

CHAPTER THREE

THE CHINESE AS FARMERS

AFTER several months' study in Japan, Korea and China, Doctor F. H. King, Professor of Agriculture at the University of Wisconsin and chief of the Bureau of Treatment of the Soil in the United States Agricultural Department, wrote in 1911 a little volume, "Farmers of Forty Centuries", which is a fascinating study for any one interested in the intensive agriculture of the Far East. King's book is written in just the right spirit, one of wonder and love for the subject. If any criticism could be suggested as to his most practical treatment, it could only be that he has become so enamored of the diligent celestial's highly developed farming that he has not had his eye open for certain obvious features where radical improvement might be made.

His travel study was a delightful adventure. Himself a leading agricultural investigator in a land which with just pride reckons itself first in the world in the use of agricultural machinery, he comes to the Far East as a humble observer with high expectations.

His wonder increases with every excursion he makes through the Chinese grain fields, and the summary of his observations may be given somewhat as follows:

We Americans are beginners, who carry on agriculture by extensive methods, relying on mineral

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fertilizers while we let great masses of natural manure be carried off in rivers and the sea on account of our sanitary arrangements. Sooner or later, when our population has grown, we must go to the East to learn the intensive culture which, with careful utilization of all natural manure but without knowledge of artificial fertilizers, has been practised for thousands of years by the people of China, Korea and Japan, so as to preserve the full fruitfulness of the ground.

Before I attempt, with the help of King's abundant statistics, to describe Chinese agriculture, I wish to cite certain utterances in his book, which are an inspired hymn to the patient farmer of the Far East:

I had long wished to stand face to face with the farmers of China, Korea and Japan, to wander through their fields and see some of the methods, tools and processes which these oldest of the world's farmers have developed through the centuries through their needs and experience. I wished to learn how it was possible for them after twenty or thirty, perhaps even forty centuries of farming to keep their fields up to a productivity that would feed the dense population of those countries.

I have now had this opportunity, and with almost every day I am instructed, astonished, and overwhelmed by the conditions and processes which confront me wherever I turn: instructed as to the methods and the extent to which these nations have preserved for centuries their natural resources, astonished as to the quantity of the harvests they get from their fields, and overwhelmed by the amount of efficient human labor that they cheerfully give for

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a daily wage of five cents and food or for fifteen cents American money without food.

Whereas the population density of the United States in 1911 was only one person per twenty acres, that of China is roughly ten times greater, that is, a person to every two acres. From the well-cultivated plain of Shantung Doctor King gives some statistics as to the number of men and beasts which Chinese farming is able to support. In one case he finds a proportion of three thousand seventy-two human beings, two hundred fifty-six asses, two hundred fifty-six kine and five hundred twelve pigs per English square mile, and in another instance, three thousand eight hundred forty persons, three hundred eighty-four asses and three hundred eighty-four pigs on the same surface. On the island of Chungming in the Yangtze delta the density of population according to the official statistics of 1902 was thirty-seven hundred persons to the square mile.

It is a question of the greatest industrial and social importance to all nations that they should have full and correct knowledge of the methods which have enabled China, Korea and Japan to support so great a population. Many of the discoveries and steps through which this development has gone are forever buried in the past, but such a unique power of maintenance, reached centuries ago and continued to the present time with hardly perceptible decline, deserves the most thorough study, and the time is now ripe for such an investigation. We who live at the beginning of a century of adjustment, passing from isolated nationalism to cosmopolitanism, involved in far-

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reaching changes as to industry, education, and social life, have especial need to make such an investigation. The time has come for every country to study the others and by reciprocal understanding and coöperative effort make the result of such studies accessible to all. This work should be so directed that all countries may become coöperative and mutually assisting factors in the development of the world.

If I were to attempt to express the secret of China's unique productive power, I should call attention to the following practical points:

1. Irrigation to a degree almost inconceivable to us.
2. The preservation and use of whatever sort of refuse can be made to serve as fertilizer.
3. Multiple harvests.
4. A limitless devotion in care and labor.

