups of men were hoeing in millet fields,
thirty in one group on one side and fifty in another
body on the other. Many small herds of cattle,
horses, donkeys and flocks of goats and sheep were
feeding along stream courses and on the unplanted
fields. Beyond the station, after crossing the
river, still another sand dune tract was passed, planted
with willows, millet occupying the level areas between
the dunes, and not far beyond, wide untilled flats
were crossed, on which many herds were grazing and
dotted with grave mounds as we neared Koupantze, where
a branch of the railway traverses the Liao plain to
the port of Newchwang. It was in this region
that there came the first suggestion of resemblance
to our marshland meadows; and very soon there were
seen approaching from the distance loads so green
that except for the large size one would have judged
them to be fresh grass. They were loads of cured
hay in the brightest green, the result, no doubt,
of curing under their dry weather conditions.
  
At Ta Hu Shan large quantities of grain in sacks were
piled along the tracks and in the freight yards, but
under matting shelters. Near here, too, large
three-mule loads of dry earth compost were going to
the fields and men were busy pulverizing and mixing
it on the threshing floors preparatory for use.
Nearly all crops growing were one or another of the
millets, but considerable areas were yet unplanted
and on these cattle, horses, mules and donkeys were
feeding and eight more loads of very bright new made
hay crossed the track.

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When the train reached Sinminfu where the railway
turns abruptly eastward to cross the Liao ho to reach
Mukden we saw the first extensive massing of the huge
bean cakes for export, together with enormous quantities
of soy beans in sacks piled along the railway and
in the freight yards or loaded on cars made up in trains
ready to move. Leaving this station we passed
among fields of grain looking decidedly yellow, the
first indication we had seen in China of crops nitrogen-hungry
and of soils markedly deficient in available nitrogen.
Beyond the next station the fields were decidedly
spotted and uneven as well as yellow, recalling conditions
so commonly seen at home and which had been conspicuously
absent here before. Crossing the Liao ho with
its broad channel of shifting sands, the river carrying
the largest volume of water we had yet seen, but the
stream very low and still characteristic of the close
of the dry season of semi-arid climates, we soon reached
another station where the freight yards and all of
the space along the tracks were piled high with bean
cakes and yet the fields about were reflecting the
impoverished condition of the soil through the yellow
crops and their uneven growth on the fields.
  
Since the Japanese-Russian war the shipments of soy
beans and of bean cake from Manchuria have increased
enormously. Up to this time there had been exports
to the southern provinces of China where the bean
cakes were used as fertilizers for the rice fields,
but the new extensive markets have so raised the price
that in several instances we were informed they could
not then afford to use bean cake as fertilizer.
From Newchwang alone, in 1905, between January 1st
and March 31st, there went abroad 2,286,000 pounds
of beans and bean cake, but in 1906 the amount had
increased to 4,883,000 pounds. But a report published
in the Tientsin papers as official, while we were
there, stated that the value of the export of bean
cake and soy beans from Dalny for the months ending
March 31st had been, in 1909, only $1,635,000, gold,
compared with $3,065,000 in the corresponding period
of 1908, and of $5,120,000 in 1907, showing a marked
decrease.
  
Edward C. Parker, writing from Mukden for the Review
of Reviews, stated: “The bean cake shipments
from Newchwang, Dalny and Antung in 1908 amounted
to 515,198 tons; beans, 239,298 tons; bean oil, 1930
tons; having a total value of $15,016,649 (U.
S. gold)”. According to the composition
of soy beans as indicated in Hopkins’ table of
analyses, these shipments of beans and bean cake would
remove an aggregate of 6171 tons of phosphorus, 10,097
tons of potassium, and 47,812 tons of nitrogen from
Manchurian soils as the result of export for that
year. Could such a rate have been maintained during
two thousand years there would have been sold from
these soils 20,194,000 tons of potassium; 12,342,000
tons of phosphorus and 95,624,000 tons of nitrogen;
and the phosphorus, were it thus exported, would have
exceeded more than threefold all thus far produced
in the United States; it would have exceeded the world’s
output in 1906 more than eighteen times, even assuming
that all phosphate rock mined was seventy-five per
cent pure.

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The choice of the millets and the sorghums as the
staple bread crops of northern China and Manchuria
has been quite as remarkable as the selection of rice
for the more southern latitudes, and the two together
have played a most important part in determining the
high maintenance efficiency of these people.
In nutritive value these grains rank well with wheat;
the stems of the larger varieties are extensively
used for both fuel and building material and the smaller
forms make excellent forage and have been used directly
for maintaining the organic content of the soil.
Their rapid development and their high endurance of
drought adapt them admirably to the climate of north
China and Manchuria where the rains begin only after
late June and where weather too cold for growth comes
earlier in the fall. The quick maturity of these
crops also permits them to be used to great advantage
even throughout the south, in their systems of multiple
cropping so generally adopted, while their great resistance
to drought, being able to remain at a standstill for
a long time when the soil is too dry for growth and
yet be able to push ahead rapidly when favorable rains
come, permits them to be used on the higher lands
generally where water is not available for irrigation.
  
In the Shantung province the large millet, sorghum
or kaoliang, yields as high as 2000 to 3000 pounds
of seed per acre, and 5600 to 6000 pounds of air-dry
stems, equal in weight to 1.6 to 1.7 cords of dry
oak wood. In the region of Mukden, Manchuria,
its average yield of seed is placed at thirty-five
bushels of sixty pounds weight per acre, and with
this comes one and a half tons of fuel or of building
material. Hosie states that, the kaoliang is the
staple food of the population of Manchuria and the
principal grain food of the work animals. The
grain is first washed in cold water and then poured
into a kettle with four times its volume of boiling
water and cooked for an hour, without salt, as with
rice. It is eaten with chopsticks with boiled
or salted vegetables. He states that an ordinary
servant requires about two pounds of this grain per
day, and that a workman at heavy labor will take double
the amount. A Chinese friend of his, keeping
five servants, supplied them with 240 pounds of millet
per month, together with 16 pounds of native flour,
regarded as sufficient for two days, and meat for
two days, the amount not being stated. Two of
the small millets (Setaria italica, and Panicum milliaceum),
wheat, maize and buckwheat are other grains which are
used as food but chiefly to give variety and change
of diet.
  
Very large quantities of matting and wrappings are
also made from the leaves of the large millet, which
serve many purposes corresponding with the rice mattings
and bags of Japan and southern China.

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The small millets, in Shantung, yield as high as 2700
pounds of seed and 4800 pounds of straw per acre.
In Japan, in the year 1906, there were grown 737,719
acres of foxtail, barnyard and proso millet, yielding
17,084,000 bushels of seed or an average of twenty-three
bushels per acre. In addition to the millets,
Japan grew, the same year, 5,964,300 bushels of buckwheat
on 394,523 acres, or an average of fifteen bushels
per acre. The next engraving, Fig. 205, shows
a crop of millet already six inches high planted between
rows of windsor beans which had matured about the
middle of June. The leaves had dropped, the beans
had been picked from the stems, and a little later,
when the roots had had time to decay the bean stems
would be pulled and tied in bundles for use as fuel
or for fertilizer.
  
We had reached Mukden thoroughly tired after a long
day of continuous close observation and writing.
The Astor House, where we were to stop, was three
miles from the station and the only conveyance to
meet the train was a four-seated springless, open,
semi-baggage carryall and it was a full hour lumbering
its way to our hotel. But here as everywhere
in the Orient the foreigner meets scenes and phases
of life competent to divert his attention from almost
any discomfort. Nothing could be more striking
than the peculiar mode the Manchu ladies have of dressing
their hair, seen in Fig. 206, many instances of which
were passed on the streets during this early evening
ride. It was fearfully and wonderfully done, laid
in the smoothest, glossiest black, with nearly the
lateral spread of the tail of a turkey cock and much
of the backward curve of that of the rooster; far
less attractive than the plainer, refined, modest,
yet highly artistic style adopted by either Chinese
or Japanese ladies.
  
The journey from Mukden to Antung required two days,
the train stopping for the night at Tsaohokow.
Our route lay most of the way through mountainous
or steep hilly country and our train was made up of
diminutive coaches drawn by a tiny engine over a three-foot
two-inch narrow gauge track of light rails laid by
the Japanese during the war with Russia, for the purpose
of moving their armies and supplies to the hotly contested
fields in the Liao and Sungari plains. Many of
the grades were steep, the curves sharp, and in several
places it was necessary to divide the short train to
enable the engines to negotiate them.
  
To the southward over the Liao plain the crops were
almost exclusively millet and soy beans, with a little
barley, wheat, and a few oats. Between Mukden
and the first station across the Hun river we had
passed twenty-four good sized fields of soy beans on
one side of the river and twenty-two on the other,
and before reaching the hilly country, after travelling
a distance of possibly fifteen miles, we had passed
309 other and similar fields close along the track.
In this distance also we had passed two of the monuments
erected by the Japanese, marking sites of their memorable
battles. These fields were everywhere flat, lying
from sixteen to twenty feet above the beds of the
nearly dry streams, and the cultivation was mostly
being done with horses or cattle.

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After leaving the plains country the railway traversed
a narrow winding valley less than a mile wide, with
gradient so steep that our train was divided.
Fully sixty per cent of the hill slopes were cultivated
nearly to the summit and yet rising apparently more
than one in three to five feet, and the uncultivated
slopes were closely wooded with young trees, few more
than twenty to thirty feet high, but in blocks evidently
of different ages. Beyond the pass many of the
cultivated slopes have walled terraces. We crossed
a large stream where railway ties were being rafted
down the river. Just beyond this river the train
was again divided to ascend a gradient of one in thirty,
reaching the summit by five times switching back,
and matched on the other side of the pass by a down
grade of one in forty.
  