What first strikes an interested and observant traveler is that nearly all China's arable land is terraced. Only in Mongolia and Manchuria is agriculture managed on the same extensive scale as in the countries recently colonized (the United States, South America, Australia). But in the whole of China proper, with the exception of course of the absolutely flat alluvial plains, all the cultivated land is terraced. Slopes are laid out in narrow belts, consisting of a perfectly level plot and a vertical border, at the base of which is the next terrace level. This vertical border is raised often as much as a foot above its own terrace level, thus forming a rampart which serves to regulate heavy rain floods as well as the water for irrigation which is brought there in dry

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seasons. This rampart is broken in one or more places to give an outlet to the overflow, and these outlets are reinforced by stones laid in mortar to keep the rampart from being torn by the violent cloudbursts which are a regular feature of the summers in northern China.

The primary purpose of these terraces is, as already indicated, to hinder the erosion of the fields by violent rainfall. On high inclined places, where the Chinese can neither conduct nor draw up water, and where accordingly they must content themselves with dry farming, the sole purpose of these terraces is one of protection. But in all the region where water is accessible the terraces have another and equally important purpose, — namely to regulate the irrigation, which is done by letting the water into the terrace through an entrance ditch until its entire surface is thoroughly saturated.

The irrigation water is obtained in various ways. The simplest and cheapest method is to deflect the water from a river over the surrounding fields. Many of the rivers of northern China have such a steep descent that a volume of water can be drawn off at some convenient point and then distributed through the fields by means of canals, which descend less abruptly than the river. In this way irrigation water is used a kilometer or so farther down the valley than the point where the main canal deflects it from the river. Around rivers which have cut their channels deep below the land immediately around them, one therefore sees the intakes of irrigation canals on

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both banks, one below the other, and all the valley plains around the river are spun over with a net of irrigation canals, which provide the desired amount of water to every part of the region.

Many of these irrigation canals are as large as a small river according to the Swedish conception, and run for ten kilometers or so alongside the river but with a more gradual descent so that their water may be ten meters or so above that of the river. A canal of this size is split up into a number of small canals, which distribute the water to various villages, frequently on different levels, depending upon what branch canals have a steeper inclination than others. Such a large system as this is based upon the co-operation of many villages, and the distribution of the water when it is to be conveyed in due order to various plots is a complicated affair. The Catholic missionary in Lanchow, who had a large and fine garden just outside the city, told me that only at a certain hour of a certain day every third week might he have water for his garden, and that if he failed to take his chance, he had no choice but to wait till it was again his turn.

In one place in Kansu, the river runs in a — geologically speaking — recent channel, which is in general about ten meters below the land of the plain. Here one cannot fail to notice a direct intake from the river, such as I have described, but the water has here to be raised these ten meters up to the level of the plain. This is accomplished in a remarkably picturesque way by means of the so-called "Persian

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wheel", a mighty waterwheel from twelve to fourteen meters in diameter, which is driven by the rapid current of the river. On one side of this wheel are numerous long tub-shaped containers, which fill with water when they are pushed down into the river and empty into an outlet ditch at the top of the wheel's revolution. These wheels look after themselves and work continuously during the entire vegetation period. In Kansu they are made of wood, in Szechuan, where they are also common, they are very stylishly constructed of bamboo.

In the districts where water cannot be obtained from rivers or brooks the people have no other way than to dig wells for irrigation. The simplest form of hoisting device is a homemade winch with a three-legged post. This slight equipment, which is portable, is used particularly in those cases where shallow wells are dug at random to water near the surface.

In the loamy regions of Honan and Shansi one sees wells all over the fields with a larger and more effective hoist worked by a small ass, which with blind-folded eyes trots around for hours at a time without getting tired.

The irrigation systems which I have just described are in use in the loamy parts of northern China. In southern China we meet quite different conditions. The rainfall there is much more abundant, the sub-soil water is nearer the surface, and open dams appear everywhere through the fields. The delta plains are traversed by a network of artificial canals. Water is

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available in great quantities, and all there is to do is to raise the required amount in order to submerge any given well-diked terrace.¹ For that purpose the natives use a small chain-pump operated by two or three men.

Hand in hand with irrigation goes the work for controlling the rivers, which carry a large proportion of sediment and therefore in the alluvial plains of north China continually tend to raise the level of their beds. Thus on the occasion of a specially violent summer flood the river may break through a weak spot and produce a destructive inundation. To check or at least to limit these natural catastrophes the rivers are banked in with huge dikes, a labor which sometimes demands the coöperation of many provinces, when, for instance, the river in question happens to be "China's Sorrow", the Hwang-ho, with its immense quantity of mud which is so hard to reckon with.