At many of the farm houses in the narrow valleys along
the way large rectangular, flat topped compost piles
were passed, thirty to forty inches high and twenty,
thirty, forty and even in one case as much as sixty
feet square on the ground. More and more it became
evident that these mountain and hill lands were originally
heavily wooded and that the new growth springs up
quickly, developing rapidly. It was clear also
that the custom of cutting over these wooded areas
at frequent intervals is very old, not always in the
same stage of growth but usually when the trees are
quite small. Considerable quantities of cordwood
were piled at the stations along the railway and were
being loaded on the cars. This was always either
round wood or sticks split but once; and much charcoal,
made mostly from round wood or sticks split but once,
was being shipped in sacks shaped like those used
for rice, seen in Fig. 180. Some strips of the
forest growth had been allowed to stand undisturbed
apparently for twenty or more years, but most areas
have been cut at more frequent intervals, often apparently
once in three to five, or perhaps ten, years.
  
At several places on the rapid streams crossed, prototypes
of the modern turbine water-wheel were installed,
doing duty grinding beans or grain. As with native
machinery everywhere in China, these wheels were reduced
to the lowest terms and the principle put to work
almost unclothed. These turbines were of the downward
discharge type, much resembling our modern windmills,
ten to sixteen feet in diameter, set horizontally
on a vertical axis rising through the floor of the
mill, with the vanes surrounded by a rim, the water
dropping through the wheel, reacting when reflected
from the obliquely set vanes. American engineers
and mechanics would pronounce these very crude, primitive
and inefficient. A truer view would regard them
as examples of a masterful grasp of principle by some,
man who long ago saw the unused energy of the stream
and succeeded thus in turning it to account.

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Both days of our journey had been bright and very
warm and, although we took the train early in the
morning at Mukden, a young Japanese anticipated the
heat, entering the train clad only in his kimono and
sandals, carrying a suitcase and another bundle.
He rode all day, the most comfortably, if immodestly,
clad man on the train, and the next morning took his
seat in front of us clad in the same garb, but before
the train reached Antung he took down his suitcase
and then and there, deliberately attired himself in
a good foreign suit, folding his kimono and packing
it away with his sandals.
  
From Antung we crossed the Yalu on the ferry to New
Wiju at 6:30 A. M., June 22, and were then in quite
a different country and among a very different people,
although all of the railway officials, employes, police
and guards were Japanese, as they had been from Mukden.
At Antung and New Wiju the Yalu is a very broad slow
stream resembling an arm of the sea more than a river,
reminding one of the St. Johns at Jacksonville, Florida.
  
June 22nd proved to be one of the national festival
days in Korea, called “Swing day”, and
throughout our entire ride to Seoul the fields were
nearly all deserted and throngs of people, arrayed
in gala dress, appeared all along the line of the
railway, sometimes congregating in bodies of two to
three thousand or more, as seen in Fig. 207.
Many swings had been hung and were being enjoyed by
the young people. Boys and men were bathing in
all sorts of “swimming holes” and places.
So too, there were many large open air gatherings
being addressed by public speakers, one of which is
seen in Fig. 208.
  
Nearly everyone was dressed in white outer garments
made from some fabric which although not mosquito
netting was nearly as open and possessed of a remarkable
stiffness which seemed to take and retain every dent
with astonishing effect and which was sufficiently
transparent to reveal a third undergarment. The
full outstanding skirts of five Korean women may be
seen in Fig. 209, and the trousers which went with
these were proportionately full but tied close about
the ankles. The garments seemed to be possessed
of a powerful repulsion which held them quite apart
and away from the person, no doubt contributing much
to comfort. It was windy but one of those hot
sultry, sticky days, and it made one feel cool to see
these open garments surging in the wind.
  
The Korean men, like the Chinese, wear the hair long
but not braided in a queue. No part of the head
is shaved but the hair is wound in a tight coil on
the top of the head, secured by a pin which, in the
case of the Korean who rode in our coach from Mukden
to Antung, was a modern, substantial tenpenny wire
nail. The tall, narrow, conical crowns of the
open hats, woven from thin bamboo splints, are evidently
designed to accommodate this style of hair dressing
as well as to be cool.

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Here, too, as in China and Manchuria, nearly all crops
are planted in rows, including the cereals, such as
wheat, rye, barley and oats. We traversed first
a flat marshy country with sandy soil and water not
more than four feet below the surface where, on the
lowest areas a close ally of our wild flower-de-luce
was in bloom. Wheat was coining into head but
corn and millet were smaller than in Manchuria.
We had left New Wiju at 7:30 in the morning and at
8:15 we passed from the low land into a hill country
with narrow valleys. Scattering young pine, seldom
more than ten to twenty-five feet high, occupied the
slopes and as we came nearer the hills were seen to
be clothed with many small oak, the sprouts clearly
not more than one or two years old. Roofs of
dwellings in the country were usually thatched with
straw laid after the manner of shingles, as may be
seen in Fig. 210, where the hills beyond show the low
tree growth referred to, but here unusually dense.
Bundles of pine boughs, stacked and sheltered from
the weather, were common along the way and evidently
used for fuel.
  
At 8:25 we passed through the first tunnel and there
were many along the route, the longest requiring thirty
seconds for the passing of the train. The valley
beyond was occupied by fields of wheat where beans
were planted between the rows. Thus far none of
the fields had been as thoroughly tilled and well
cared for as those seen in China, nor were the crops
as good. Further along we passed hills where the
pines were all of two ages, one set about thirty feet
high and the others twelve to fifteen feet or less,
and among these were numerous oak sprouts. Quite
possibly these are used as food for the wild silkworms.
In some places appearances indicate that the oak and
other deciduous growth, with the grass, may be cut
annually and only the pines allowed to stand for longer
periods. As we proceeded southward and had passed
Kosui the young oak sprouts were seen to cover the
hills, often stretching over the slopes much like a
regular crop, standing at a height of two to four feet,
and fresh bundles of these sprouts were seen at houses
along the foot of the slopes, again suggesting that
the leaves may be for the tussur silkworms although
the time appears late for the first moulting.
After we had left Seoul, entering the broader valleys
where rice was more extensively grown, the using of
the oak boughs and green grass brought down from the
hill lands for green manure became very extensive.
  
After the winter and early spring crops have been
harvested the narrow ridges on which they are grown
are turned into the furrows by means of their simple
plow drawn by a heavy bullock, different from the
cattle in China but closely similar to those in Japan.
The fields are then flooded until they have the appearance
seen in Fig. 12. Over these flooded ridges the
green grass and oak boughs are spread, when the fields
are again plowed and the material worked into the

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wet soil. If this working is not completely successful
men enter the fields and tramp the surface until every
twig and blade is submerged. The middle section
in this illustration has been fitted and transplanted;
in front of it and on the left are two other fields
once plowed but not fertilized; those far to the right
have had the green manure applied and the ground plowed
a second time but not finished, and in the immediate
foreground the grass and boughs have been scattered
but the second plowing is not yet done.
  
We passed men and bullocks coming from the hill lands
loaded with this green herbage and as we proceeded
towards Fusan more and more of the hill area was being
made to contribute materials for green manure for
the cultivated fields. The foreground of Fig.
211 had been thus treated and so had the field in
Fig. 212, where the man was engaged in tramping the
dressing beneath the surface. In very many cases
this material was laid along the margin of the paddies;
in other cases it had been taken upon the fields as
soon as the grain was cut and was lying in piles among
the bundles; while in still other cases the material
for green manure had been carried between the rows
while the grain was still standing, but nearly ready
to harvest. In some fields a full third of a bushel
of the green stuff had been laid down at intervals
of three feet over the whole area. In other cases
piles of ashes alternated with those of herbage, and
again manure and ashes mixed had been distributed in
alternate piles with the green manure.
  
In still other cases we saw untreated straw distributed
through the fields awaiting application. At Shindo
this, straw had the appearance of having been dipped
in or smeared with some mixture, apparently of mud
and ashes or possibly of some compost which had been
worked into a thin paste with water.
  
After passing Keizan, mountain herbage had been brought
down from the hills in large bales on cleverly constructed
racks saddled to the backs of bullocks, and in one
field we saw a man who had just come to his little
field with an enormous load borne upon his easel-like
packing appliance. Thus we find the Koreans also
adopting the rice crop, which yields heavily under
conditions of abundant water; we find them supplementing
a heavy summer rainfall with water from their hills,
and bringing to their fields besides both green herbage
for humus and organic matter, and ashes derived from
the fuel coming also from the hills, in these ways
making good the unavoidable losses, through intense
cropping.
  
The amount of forest growth in Korea, as we saw it,
in proximity to the cultivated valleys, is nowhere
large and is fairly represented in Figs. 210, 213
and 214. There were clear evidences of periodic
cutting and considerable, amounts of cordwood split
from timber a foot through were being brought to the
stations on the backs of cattle. In some places
there was evident and occasionally very serious soil
erosion, as may be seen in Fig. 214, one such region
being passed just before reaching Kinusan, but generally
the hills are well rounded and covered with a low
growth of shrubs and herbaceous plants.

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Southernmost Korea has the latitude of the northern
boundary of South Carolina, Georgia, Alabama and Mississippi,
while the northeast corner attains that of Madison,
Wisconsin, and the northern boundary of Nebraska,
the country thus spanning some nine degrees and six
hundred miles of latitude. It has an area of some
82,000 square miles, about equaling the state of Minnesota,
but much of its surface is occupied by steep hill
and mountain land. The rainy season had not yet
set in, June 23rd. Wheat and the small grains
were practically all harvested southward of Seoul and
the people were everywhere busy with their flails
threshing in the open, about the dwellings or in the
fields, four flails often beating together on the
same lot of grain. As we journeyed southward the
valleys and the fields became wider and more extensive,
and the crops, as well as the cultural methods, were
clearly much better.
  
Neither the foot-power, animal-power, nor the wooden
chain pump of the Chinese were observed in Korea in
use for lifting water, but we saw many instances of
the long handled, spoonlike swinging scoop hung over
the water by a cord from tall tripods, after the manner
seen in Fig. 215, each operated by one man and apparently
with high efficiency for low lifts. Two instances
also were observed of the form of lift seen in Fig.
173, where the man walks the circumference of the
wheel, so commonly observed in Japan. Much hemp
was being grown in southern Korea but everywhere on
very small isolated areas which flecked the landscape
with the deepest green, each little field probably
representing the crop of a single family.
  
It was 6:30 P. M. when our train reached Fusan after
a hot and dusty ride. The service had been good
and fairly comfortable but the ice-water tanks of
American trains were absent, their place being supplied
by cooled bottled waters of various brands, including
soda-water, sold by Japanese boys at nearly every important
station. Close connection was made by trains
with steamers to and from Japan and we went directly
on board the Iki Maru which was to weigh anchor for
Moji and Shimonoseki at 8 P. M. Although small, the
steamer was well equipped, providing the best of service.
We were fortunate in having a smooth passage, anchoring
at 6:30 the next morning and making close connection
with the train for Nagasaki, landing at the wharf
with the aid of a steam launch.
  
Our ride by train through the island of Kyushu carried
us through scenes not widely different from those
we had just left. The journey was continuously
among fields of rice, with Korean features strongly
marked but usually under better and more intensified
culture, and the season, too, was a little more advanced.
Here the plowing was being done mostly with horses
instead of the heavy bullocks so exclusively employed
in Korea. Coming from China into Korea, and from
there into Japan, it appeared very clear that in agricultural
methods and appliances the Koreans and Japanese are
more closely similar than the Chinese and Koreans,
and the more we came to see of the Japanese methods
the more strongly the impression became fixed that
the Japanese had derived their methods either from
the Koreans or the Koreans had taken theirs more largely
from Japan than from China.

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It was on this ride from Moji to Nagasaki that we
were introduced to the attractive and very satisfactory
manner of serving lunches to travelers on the trains
in Japan. At important stations hot tea is brought
to the car windows in small glazed, earthenware teapots
provided with cover and bail, and accompanied with
a teacup of the same ware. The set and contents
could be purchased for five sen, two and a half cents,
our currency. All tea is served without milk or
sugar. The lunches were very substantial and put
together in a neat sanitary manner in a three-compartment
wooden box, carefully made from clear lumber joined
with wooden pegs and perfect joints. Packed in
the cover we found a paper napkin, toothpicks and a
pair of chopsticks. In the second compartment
there were thin slices of meat, chicken and fish,
together with bamboo sprouts, pickles, cakes and small
bits of salted vegetables, while the lower and chief
compartment was filled with rice cooked quite stiff
and without salt, as is the custom in the three countries.
The box was about six inches long, four inches deep
and three and a half inches wide. These lunches
are handed to travelers neatly wrapped in spotless
thin white paper daintily tied with a bit of color,
all in exchange for 25 sen,—­12.5 cents.
Thus for fifteen cents the traveler is handed, through
the car window, in a respectful manner, a square meal
which he may eat at his leisure.

**XVII**

**RETURN TO JAPAN**  
We had returned to Japan in the midst of the first
rainy season, and all the day through, June 25th,
and two nights, a gentle rain fell at Nagasaki, almost
without interruption. Across the narrow street
from Hotel Japan were two of its guest houses, standing
near the front of a wall-faced terrace rising twenty-eight
feet above the street and facing the beautiful harbor.
They were accessible only by winding stone steps shifting
on paved landings to continue the ascent between retaining
walls overhung with a wealth of shrubbery clothed
in the densest foliage, so green and liquid in the
drip of the rain, that one almost felt like walking
edgewise amid stairs lest the drip should leave a
stain. Over such another series of steps, but
longer and more winding, we found our way to the American
Consulate where in the beautifully secluded quarters
Consul-General Scidmore escaped many annoyances of
settling the imagined petty grievances arising between
American tourists and the ricksha boys.
  
Through the kind offices of the Imperial University
of Sapporo and of the National Department of Agriculture
and Commerce, Professor Tokito met us at Nagasaki,
to act as escort through most of the journey in Japan.
Our first visit was to the prefectural Agricultural
Experiment Station at Nagasaki. There are four
others in the four main islands, one to an average
area of 4280 square miles, and to each 1,200,000 people.
The island of Kyushu, whose latitude is that of middle

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Mississippi and north Louisiana, has two rice harvests,
and gardeners at Nagasaki grow three crops, each year.
The gardener and his family work about five tan, or
a little less than one and one-quarter acres, realizing
an annual return of some $250 per acre. To maintain
these earnings fertilizers are applied rated worth
$60 per acre, divided between the three crops, the
materials used being largely the wastes of the city,
animal manure, mud from the drains, fuel ashes and
sod, all composted together. If this expenditure
for fertilizers appears high it must be remembered
that nearly the whole product is sold and that there
are three crops each year. Such intense culture
requires a heavy return if large yields are maintained.
Good agricultural lands were here valued at 300 yen
per tan, approximately $600 per acre.
  
When returning toward Moji to visit the Agricultural
Experiment Station of Fukuoka prefecture, the rice
along the first portion of the route was standing
about eight inches above the water. Large lotus
ponds along the way occupied areas not readily drained,
and the fringing fields between the rice paddies and
the untilled hill lands were bearing squash, maize,
beans and Irish potatoes. Many small areas had
been set to sweet potatoes on close narrow ridges,
the tops of which were thinly strewn with green grass,
or sometimes with straw or other litter, for shade
and to prevent the soil from washing and baking in
the hot sun after rains. At Kitsu we passed near
Government salt works, for the manufacture of salt
by the evaporation of sea water, this industry in
Japan, as in China, being a Government monopoly.
  
Many bundles of grass and other green herbage were
collected along the way, gathered for use in the rice
fields. In other cases the green manure had already
been spread over the flooded paddies and was being
worked beneath the surface, as seen in Fig. 216.
At this time the hill lands were clothed in the richest,
deepest green but the tree growth was nowhere large
except immediately about temples, and was usually
in distinct small areas with sharp boundaries occasioned
by differences in age. Some tracts had been very
recently cut; others were in their second, third or
fourth years; while others still carried a growth
of perhaps seven to ten years. At one village
many bundles of the brush fuel had been gathered from
an adjacent area, recently cleared.
  
A few fields were still bearing their crop of soy
beans planted in February between rows of grain, and
the green herbage was being worked into the flooded
soil, for the crop of rice. Much compost, brought
to the fields, was stacked with layers of straw between,
laid straight, the alternate courses at right angles,
holding the piles in rectangular form with vertical
sides, some of which were four to six feet high and
the layers of compost about six inches thick.
  
Just before reaching Tanjiro, a region is passed where
orchards of the candleberry tree occupy high leveled
areas between rice paddies, after the manner described
for the mulberry orchards in Chekiang, China.
These trees, when seen from a distance, have quite
the appearance of our apple orchards.

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At the Fukuoka Experiment Station we learned that
the usual depth of plowing for the rice fields is
three and a half to four and a half inches, but that
deeper plowing gives somewhat larger yields. As
an average of five years trials, a depth of seven
to eight inches increased the yield from seven to
ten per cent over that of the usual depth. In
this prefecture grass from the bordering hill lands
is applied to the rice fields at rates ranging from
3300 to 16,520 pounds green weight per acre, and,
according to analyses given, these amounts would carry
to, the fields from 18 to 90 pounds of nitrogen; 12.4
to 63.2 pounds of potassium, and 2.1 to 10.6 pounds
of phosphorus per acre.
  
Where bean cake is used as a fertilizer the applications
may be at the rate of 496 pounds per acre, carrying
33.7 pounds of nitrogen, nearly 5 pounds of phosphorus
and 7.4 pounds of potassium. The earth composts
are chiefly applied to the dry land fields and then
only after they are well rotted, the fermentation
being carried through at least sixty days, during
which the material is turned three times for aeration,
the work being done at the home. When used on
the rice fields where water is abundant the composts
are applied in a less fermented condition.
  
The best yields of rice in this prefecture are some
eighty bushels per acre, and crops of barley may even
exceed this, the two crops being grown the same year,
the rice following the barley. In most parts
of Japan the grain food of the laboring people is about
70 per cent naked barley mixed with 30 per cent of
rice, both cooked and used in the same manner.
The barley has a lower market value and its use permits
a larger share of the rice to be sold as a money crop.
  
The soils are fertilized for each crop every year
and the prescription for barley and rice recommended
by the Experiment Station, for growers in this prefecture,
is indicated by the following table:
 *Fertilization* *fornaked* *barley*.   
Pounds per acre.   
Fertilizers. N P K  
Manure compost 6,613 33.0 7.4 33.8  
Rape seed cake 330 16.7 2.8 3.5  
Night soil 4,630 26.4 2.6 10.2  
Superphosphate 132 9.9  
----------------------  
Sum 11,705 76.1 22.7 47.5
 *Fertilization* *forpaddy* *rice*.
  
Manure compost 5,291 26.4 5.9 27.1  
Green manure,  
 soy beans 3,306 19.2 1.1
19.6  
Soy bean cake 397 27.8 1.7 6.4  
Superphosphate 198 12.8  
 ----------------------  
 Sum
9,192 73.4 21.5 53.1  
 ======
===== ==== =====  
Total for year 20,897 149.5 44.2 100.6
  
Where these recommendations are followed there is
an annual application of fertilizer material which
aggregates some ten tons per acre, carrying about
150 pounds of nitrogen, 44 pounds of phosphorus and
100 pounds of potassium. The crop yields which
have been associated with these applications on the
Station fields are about forty-nine bushels of barley
and fifty bushels of rice per acre.

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The general rotation recommended for this portion
of Japan covers five years and consists of a crop
of wheat or naked barley the first two years with
rice as the summer crop; in the third year genge,
“pink clover” (Astragalus sinicus) or some
other legume for green manure is the winter crop,
rice following in the summer; the fourth year rape
is the winter crop, from which the seed is saved and
the ash of the stems returned to the soil, or rarely
the stems themselves may be turned under; on the fifth
and last year of the rotation the broad kidney or
windsor bean is the winter crop, preceding the summer
crop of rice. This rotation is not general yet
in the practice of the farmers of the section, they
choosing rape or barley and in February plant windsor
or soy beans between the rows for green manure to
use when the rice comes on.
  