On the efforts of the Chinese to control this river King makes the following well-formulated comment: "How can we help admiring the temper of a people who for forty centuries have maintained the conflict against such a giant, that rushes past their homes higher than the level of their fields, shut off

¹ As an instance of the extremely strict economy with which the Chinaman works I would mention that the rice fields, which are nearly always of small extent, are often so small that it is almost inconceivable to us that human effort could be devoted to such miniature holdings with any hope of profit. Professor Ross says that in the interior of China the rice fields are no larger than the floor of a small room, in some instances no larger than a table, and once he saw a little rice plot surrounded by a wall and filled with water, the whole no bigger than an ordinary napkin.

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only by the walls they themselves have built? They have not, to be sure, always succeeded in mastering the river, but they have never hesitated to take up the struggle anew after every defeat."

In the fertile Yangtze valley great dikes have been built to protect the outermost zone of cultivation from the ravages of the sea. This delta area has increased considerably during historic times, so that the oldest parts lie well in on the delta and only quite young communities out on the sea. This filling in, which year by year has given the Chinese peasant new land, proceeds not only as the undirected work of nature, for the people have taken deliberate measures to direct the sediment where they wish it to go.

Unless I am mistaken, the great apostle of agriculture, Rösio, used often to insert into his hymns on the work of the fields an inspired encomium on that which is the basis of all good growth, manures. If that be so, he must be an enthusiastic disciple of the Chinese, for no one can excel them in the preservation and use of these valuable products.

In my chapter on Chinese economy I describe how people in the villages take toll from the wayfarer by laying beds of straw in the very streets so that the pack animals may be led there to deliver their tribute. I also mention how the roads and even the smallest paths are patrolled by manure collectors, who preserve with the greatest care whatever the beasts deposit.

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King relates a little anecdote which is typical of the forethought with which this collection is made. On a farm in the Yangtze delta he saw an appliance for irrigation being drawn by two cows, which were driven by a little boy. This boy was provided with a wooden scoop on a long bamboo shaft, and as soon as one of the cows evinced promising signs he was at hand to convey the fresh contribution into a receptacle placed for that purpose.

King likewise narrates how in the mulberry plantations the excrements of the silkworms together with their cast-off skins and bits of leaves and twigs are preserved and carried to the earth under the trees. In that way the plantation suffers no further loss of substance than the silk which is produced from the leaves. Everything else is carried back to the earth to contribute to the development of next year's harvest.

Another custom which illustrates the strict economy of the Chinese with manure is connected with their method of heating a house in the country during the cold season. Almost every room in the dwelling house is provided with a *k'ang*, a high platform which takes up a large portion of floor space and is intended for a sleeping place. The *k'ang* is always covered with a straw mat on which the bedclothes are spread.

This *k'ang* is constructed of sun-dried brick made out of earth in which is mixed chaff and short bits of grass. In connection with the *k'ang* is a fireplace, which is either in the same room or by the outer wall

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opposite, and in this stove is burned grass, twigs and other combustible rubbish. Nitrogen in the form of sal ammoniac, as well as phosphorus and potash is carried in small quantities in the smoke and deposited in the soot which clings to the long smoke pipes and on the inner side of the porous bricks. After some years the porosity of the *k'ang* foundation increases so that the smoke filters into the room, and the *k'ang* has to be reconstructed. But this labor is not considered an unproductive affair. The bricks, being soaked with soot and vegetable by-products, are kept, powdered and worked into a compost soil.

A considerable amount of nourishment is brought to the soil in the irrigation water which comes from the muddy rivers. It is a widespread practice in the Yangtze delta to fetch the mud from the irrigation canals and lay it on the fields in quantities as high as seventy to one hundred and twenty tons per acre, which process is often repeated yearly. This plan has two advantages; it gradually raises the surface of the fields so as to afford better drainage, and it offers the new growth a virginal soil of the most fertile sort. The canal earth is frequently full of snail shells, which give the fields a much needed supply of lime.

The Chinaman never shrinks from hard work if it can help him to a richer harvest. He has found out from experience that the soil which is long used in mulberry plantations is very favorable for rice harvests, whereas the earth from the rice fields assists the growth of the mulberry trees. He therefore keeps



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up a constant interchange of earth between these two species of agriculture.

The fertilizing material which is collected in the Chinese villages from latrines, cattle manure, household refuse, old *k'angs*, etc., is made into a compost, given the right amount of moisture for proper fermentation, and finally pulverized with the greatest care before being spread on the fields.

In speaking here of the preparations for fermentation I do not of course mean that the Chinese peasant has any knowledge of the biochemical processes in question. Through centuries of practical experimentation he has found that certain procedures bring good results and he works according to these rules with an unhesitating certainty which modern science cannot improve upon but can only explain.

Such too is the case with the Chinaman's remarkable process of using the activity of leguminous plants in collecting nitrogen. For this purpose he generally cultivates the plant known among foreigners as "Chinese clover" (*Medicago astragalus*). When this is in flower, it is cut and laid on compost heaps mixed with canal mud. It is left for three weeks in a process of fermentation before the green fertilizer and the compost are spread on the fields.

During my work in the Gobi Desert in August, 1924, I happened to observe a noteworthy case of nitrogen collection by means of *leguminosa*. We were staying out at Sha Ching, a little desert village which lies in the midst of the barren sandhills eight miles beyond the oasis of Chenfan. The hills lie on a plain

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of clay, which is visible over large spaces between the dune ranges. On these spaces grows a coarse, shaggy-white legume, whose name I cannot give.

I was struck by the appearance of masses of peasants coming with their wagons from the oasis out in the desert and collecting great loads of this plant. Whole lines of wagons with these loads went off in the afternoons toward the oasis.

I made inquiries of my people and received the answer that this desert plant was used to fertilize the melon fields. I had no chance to observe more closely the process which this green fertilizer undergoes before it is used, but I have no doubt that it concerns the obtaining of nitrogen and that the plant is made into some sort of compost.

Here then is a wild legume which is used for agriculture. By means of this rough plant the almost barren desert is made to help the blossoming oasis to greater fertility.

With regard to this remarkable process I make the following citation from Doctor King:

It was only in 1888 after a long scientific dispute, which was carried on for more than thirty years by the most distinguished European authorities, that the conclusion was reached that the *leguminosa* by nourishing lower organisms which live on their roots are responsible for keeping up the supply of the world's nitrogen, which is gathered direct from the air. But the experience of centuries taught the most remote oriental peasant that the cultivation of these plants is essential for maintaining the fertility of the soil. Therefore the cultivation of *leguminosa* in rotation

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with other crops has become from ancient times a steadfast practice with these people.

One of the leading principles of Chinese agriculture is the harvesting of two or more crops during one and the same period of vegetation.

Far to the north in Manchuria, where the climate is severe because of its northern latitude; in inner Mongolia, where the agricultural region lies some fifteen hundred meters above the sea level; and in certain parts of western Kansu, where much of the land is more than two thousand meters up, I met with farming conditions that reminded me greatly of my native land. The fields, often of considerable size, are seldom terraced but follow the gentle slope of the ground. The usual crops are oats, barley, buckwheat, millet, hemp and flax. The spring is late, the autumn frost comes early, and the peasant is satisfied if he can harvest one sure crop.

But one need not go farther south than to Peking and Tientsin, which are almost on the sea level, to encounter the typical Chinese conditions. King makes the following statement regarding Tientsin: "I talked to a peasant who, after his wheat crop, planted his little enclosure with onions and after the onions with cabbage, by which process of three harvests he got a return corresponding to the value of one hundred sixty-three dollars an acre." Another farmer planted Irish potatoes, gathered them early, then planted radishes and after them cabbage, by which he got a return of two hundred three dollars an acre.

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In Shantung wheat or barley are planted in the winter and harvested early in the spring, to be followed by another harvest of *kaoliang* or 'millet, sweet potatoes, soya beans or groundnuts.

In southern China two rice crops are taken in, and upon these follows during the winter and early spring a third, sometimes even a fourth of cabbage, rape, peas and beans, etc.

To save both land and time the rice is sown on a little plot, where by strong fertilizing and careful labor for some thirty to fifty days enough plants are raised on one acre to suffice for ten. Meanwhile the nine acres which have thus been left free have had other crops, which have been taken in, after which the land is prepared for the transplanting of the rice.

In connection with these successive crops the Chinese farmer avails himself to the greatest possible extent of the system of multiple harvests. A development of this is the drill-sowing system, which is used for all agriculture and which enables the farmer to cultivate in alternating rows plants of differing age, which therefore ripen and are harvested at different times. By this method the farmer not only gets the fullest yield from the earth and a greater variety in his total harvest, but has also a better division of his labor at separate times of the vegetation period.

As an example of these multiple harvests one may thus find at one time in the same field wheat ready to reap, beans nearly mature, and cotton that has just been planted.