It was evident from our observations that the use
of composts in fertilizing was very much more general
and extensive in China than it was in either Korea
or Japan, but, to encourage the production and use
of compost fertilizers, this and other prefectures
have provided subsidies which permit the payment of
$2.50 annually to those farmers who prepare and use
on their land a compost heap covering twenty to forty
square yards, in accordance with specified directions
given.
  
The agricultural college at Fukuoka was not in session
the day of our visit, it being a holiday usually following
the close of the last transplanting season. One
of the main buildings of the station and college is
seen in Fig. 217, and Figs. 218, 219 and 220, placed
together from left to right in the order of their numbers,
form a panoramic view of the station grounds and buildings
with something of the beautiful landscape setting.
There is nowhere in Japan the lavish expenditure of
money on elaborate and imposing architecture which
characterizes American colleges and stations, but in
equipment for research work, both as to professional
staff and appliances, they compare favorably with
similar institutions in America. The dormitory
system was in vogue in the college, providing room
and board at eight yen per month or four dollars of
our currency. Eight students were assigned to
one commodious room, each provided with a study table,
but beds were mattresses spread upon the matting floor
at night and compactly stored on closet shelves during
the day.
  
The Japanese plow, which is very similar to the Korean
type, may be seen in Fig. 221, the one on the right
costing 2.5 yen and the other 2 yen. With the
aid of the single handle and the sliding rod held in
the right hand, the course of the plow is directed
and the plow tilted in either direction, throwing
the soil to the right or the left.
  
The nursery beds for rice breeding experiments and
variety tests by this station are shown in Fig. 222.
Although these plots are flooded the marginal plants,
adjacent to the free water paths, were materially
larger than those within and had a much deeper green
color, showing better feeding, but what seemed most
strange was the fact that these stronger plants are
never used in transplanting, as they do not thrive
as well as those less vigorous.

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We left the island of Kyushu in the evening of June
29th, crossing to the main island of Honshu, waiting
in Shimonoseki for the morning train. The rice-planted
valleys near Shimonoseki were relatively broad and
the paddies had all been recently set in close rows
about a foot apart and in hills in the rows.
Mountain and hill lands were closely wooded, largely
with coniferous trees about the base but toward and
at the summits, especially on the South slopes, they
were green only with herbage cut for fertilizing and
feeding stock. Many very small trees, often not
more than one foot high, were growing on the recently
cut-over areas; tall slender graceful bamboos clustered
along the way and everywhere threw wonderful beauty
into the landscape. Cartloads of their slender
stems, two to four inches in diameter at the base
and twenty or more feet long, were moving along the
generally excellent, narrow, seldom fenced roads, such
as seen in Fig. 223. On the borders and pathways
between rice paddies many small stacks of straw were
in waiting to be laid between the rows of transplanted
rice, tramped beneath the water and overspread with
mud to enrich the soil. The farmers here, as
elsewhere, must contend against the scouring rush,
varieties of grass and our common pigweeds, even in
the rice fields. The large area of mountain and
hill land compared with that which could be tilled,
and the relatively small area of cultivated land not
at this time under water and planted to rice persisted
throughout the journey.
  
If there could be any monotony for the traveller new
to this land of beauty it must result from the quick
shifting of scenes and in the way the landscapes are
pieced together, out-doing the craziest patchwork
woman ever attempted; the bits are almost never large;
they are of every shape, even puckered and crumpled
and tilted at all angles. Here is a bit of the
journey: Beyond Habu the foothills are thickly
wooded, largely with conifers. The valley is extremely
narrow with only small areas for rice. Bamboo
are growing in congenial places and we pass bundles
of wood cut to stove length, as seen in Fig. 224.
Then we cross a long narrow valley practically all
in rice, and then another not half a mile wide, just
before reaching Asa. Beyond here the fields become
limited in area with the bordering low hills recently
cut over and a new growth springing up over them in
the form of small shrubs among which are many pine.
Now we are in a narrow valley between small rice fields
or with none at all, but dash into one more nearly
level with wide areas in rice chiefly on one side
of the track just before reaching Onoda at 10:30 A.
M. and continuing three minutes ride beyond, when we
are again between hills without fields and where the
trees are pine with clumps of bamboo. In four
minutes more we are among small rice paddies and at
10:35 have passed another gap and are crossing another
valley checkered with rice fields and lotus ponds,
but in one minute more the hills have closed in, leaving

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only room for the track. At 10:37 we are running
along a narrow valley with its terraced rice paddies
where many of the hills show naked soil among the
bamboo, scattering pine and other small trees; then
we are out among garden patches thickly mulched with
straw. At 10:38 we are between higher hills with
but narrow areas for rice stretching close along the
track, but in two minutes these are passed and we are
among low hills with terraced dry fields. At 10:42
we are spinning along the level valley with its rice,
but are quickly out again among hills with naked soil
where erosion was marked. This is just before
passing Funkai where we are following the course of
a stream some sixty feet wide with but little cultivated
land in small areas. At 10:47 we are again passing
narrow rice fields near the track where the people
are busy weeding with their hands, half knee-deep
in water. At 10:53 we enter a broader valley stretching
far to the south and seaward, but we had crossed it
in one minute, shot through another gap, and at 10:55
are traversing a much broader valley largely given
over to rice, but where some of the paddies were bearing
matting rush set in rows and in hills after the manner
of rice. It is here we pass Oyou and just beyond
cross a stream confined between levees built some
distance back from either bank. At 11:17 this
plain is left and we enter a narrow valley without
fields. Thus do most of the agricultural lands
of Japan lie in the narrowest valleys, often steeply
sloping, and into which jutting spurs create the greatest
irregularity of boundary and slope.
  
The journey of this day covered 350 miles in fourteen
hours, all of the way through a country of remarkable
and peculiar beauty which can be duplicated nowhere
outside the mountainous, rice-growing Orient and there
only during fifteen days closing the transplanting
season. There were neither high mountains nor
broad valleys, no great rivers and but few lakes;
neither rugged naked rocks, tall forest trees nor
wide level fields reaching away to unbroken horizons.
But the low, rounded, soil-mantled mountain tops clothed
in herbaceous and young forest growth fell everywhere
into lower hills and these into narrow steep valleys
which dropped by a series of water-level benches,
as seen in Fig. 225, to the main river courses.
Each one of these millions of terraces, set about by
its raised rim, was a silvery sheet of water dotted
in the daintiest manner with bunches of rice just
transplanted, but not so close nor yet so high and
over-spreading as to obscure the water, yet quite
enough to impart to the surface a most delicate sheen
of green; and the grass-grown narrow rims retaining
the water in the basins, cemented them into series
of the most superb mosaics, shaped into the valley
bottoms by artizan artists perhaps two thousand years
before and maintained by their descendants through
all the years since, that on them the rains and fertility
from the mountains and the sunshine from heaven might

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be transformed by the rice plant into food for the
families and support for the nation. Two weeks
earlier the aspect of these landscapes was very different,
and two weeks later the reflecting water would lie
hidden beneath the growing and rapidly developing
mantle of green, to go on changing until autumn, when
all would be overspread with the ripened harvest of
grain. And what intensified the beauty of it
all was the fact that only along the widest valley
bottoms were the mosaics level, except the water surface
of each individual unit and these were always small.
At one time we were riding along a descending series
of steps and then along another rising through a winding
valley to disappear around a projecting spur, and
anywhere in the midst of it all might be standing
Japanese cottages or villas with the water and the
growing rice literally almost against the walls, as
seen in Fig. 226, while a near-by high terrace might
hold its water on a level with the chimney-tops.
Can one wonder that the Japanese loves his country
or that they are born and bred landscape artists?
  
Just before reaching Hongo there were considerable
areas thrown into long narrow, much-raised, east and
west beds under covers of straw matting inclined at
a slight angle toward the south, some two feet above
the ground but open toward the north. What crop
may have been grown here we did not learn but the
matting was apparently intended for shade, as it was
hot midsummer weather, and we suspect it may have
been ginseng. It was here, too, that we came into
the region of the culture of matting rush, extensively
grown in Hiroshima and Okayama prefectures, but less
extensively all over the empire. As with rice,
the rush is first grown in nursery beds from which
it is transplanted to the paddies, one acre of nursery
supplying sufficient stock for ten acres of field.
The plants are set twenty to thirty stalks in a hill
in rows seven inches apart with the hills six inches
from center to center in the row. Very high fertilization
is practiced, costing from 120 to 240 yen per acre,
or $60 to $120 annually, the fertilizer consisting
of bean cake and plant ashes, or in recent years,
sometimes of sulphate of ammonia for nitrogen, and
superphosphate of lime. About ten per cent of
the amount of fertilizer required for the crop is
applied at the time of fitting the ground, the balance
being administered from time to time as the season
advances. Two crops of the rush may be taken from
the same ground each year or it is grown in rotation
with rice, but most extensively on the lands less
readily drained and not so well suited for other crops.
Fields of the rush, growing in alternation with rice,
are seen in Fig. 45, and in Fig. 227, with the Government
salt fields lying along the seashore beyond.
  
With the most vigorous growth the rush attain a height
exceeding three feet and the market price varies materially
with the length of the stems. Good yields, under
the best culture, may be as high as 6.5 tons per acre
of the dry stems but the average yield is less, that
of 1905 being 8531 pounds, for 9655 acres, The value
of the product ranges from $120 to $200 per acre.

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It is from this material that mats are woven in standard
sizes, to be laid over padding, upholstering the floors
which are the seats of all classes in Japan, used
in the manner seen in Fig. 228 and in Fig. 229, which
is a completely furnished guest room in a first class
Japanese inn, finished in natural unvarnished wood,
with walls of sliding panels of translucent paper,
which may open upon a porch, into a hallway or into
another apartment; and with its bouquet, which may
consist of a single large shapely branch of the purple
leaved maple, having the cut end charred to preserve
it fresh for a longer time, standing in water in the
vase.
  
“Two little maids I’ve heard of, each
with a pretty taste, Who had two little rooms to fix
and not an hour to waste. Eight thousand miles
apart they lived, yet on the selfsame day The one in
Nikko’s narrow streets, the other on Broadway,
They started out, each happy maid her heart’s
desire to find, And her own dear room to furnish just
according to her mind.
  
When Alice went a-shopping, she bought a bed of brass,
A bureau and some chairs and things and such a lovely
glass To reflect her little figure—­with
two candle brackets near—­ And a little dressing
table that she said was simply dear! A book shelf
low to hold her books, a little china rack, And then,
of course, a bureau set and lots of bric-a-brac; A
dainty little escritoire, with fixings all her own
And just for her convenience, too, a little telephone.
Some oriental rugs she got, and curtains of madras,
With ‘cunning’ ones of lace inside, to
go against the glass; And then a couch, a lovely one,
with cushions soft to crush, And forty pillows, more
or less, of linen, silk and plush; Of all the ornaments
besides I couldn’t tell the half, But wherever
there was nothing else, she stuck a photograph.
And then, when all was finished, she sighed a little
sigh, And looked about with just a shade of sadness
in her eye: ’For it needs a statuette or
so—­a fern—­a silver stork Oh,
something, just to fill it up!’ said Alice of
New York.
  
When little Oumi of Japan went shopping, pitapat,
She bought a fan of paper and a little sleeping mat;
She set beside the window a lily in a vase, And looked
about with more than doubt upon her pretty face:
’For, really—­don’t you think
so?—­with the lily and the fan. It’s
a little overcrowded!’ said Oumi of Japan.”
  
(Margaret Johnson in St. Nicholas Magazine)
  
In the rural homes of Japan during 1906 there were
woven 14,497,058 sheets of these floor mats and 6,628,772
sheets of other matting, having a combined value of
$2,815,040, and in addition, from the best quality
of rush grown upon the same ground, aggregating 7657
acres that year, there were manufactured for the export
trade, fancy mattings, having the value of $2,274,131.
Here is a total value, for the product of the soil
and for the labor put into the manufacture, amounting
to $664 per acre for the area named.

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At the Akashi agricultural experiment station, under
the Directorship of Professor Ono, we saw some of
the methods of fruit culture as practiced in Japan.
He was conducting experiments with the object of improving
methods of heading and training pear trees, to which
reference was made on page 22. A study was also
being made of the advantages and disadvantages associated
with covering the fruit with paper bags, examples
of which are seen in Figs. 6 and 7. The bags
were being made at the time of our visit, from old
newspapers cut, folded and pasted by women. Naked
cultivation was practiced in the orchard, and fertilizers
consisting of fish guano and superphosphate of lime
were being applied twice each year in amounts aggregating
a cost of twenty-four dollars per acre.
  
Pear orchards of native varieties, in good bearing,
yield returns of 150 yen per tan, and those of European
varieties, 200 yen per tan, which is at the rate of
$300 and $400 per acre. The bibo, so extensively
grown in China was being cultivated here also and was
yielding about $320 per acre.
  
It was here that we first met the cultivation of a
variety of burdock grown from the seed, three crops
being taken each season where the climate is favorable,
or as one of three in the multiple crop system.
It is grown for the root, yielding a crop valued at
$40 to $50 per acre. One crop, planted, in March,
was being harvested July 1st.
  
During our ride to Akashi on the early morning train
we passed long processions of carts drawn by cattle,
horses or by men, moving along the country road which
paralleled the railway, all loaded with the waste
of the city of Kobe, going to its destination in the
fields, some of it a distance of twelve miles, where
it was sold at from 54 cents to $1.63 per ton.
  
At several places along our route from Shimonoseki
to Osaka we had observed the application of slacked
lime to the water of the rice fields, but in this
prefecture, Hyogo, where the station is located, its
use was prohibited in 1901, except under the direction
of the station authorities, where the soil was acid
or where it was needed on account of insect troubles.
Up to this time it had been the custom of farmers
to apply slacked lime at the rate of three to five
tons per acre, paying for it $4.84 per ton. The
first restrictive legislation permitted the use of
82 pounds of lime with each 827 pounds of organic
manure, but as the farmers persisted in using much
larger quantities, complete prohibition was resorted
to.
  
Reference has been made to subsidies encouraging the
use of composts, and in this prefecture prizes are
awarded for the best compost heaps in each county,
examinations being made by a committee. The composts
receiving the four highest awards in each county are
allowed to compete with those in other counties for
a prefectural prize awarded by another committee.
  
The “pink clover” grown in Hyogo after
rice, as a green manure crop, yields under favorable
conditions twenty tons of the green product per acre,
and is usually applied to about three times the area
upon which it grew, at the rate of 6.6 tons per acre,
the stubble and roots serving for the ground upon
which the crop grew.

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On July 3rd we left Osaka, going south through Sakai
to Wakayama, thence east and north to the Nara Experiment
Station. After passing the first two stations
the route lay through a very flat, highly cultivated
garden section with cucumbers trained on trellises,
many squash in full bloom, with fields of taro, ginger
and many other vegetables. Beyond Hamadera considerable
areas of flat sandy land had been set close with pine,
but with intervening areas in rice, where the growers
were using the revolving weeder seen in Fig. 14.
At Otsu broad areas are in rice but here worked with
the short handled claw weeders, and stubble from a
former crop had been drawn together into small piles,
seen in Fig. 230, which later would be carefully distributed
and worked beneath the mud.
  
Much of the mountain lands in this region, growing
pine, is owned by private parties and the growth is
cut at intervals of ten, twenty or twenty-five years,
being sold on the ground to those who will come and
cut it at a price of forty sen for a one-horse load,
as already described, page 159.
  
The course from here was up the rather rapidly rising
Kiigawa valley where much water was being applied
to the rice fields by various methods of pumping,
among them numerous current wheels; an occasional
power-pump driven by cattle; and very commonly the
foot-power wheel where the man walks on the circumference,
steadying himself with a long pole, as seen in the
field, Fig. 231. It was here that a considerable
section of the hill slope had been very recently cut
over, the area showing light in the engraving.
It was in the vicinity of Hashimoto on this route,
too, that the two beautiful views reproduced in Figs.
151 and 152 were taken.
  
At the experiment station it was learned that within
the prefecture of Nara, having a population of 558,314,
and 107,574 acres of cultivated land, two-thirds of
this was in paddy rice. Within the province there
are also about one thousand irrigation reservoirs
with an average depth of eight feet. The rice
fields receive 16.32 inches of irrigation water in
addition to the rain.
  
Of the uncultivated hill lands, some 2500 acres contribute
green manure for fertilization of fields. Reference
has been made to the production of compost for fertilizers
on page 211. The amount recommended in this prefecture
as a yearly application for two crops grown is:
  
Organic matter 3,711 to 4,640 lbs. per acre  
Nitrogen 105 to 131 lbs. per acre  
Phosphorus 35 to 44 lbs. per acre  
Potassium 56 to 70 lbs. per acre
  
These amounts, on the basis of the table, p. 214,
are nearly sufficient for a crop of thirty bushels
of wheat, followed by one of thirty bushels of rice,
the phosphorus being in excess and the potassium not
quite enough, supposing none to be derived from other
sources.

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At the Nara hotel, one of the beautiful Japanese inns
where we stopped, our room opened upon a second story
veranda from which one looked down upon a beautiful,
tiny lakelet, some twenty by eighty feet, within a
diminutive park scarcely more than one hundred by two
hundred feet, and the lakelet had its grassy, rocky
banks over-hung with trees and shrubs planted in all
the wild disorder and beauty of nature; bamboo, willow,
fir, pine, cedar, red-leaved maple, catalpa, with
other kinds, and through these, along the shore, wound
a woodsy, well trodden, narrow footpath leading from
the inn to a half hidden cottage apparently quarters
for the maids, as they were frequently passing to
and fro. A suggestion of how such wild beauty
is brought right to the very doors in Japan may be
gained from Fig. 232, which is an instance of parking
effect on a still smaller scale than that described.
  
On the morning of July 6th, with two men for each
of our rickshas, we left the Yaami hotel for the Kyoto
Experiment station, some two miles to the southwest
of the city limits. As soon as we had entered
upon the country road we found ourselves in a procession
of cart men each drawing a load of six large covered
receptacles of about ten gallons capacity, and filled
with the city’s waste. Before reaching
the station we had passed fifty-two of these loads,
and on our return the procession was still moving
in the same direction and we passed sixty-one others,
so that during at least five hours there had moved
over this section of road leading into the country,
away from the city, not less than ninety tons of waste;
along other roadways similar loads were moving.
These freight carts and those drawn by horses and
bullocks were all provided with long racks similar
to that illustrated in Fig. 108, page 197, and when
the load is not sufficient to cover the full length
it is always divided equally and placed near each
end, thus taking advantage of the elasticity of the
body to give the effect of springs, lessening the
draft and the wear and tear,
  
One of the most common commodities coming into the
city along the country roads was fuel from the hill
lands, in split sticks tied in bundles as represented
in Fig. 224; as bundles of limbs twenty-four to thirty
inches, and sometimes four to six feet, long; and in
the form of charcoal made from trunks and stems one
and a half inches to six inches long, and baled in
straw matting. Most of the draft animals used
in Japan are either cows, bulls or stallions; at least
we saw very few oxen and few geldings.
  
As early as 1895 the Government began definite steps
looking to the improvement of horse breeding, appointing
at that time a commission to devise comprehensive
plans. This led to progressive steps finally
culminating in 1906 in the Horse Administration Bureau,
whose duties were to extend over a period of thirty
years, divided into two intervals, the first, eighteen
and the second, twelve years. During the first
interval it is contemplated that the Government shall
acquire 1,500 stallions to be distributed throughout
the country for the use of private individuals, and
during the second period it is the expectation that
the system will have completely renovated the stock
and familiarized the people with proper methods of
management so that matters may be left in their hands.

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As our main purpose and limited time required undivided
attention to agricultural matters, and of these to
the long established practices of the people, we could
give but little time to sight-seeing or even to a
study of the efforts being made for the introduction
of improved agricultural methods and practices.
But in the very old city of Kyoto, which was the seat
of the Mikado’s court from before 800 A. D.
until 1868, we did pay a short visit to the Kiyomizu
temple, situated some three hundred yards south from
the Yaami hotel, which faces the Maruyaami park with
its centuries-old giant cherry tree, having a trunk
of more than four feet through and wide spreading
branches, now much propped up to guard against accident,
as seen in Fig. 233. These cherry trees are very
extensively used for ornamental purposes in Japan
with striking effect. The tree does not produce
an edible fruit, but is very beautiful when in full
bloom, as may be seen from Fig. 234. It was these
trees that were sent by the Japanese government to
this country for use at Washington but the first lot
were destroyed because they were found to be infested
and threatened danger to native trees.
  
Kyoto stands amid surroundings of wonderful beauty,
the site apparently having been selected with rare
acumen for its possibilities in large landscape effects,
and these have been developed with that fullness and
richness which the greatest artists might be content
to approach. We are thinking particularly of the
Kiyomizu-dera, or rather of the marvelous beauty of
tree and foliage which has overgrown it and swept
far up and over the mountain summit, leaving the temple
half hidden at the base. No words, no brush,
no photographic art can transfer the effect. One
must see to feel the influence for which it was created,
and scores of people, very old and very young, nearly
all Japanese, and more of them on that day from the
poorer rather than from the well-to-do class, were
there, all withdrawing reluctantly, like ourselves,
looking backward, under the spell. So potent
and impressive was that something from the great overshadowing
beauty of the mountain, that all along up the narrow,
shop-lined street leading to the gateway of the temple,
seen in Fig. 235, the tiniest bits of park effect were
flourishing in the most impossible situations; and
as Professor Tokito and myself were coming away we
chanced upon six little roughly dressed lads laying
out in the sand an elaborate little park, quite nine
by twelve feet. They must have been at it hours,
for there were ponds, bridges, tiny hills and ravines
and much planting in moss and other little greens.
So intent on their task were they that we stood watching
full two minutes before our presence attracted their
attention, and yet the oldest of the group must have
been under ten years of age.

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One partly hidden view of the temple is seen in Fig.
236, the dense mountain verdure rising above and beyond
it. And then too, within the temple, as the peasant
men and women came before the shrine and grasped the
long depending rope knocker, with the heavy knot in
front of the great gong, swinging it to strike three
rings, announcing their presence before their God,
then kneeling to offer prayers, one could not fail
to realize the deep sincerity and faith expressed
in face and manner, while they were oblivious to all
else. No Christian was ever more devout and one
may well doubt if any ever arose from prayer more
uplifted than these. Who need believe they did
not look beyond the imagery and commune with the Eternal
Spirit?
  
A third view of the same temple, showing resting places
beneath the shade, which serve the purpose of lawn
seats in our parks, is seen in Fig. 237.
  
That a high order of the esthetic sense is born to
the Japanese people; that they are masters of the
science of the beautiful; and that there are artists
among them capable of effective and impressive results,
is revealed in a hundred ways, and one of these is
the iris garden of Fig. 238. One sees it here
in the bulrushes which make the iris feel at home;
in the unobtrusive semblance of a log that seems to
have fallen across the run; in the hard beaten narrow
path and the sore toes of the old pine tree, telling
of the hundreds that come and go; it is seen in the
dress and pose of the ladies, and one may be sure
the photographer felt all that he saw and fixed so
well.
  
The vender of Oumi’s lily that Margaret Johnson
saw, is in Fig. 239. There another is bartering
for a spray of flowers, and thus one sold the branch
of red maple leaves in our room at the Nara inn.
His floral stands are borne along the streets pendant
from the usual carrying pole.
  
When returning to the city from the Kyoto Experiment
Station several fields of Japanese indigo were passed,
growing in water under the conditions of ordinary
rice culture, Fig. 240 being a view of one of these.
The plant is Poligonum tinctoria, a close relative
of the smartweed. Before the importation of aniline
and alizarin dyes, which amounted in 1907 to 160,558
pounds and 7,170,320 pounds respectively, the cultivation
of indigo was much more extensive than at present,
amounting in 1897 to 160,460,000 pounds of the dried
leaves; but in 1906 the production had fallen to 58,696,000
pounds, forty-five per cent of which was grown in
the prefecture of Tokushima in the eastern part of
the island of Shikoku. The population of this
prefecture is 707,565, or 4.4 people to each of the
159,450 acres of cultivated field, and yet 19,969 of
these acres bore the indigo crop, leaving more than
five people to each food-producing acre.

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The plants for this crop are started in nursery beds
in February and transplanted in May, the first crop
being cut the last of June or first of July, when
the fields are again fertilized, the stubble throwing
out new shoots and yielding a second cutting the last
of August or early September. A crop of barley
may have preceded one of indigo, or the indigo may
be set following a crop of rice. Such practice,
with the high fertilization for every crop, goes a
long way toward supplying the necessary food.
The dense population, too, has permitted the manufacture
of the indigo as a home industry among the farmers,
enabling them to exchange the spare labor of the family
for cash. The manufactured product from the reduced
planting in 1907 was worth $1,304,610, forty-five
per cent of which was the output of the rural population
of the prefecture of Tokushima, which they could exchange
for rice and other necessaries. The land in rice
in this prefecture in 1907 was 73,816 acres, yielding
114,380,000 pounds, or more than 161 pounds to each
man, woman and child, and there were 65,665 acres
bearing other crops. Besides this there are 874,208
acres of mountain and hill land in the prefecture which
supply fuel, fuel ashes and green manure for fertilizer;
run-off water for irrigation; lumber and remunerative
employment for service not needed in the fields.
  
The journey was continued from Kyoto July 7th, taking
the route leading northeastward, skirting lake Biwa
which we came upon suddenly on emerging from a tunnel
as the train left Otani. At many places we passed
waterwheels such as that seen in Fig. 241, all similarly
set, busily turning, and usually twelve to sixteen
feet in diameter but oftenest only as many inches
thick. Until we had reached Lake Biwa the valleys
were narrow with only small areas in rice. Tea
plantations were common on the higher cultivated slopes,
and gardens on the terraced hillsides growing vegetables
of many kinds were common, often with the ground heavily
mulched with straw, while the wooded or grass-covered
slopes still further up showed the usual systematic
periodic cutting. After passing the west end of
the lake, rice fields were nearly continuous and extensive.
Before reaching Hachiman we crossed a stream leading
into the lake but confined between levees more than
twelve feet high, and we had already passed beneath
two raised viaducts after leaving Kusatsu. Other
crops were being grown side by side with the rice on
similar lands and apparently in rotation with it,
but on sharp, narrow close ridges twelve to fourteen
inches high. As we passed eastward we entered
one of the important mulberry districts where the fields
are graded to two levels, the higher occupied with
mulberry or other crops not requiring irrigation,
while the lower was devoted to rice or crops grown
in rotation with it.
  
On the Kisogawa, at the station of the same name,
there were four anchored floating water-power mills
propelled by two pair of large current wheels stationed
fore and aft, each pair working on a common axle from
opposite sides of the mill, driven by the force of
the current flowing by.

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At Kisogawa we had entered the northern end of one
of the largest plains of Japan, some thirty miles
wide and extending forty miles southward to Owari
bay. The plain has been extensively graded to
two levels, the benches being usually not more than
two feet above the rice paddies, and devoted to various
dry land crops, including the mulberry. The soil
is decidedly sandy in character but the mean yield
of rice for the prefecture is 37 bushels per acre and
above the average for the country at large. An
analysis of the soils at the sub-experiment station
north of Nagoya shows the following content of the
three main plant food elements.
  
Nitrogen Phosphorus
Potassium  
Pounds per million  
In paddy field  
Soil 1520 769 805  
Subsoil 810 756 888  
In upland field  
Soil 1060 686 1162  
Subsoil 510 673 1204
  
The green manure crops on this plain are chiefly two
varieties of the “pink clover,” one sowed
in the fall and one about May 15th, the first yielding
as high as sixteen tons green weight per acre and the
other from five to eight tons.
  
On the plain distant from the mountain and hill land
the stems of agricultural crops are largely used as
fuel and the fuel ashes are applied to the fields
at the rate of 10 kan per tan, or 330 pounds per acre,
worth $1.20, little lime, as such, being used.
  
In the prefecture of Aichi, largely in this plain,
with an area of cultivated land equal to about sixteen
of our government townships, there is a population
of 1,752,042, or a density of 4.7 per acre, and the
number of households of farmers was placed at 211,033,
thus giving to each farmer’s family an average
of 1.75 acres, their chief industries being rice and
silk culture.
  
Soon after leaving the Agricultural Experiment Station
of Aichi prefecture at An Jo we crossed the large
Yahagigawa, flowing between strong levees above the
level of the rice fields. Mulberries, with burdock
and other vegetables were growing upon all of the tables
raised one to two, feet above the rice paddies, and
these features continued past Okasaki, Koda, and Kamagori,
where the hills in many places had been recently cut
clean of the low forest growth and where we passed
many large stacks of pine boughs tied in bundles for
fuel. After passing Goyu sixty-five miles east
from Nagoya, mulberry was the chief crop. Then
came a plain country which had been graded and leveled
at great cost of labor, the benches with their square
shoulders standing three to four feet above the paddy
fields; and after passing Toyohashi some distance
we were surprised to cross a rather wide section of
comparatively level land overgrown with pine and herbaceous,
plants which had evidently been cut and recut many
times. Beyond Futagawa rice fields were laid out
on what appeared to be, similar land but with soil
a little finer in texture, and still further along
were other flat areas not cultivated.

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At Maisaka quite half the cultivated fields appear
to be in mulberry with ponds of lotus plants in low
places, while at Hamamatsu the rice fields are interspersed
with many square-shouldered tables raised three to
four feet and occupied with mulberry or vegetables.
As we passed upon the flood plain of the Tenryugawa,
with its nearly dry bed of coarse gravel half a mile
wide, the dwellings of farm villages were, many of
them surrounded with nearly solid, flat-topped, trimmed
evergreen hedges nine to twelve feet high, of the
umbrella pine, forming beautiful and effective screens.
  
At Nakaidzumi we had left the mulberry orchards for
those of tea, rice still holding wherever paddies
could be formed. Here, too, we met the first
fields of tobacco, and at Fukuroi and Homouchi large
quantities of imported Manchurian bean cake were stacked
about the station, having evidently been brought by
rail. At Kanaya we passed through a long tunnel
and were in the valley of the Oigawa, crossing the
broad, nearly dry stream over a bridge of nineteen
long spans and were then in the prefecture of Shizuoka
where large fields of tea spread far up the hillsides,
covering extensive areas, but after passing the next
station, and for seventeen miles before reaching Shizuoka
we traversed a level stretch of nearly continuous rice
fields.
  
The Shizuoka Experiment Station is devoting special
attention to the interests of horticulture, and progress
has already been made in introducing new fruits of
better quality and in improving the native varieties.
The native pears and peaches, as we found them served
on the hotel tables in either China or Japan, were
not particularly attractive in either texture or flavor,
but we were here permitted to test samples of three
varieties of ripe figs of fine flavor and texture,
one of them as large as a good sized pear. Three
varieties of fine peaches were also shown, one unusually
large and with delicate deep rose tint, including
the flesh. If such peaches could be canned so
as to retain their delicate color they would prove
very attractive for the table. The flavor and
texture of this peach were also excellent, as was
the case with two varieties of pears.
  
The station was also experimenting with the production
of marmalades and we tasted three very excellent brands,
two of them lacking the bitter flavor. It would
appear that, in Japan, Korea and China there should
be a very bright future along the lines of horticultural
development, leading to the utilization of the extensive
hill lands of these countries and the development
of a very extensive export trade, both in fresh fruits
and marmalades, preserves and the canned forms.
They have favorable climatic and soil conditions and
great numbers of people with temperament and habits
well suited to the industries, as well as an enormous
home need which should be met, in addition to the
large possibilities in the direction of a most profitable
export trade which would increase opportunities for
labor and bring needed revenue to the people.
In Fig. 242 are three views at this station, the lower
showing a steep terraced hillside set with oranges
and other fruits, holding out a bright promise for
the future.

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Peach orchards were here set on the hill lands, the
trees six feet apart each way. They come into
bearing in three years, remain productive ten to fifteen
years, and the returns are 50 to 60 yen per tan, or
at the rate of $100 to $120 per acre. The usual
fertilizers for a peach orchard are the manure-earth-compost,
applied at the rate of 3300 pounds per acre, and fish
guano applied in rotation and at the same rate.
  
Shizuoka is one of the large prefectures, having a
total area of 3029 square miles; 2090 of which are
in forest; 438 in pasture and genya land, and 501
square miles cultivated, not quite one-half of which
is in paddy fields. The mean yield of paddy rice
is nearly 33 bushels per acre. The prefecture
has a population of 1,293,470, or about four to the
acre of cultivated field, and the total crop of rice
is such as, to provide 236 pounds to each person.
  
At many places along the way as we left Shizuoka July
10th for Tokyo, farmers were sowing broadcast, on
the water, over their rice fields, some pulverized
fertilizer, possibly bean cake. Near the railway
station of Fuji, and after crossing the boulder gravel
bed of the Fujikawa which was a full quarter of a
mile wide, we were traversing a broad plain of rice
paddies with their raised tables, but on them pear
orchards were growing, trained to their overhead trellises.
About. Suduzuka grass was being cut with sickles
along the canal dikes for use as green manure in the
rice fields, which on the left of the railway, stretched
eastward more than six miles to beyond Hara where
we passed into a tract of dry land crops consisting
of mulberry, tea and various vegetables, with more
or less of dry land rice, but we returned to the paddy
land again at Numazu, in another four miles.
Here there were four carloads of beef cattle destined
for Tokyo or Yokohama, the first we had seen.
  
It was at this station that the railway turns northward
to skirt the eastern flank of the beautiful Fuji-yama,
rising to higher lands of a brown loamy character,
showing many large boulders two feet in diameter.
Horses were here moving along the roadways under large
saddle loads of green grass, going to the paddy fields
from the hills, which in this section are quite free
from all but herbaceous growth, well covered and green.
Considerable areas were growing maize and buckwheat,
the latter being ground into flour and made into macaroni
which is eaten with chopsticks, Fig. 243, and used
to give variety to the diet of rice and naked barley.
At Gotenba, where tourists leave the train to ascend
Fuji-yama, the road turns eastward again and descends
rapidly through many tunnels, crossing the wide gravelly
channel of the Sakawagawa, then carrying but little
water, like all of the other main streams we had crossed,
although we were in the rainy season. This was
partly because the season was yet not far advanced;
partly because so much water was being taken upon
the rice fields, and again because the drainage is
so rapid down the steep slopes and comparatively short
water courses. Beyond Yamakita the railway again
led along a broad plain set in paddy rice and the
hill slopes were terraced and cultivated nearly to
their summits.

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Swinging strongly southeastward, the coast was reached
at Noduz in a hilly country producing chiefly vegetables,
mulberry and tobacco, the latter crop being extensively
grown eastward nearly to Oiso, beyond which, after
a mile of sweet potatoes, squash and cucumbers, there
were paddy fields of rice in a flat plain. Before
Hiratsuka was reached the rice paddies were left and
the train was crossing a comparatively flat country
with a sandy, sometimes gravelly, soil where mulberries,
peaches, eggplants, sweet potatoes and dry land rice
were interspersed with areas still occupied with small
pine and herbaceous growth or where small pine had
been recently set. Similar conditions prevailed
after we had crossed the broad channel of the Banyugawa
and well toward and beyond Fujishiwa where a leveled
plain has its tables scattered among the fields of
paddy rice, this being the southwest margin of the
Tokyo plain, the largest in Japan, lying in five prefectures,
whose aggregate area of 1,739,200 acres of arable
lands was worked by 657,235 families of farmers; 661,613
acres of which was in paddy rice, producing annually
some 19,198,000 bushels, or 161 pounds for each of
the 7,194,045 men, women and children in the five
prefectures, 1,818,655 of whom were in the capital
city, Tokyo.
  
Three views taken in the eastern portion of this plain
in the prefecture of Chiba, July 17th, are seen in
Fig. 244, in two of which shocks of wheat were still
standing in the fields among the growing crops, badly
weathered and the grain sprouting as the result of
the rainy season. Peanuts, sweet potatoes and
millet were the main dry land, crops then on the ground,
with paddy rice in the flooded basins. Windsor
beans, rape, wheat and barley had been harvested.
One family with whom we talked were threshing their
wheat. The crop had been a good one and was yielding
between 38.5 and. 41.3 bushels per acre, worth at
the time $35 to $40. On the same land this farmer
secures a yield of 352 to 361 bushels of potatoes,
which at the market price at that time would give a
gross earning of $64 to $66 per acre.
  
Reference has been made to the extensive use of straw
in the cultural methods of the Japanese. This
is notably the case in their truck garden work, and
two phases of this are shown in Fig. 245. In
the lower section of the illustration the garden has
been ridged and furrowed for transplanting, the sets
have been laid and the roots covered with a little
soil; then, in the middle section, showing the next
step in the method, a layer of straw has been pressed
firmly above the roots, and in the final step this
would be covered with earth. Adopting this method
the straw is so placed that (1) it acts as an effective
mulch without in any way interfering with the capillary
rise of water to the roots of the sets; (2) it gives
deep, thorough aeration of the soil, at the same time
allowing rains to penetrate quickly, drawing the air
after it; (3) the ash ingredients carried in the straw

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are leached directly to the roots where they are needed;
(4) and finally the straw and soil constitute a compost
where the rapid decay liberates plant food gradually
and in the place where it will be most readily available.
The upper section of the illustration shows rows of
eggplants very heavily mulched with coarse straw,
the quantity being sufficient to act as a most effective
mulch, to largely prevent the development of weeds
and to serve during the rainy season as a very material
fertilizer.
  
In growing such dry land crops as barley, beans, buckwheat
or dry land rice the soil of the field is at first
fitted by plowing or spading, then furrowed deeply
where the rows are to be planted. Into these
furrows fertilizer is placed and covered with a layer
of earth upon which the seed is planted. When
the crop is up, if a second fertilization is desired,
a furrow may be made alongside each row, into which
the fertilizer is sowed and then covered. When
the crop is so far matured that a second may be planted,
a new furrow is made, either midway between two others
or adjacent to one of them, fertilizer applied and
covered with a layer of soil and the seed planted.
In this way the least time possible is lost during
the growing season, all of the soil of the field doing
duty in crop production.
  
It was our privilege to visit the Imperial Agricultural
Experiment Station at Nishigahara, near Tokyo, which
is charged with the leadership of the general and
technical agricultural research work for the Empire.
The work is divided into the sections of agriculture,
agricultural chemistry, entomology, vegetable pathology,
tobacco, horticulture, stock breeding, soils, and tea
manufacture, each with their laboratory equipment and
research staff, while the forty-one prefectural stations
and fourteen sub-stations are charged with the duty
of handling all specific local, practical problems
and with testing out and applying conclusions and
methods suggested by the results obtained at the central
station, together with the local dissemination of knowledge
among the farmers of the respective prefectures.
  
A comprehensive soil survey of the arable lands of
the Empire has been in progress since before 1893,
excellent maps being issued on a scale of 1 to 100,000,
or about 1.57 inch-to the mile, showing the geological
formations in eight colors with subdivisions indicated
by letters. Some eleven soil types are recognized,
based on physical composition and the areas occupied
by these are shown by means of lines and dots in black
printed over the colors. Typical profiles of
the soil to depths of three meters are printed as insets
on each sheet and localities where these apply are
indicated by corresponding numbers in red on the map.
  
Elaborate chemical and physical studies are also being
made in the laboratories of samples of both soil and
subsoil. The Imperial Agricultural Experiment
Station is well equipped for investigation work along
many lines and that for soils is notably strong.
In Fig. 246 may be seen a portion of the large immersed
cylinders which are filled with typical soils from
different parts of the Empire, and Fig. 247 shows
a portion of another part of their elaborate outfit
for soil studies which are in progress.

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It is found that nearly all cultivated soils of Japan
are acid to litmus, and this they are inclined to
attribute to the presence of acid hydro-aluminum silicates.
  
The Island Empire of Japan stretches along the Asiatic
coast through more than twenty-nine degrees of latitude
from the southern extremity of Formosa northward to
the middle of Saghalin, some 2300 statute miles; or
from the latitude of middle Cuba to that of north
Newfoundland and Winnipeg; but the total land area
is only 175,428 square miles, and less than that of
the three states of Wisconsin, Iowa and Minnesota.
Of this total land area only 23,698 square miles are
at present cultivated; 7151 square miles in the three
main islands are weed and pasture land. Less
than fourteen per cent of the entire land area is
at present under cultivation.
  
If all lands having a slope of less than fifteen degrees
may be tilled, there yet remain in the four main islands,
15,400 square miles to bring under cultivation, which
is an addition of 65.4 per cent to the land already
cultivated.
  
In 1907 there were in the Empire some 5,814,362 households
of farmers tilling 15,201,969 acres and feeding 3,522,877
additional households, or 51,742,398 people.
This is an average of 3.4 people to the acre of cultivated
land, each farmer’s household tilling an average
of 2.6 acres.
  
The lands yet to be reclaimed are being put under
cultivation rapidly, the amount improved in 1907 being
64,448 acres. If the new lands to be reclaimed
can be made as productive as those now in use there
should be opportunity for an increase in population
to the extent of about 35,000,000 without changing
the present ratio of 3.4 people to the acre of cultivated
land.
  
While the remaining lands to be reclaimed are not
as inherently productive as those now in use, improvements
in management will more than compensate for this,
and the Empire is certain to quite double its present
maintenance capacity and provide for at least a hundred
million people with many more comforts of home and
more satisfaction for the common people than they
now enjoy.
  
Since 1872 there has been an increase in the population
of Japan amounting to an annual average of about 1.1
per cent, and if this rate is maintained the one hundred
million mark would be passed in less than sixty years.
It appears probable however that the increased acreage
put under cultivation and pasturage combined, will
more than keep pace with the population up to this
limit, while the improvement in methods and crops
will readily permit a second like increment to her
population, bringing that for the present Empire up
to 150 millions. Against this view, perhaps, is
the fact that the rice crop of the twenty years ending
in 1906 is only thirty-three per cent greater than
the crop of 1838.

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In Japan, as in the United States, there has been
a strong movement from the country to the city as
a natural result of the large increase in manufactures
and commerce, and the small amount of land per each
farmer’s household. In 1903 only .23 per
cent of the population of Japan were living in villages
of less than 500, while 79.06 per cent were in towns
and villages of less than 10,000 people, 20.7 per
cent living in those larger. But in 1894 84.36
per cent of the population were living in towns and
villages of less than 10,000, and only 15.64 per cent
were in cities, towns and villages of over 10,000
people; and while during these ten years the rural
population had increased at the rate of 640 per 10,000,
in cities the increase had been 6,174 per 10,000.
  
Japan has been and still is essentially an agricultural
nation and in 1906 there were 3,872,105 farmers’
households, whose chief work was farming, and 1,581,204
others whose subsidiary work was farming, or 60.2
per cent of the entire number of households. A
like ratio holds in Formosa. Wealthy land owners
who do not till their own fields are not included.
  
Of the farmers in Japan some 33.34 per cent own and
work their land. Those having smaller holdings,
who rent additional land, make up 46.03 per cent of
the total farmers; while 20.63 per cent are tenants
who work 44.1 per cent of the land. In 1892 only
one per cent of the land holders owned more than twenty-five
acres each; those holding between twenty-five acres
and five acres made up 11.7 per cent; while 87.3 per
cent held less than five acres each. A man owning
seventy-five acres of land in Japan is counted among
the “great landholders”. It is never
true, however, except in the Hokkaido, which is a
new country agriculturally, that such holdings lie
in one body.
  
Statistics published in “Agriculture in Japan”,
by the Agricultural Bureau, Department of Agriculture
and Commerce, permit the following statements of rent,
crop returns, taxes and expenses, to be made.
The wealthy land owners who rent their lands receive
returns like these:
For paddy field, For upland field,
per acre. per acre.
Rent $27.98 $13.53
Taxes 7.34 1.98
Expenses 1.72 2.48
Total expenses $9.06 $4.46
Net profit 18.92 9.07
  
It is stated, in connection with these statistics,
that the rate of profit for land capital is 5.6 per
cent for the paddy field, and 5.7 per cent for the
upland field. This makes the valuation of the
land about $338 and $159 per acre, respectively.
A land holder who owns and rents ten acres of paddy
field and ten acres of upland field would, at these
rates, realize a net annual income of $279.90.
  
Peasant farmers who own and work their lands receive
per acre an income as follows:

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For paddy field, For upland field,
per acre. per acre.
Crop returns $55.00 $30.72
Taxes 7.34 1.98
Labor and expenses 36.20 24.00
------- -------
Total expense $43.54 $25.98
Net profit 11.46 4.74
  
The peasant farmer who owns and works five acres,
2.5 of paddy and 2.5 of upland field, would realize
a total net income of $40.50. This is after deducting
the price of his labor. With that included, his
income would be something like $91.
  
Tenant farmers who work some 41 per cent of the farm
lands of Japan, would have accounts something as follows:
  
For paddy field, For
upland field,  
1 crop. 2 crops.  
per acre. per acre.   
Crop returns $49.03 $78.62 $41.36  
Tenant fee 23.89 31.58 13.52  
Labor 15.78 25.79 14.69  
Fertilization 7.82 17.30 10.22  
Seed .82 1.40 1.57  
Other expenses 1.69 2.82 1.66  
------------- -------  
Total expenses $50.00 $78.89 $41.66  
Net profit —.97 —.27
—.30
  
This statement indicates that tenant farmers do not
realize enough from the crops to quite cover expenses
and the price named for their labor. If the tenant
were renting five acres, equally divided between paddy
and upland field, the earning would be $73.00 or $99.73
according as one or two crops are taken from the paddy
field, this representing what he realizes on his labor,
his other expenses absorbing the balance of the crop
value.
  
But the average area tilled by each Japanese farmer’s
household is only 2.6 acres, hence the average earning
of the tenant household would be $37.95 or $51.86.
A clearer view of the difference in the present condition
of farmers in Japan and of those in the United States
may be gained by making the Japanese statement on the
basis of our 160-acre farm, as expressed in the table
below:
  
For paddy field.
For upland field. Total.   
For 80 acres. For 80 acres.
160 acres.   
Crop returns $4,400.00 $2,457.60
$6,857.60  
---------- ----------
----------  
Taxes $587.20 $158.40
$745.60 Expenses 1,633.60 744.80
2,378.40 Labor 1,262.40
1,175.20 2,437.60  
---------- ----------
----------  
Total cost $3,488.20 $2,078.40
$5,561.60  
Net return 916.80 379.20
1,296.00 Return  
including labor 2,179.20 1,554.40
3,783.60
  
In the United States the 160-acre farm is managed
by and supports a single family, but in Japan, as
the average household works but 2.6 acres, the earnings
of the 160 acres are distributed among some 61 households,
making the net return to each but $21.25, instead of
$1296, and including the labor as earning, the income
would be $39.96 more, or $60.67 per household instead
of $3733.60, the total for a 160-acre farm worked
under Japanese conditions.

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These figures reveal something of the tense strain
and of the terrible burden which is being carried
by these people, over and above that required for
the maintenance of the household. The tenant
who raises one crop of rice pays a rental of $23.89
per acre. If he raises two crops he pays $31.58;
if it is upland field, he pays $13.52. To these
amounts he adds $10.33, $21.52 or $13.45 respectively
for fertilizer, seed and other expenses making a total
investment of $34.22, $53.10 or $26.97 per acre, which
would require as many bushels of wheat sold at a dollar
a bushel to cover this cost. In addition to this
he assumes all the risks of loss from weather, from
insects and from blight, in the hope that he may recoup
his expenses and in addition have for his services
$14.81, $25.52 or $14.39 for the season’s work.
  
The burdens of society, which have been and still
are so largely burdens of war and of government, with
all nations, are reflected with almost blinding effect
in the land taxes of Japan, which range from $1.98,
on the upland, to $7.34 per acre on the paddy fields,
making a quarter section, without buildings, carry
a burden of $300 to $1100 annually. Japan’s
budget in 1907 was $134,941,113, which is at the rate
of $2.60 for each man, woman and child; $8.90 for each
acre of cultivated land, and $23, for each household
in the Empire. When such is the case it is not
strange that scenes like Fig. 248 are common in Japan
today where, after seventy years, toil may not cease.
  
There is a bright, as well as a pathetic side to scenes
like this. The two have shared for fifty years,
but if the days have been full of toil, with them
have come strength of body, of mind and sterling character.
If the burdens have been heavy, each has made the other’s
lighter, the satisfaction fuller, the joys keener,
the sorrows less difficult to bear; and the children
who came into the home and have gone from it to perpetuate
new ones, could not well be other than such as to
contribute to the foundations of nations of great
strength and long endurance.
  
Reference has been made to the large amount of work
carried on in the farmers’ households by the
women and children, and by the men when they are not
otherwise employed, and the earnings of this subsidiary
work have materially helped to piece out the meagre
income and to meet the relatively high taxes and rent.

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Pears, per lb 5.73
Apricots, per lb 8.60
Pork, fresh, per lb 10.33
Fish, per lb 5.73
Eggs, per dozen 5.16