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This alternation of various crops in the same season is carried on to some degree with the animal kingdom.

The soil of the fields is rich in worms of the sort commonly known as angleworms, which perform a necessary function for the farmer in perforating the earth and thus assisting its ventilation. These worms are carefully guarded during the preparation of the soil, for the Chinaman wishes as much as possible to spare these useful assistants. But when the water is let into the rice fields, the worms are forced to the surface of the earth in an enormous multitude. Thereupon the farmer lets in great flocks of ducks, which eat themselves fat on the worms. With the water pumped into the rice fields come broods of fish, which grow along with the rice.

Through all the foregoing description recurs as a leading motive the astonishing and to us almost incredible industry of the Chinaman. It seems as if he economized with everything except human labor. To transplant a crop as the Chinaman does with rice, to carry back and forth the soil which he uses in preparing his composts, to till, plant and weed his fields so that they look better kept than most of our garden beds,—all this is for him something that goes without saying. Often we venture to think he performs much unnecessary labor, but we later find that we did not understand his reasons for it.

Live simply, give work to many hands, food to many mouths, I would place as the motto above the China-

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man's way of ordering his life, and this is, all things considered, no bad rule of life.

We must remember that great parts of China are so extremely densely populated that it is a very delicate task to give food and of course work to all these people. The competition for work there is intense to a degree that we can hardly imagine. Crowds of coolies are brought by sea to Manchuria every year to offer their services to the great Manchurian proprietors for a, to us, incredibly low wage. Similarly in May, 1923, I saw on a trip to Kansu great roads thronged with young men streaming down to Shensi to get a season's work.

King relates a little story that illustrates well the fearful struggle for existence:

When we left our hotel at Tsingtao to go by rickshaw to the steamer on our way back to Shanghai, we noticed a thirteen- or fourteen-year-old boy who was apparently following us, sometimes in front, sometimes behind, mostly running on the sidewalk but slowing down when the rickshaw coolie fell into a walk. It was a good mile to the wharf. Evidently the boy knew the time of the boat's departure and hoped that he might possibly earn a few cents by carrying my hand luggage on board the steamer. Twenty men were waiting at the wharf to do this little service but the boy risked a trip of a mile there and back on the chance of the odd job. When we neared the boat, the boy drew nearer to us, but strong and eager men stood there waiting. Twice he was roughly pushed aside, and before the rickshaw stopped a big fellow seized the valise. Had I not seen the boy's exertions, he would have had only his toil for

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his pains. The struggle for existence is so severe that a boy throws himself into it determinedly. True to his race and training, this one had spared no pains to win and was surprised but grateful at getting more than he expected.

The primitive handwork which the Chinese enjoy so has not deteriorated as much as we incline to think. Because of the unusual dexterity which the Chinaman has attained in rice planting by hand, King discovered that this hand labor could be done more cheaply than Americans could plant cabbage or tobacco with their best machinery.

Moreover it is striking how the Chinese have time out of mind practised certain methods which for us are comparatively modern discoveries. Thus there are families which through many generations have worked at egg-hatching in incubators consisting of separate earthen vessels, which hold twelve hundred chicken eggs and are carefully heated with wood charcoal. These people have no thermometer for measuring the temperature but can ascertain whether an egg has the right warmth by pressing it against their eye.

As a whole, Chinese farming, together with the occupations subsidiary to it, is strictly regulated by sound economic principles. The Chinaman, who likes strong and rich food, such as meat, eggs, etc., at least as well as we do, lives almost exclusively on a vegetable diet because it is so much cheaper. The fat which he uses in his cooking is cheap vegetable oil.

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King gives an interesting explanation of the fact that the Chinese are such notable swine-raisers and pork-caters. According to his figures beef makes only six and two tenths per cent. of their diet, reckoned on the dry substance of their food. The corresponding figures for mutton are eight per cent. and for pork seventeen and six tenths per cent. If we further take into account that swine subsist on a quantity of refuse and roots which are useless for the other kinds of domestic animals, we can understand why these animals are chosen to produce meat for the Chinese. In this connection it is worth noting that according to our excavations swine were the principal domestic animals in the stone age in Honan.

This account of Chinese agriculture, in which I have mostly followed the statistical summary of King, has been essentially a eulogy on the Chinese peasant's knowledge, intelligence and industry.

Is there then no weak point in this firm structure, no incompleteness in which modern science can be of help? I am convinced that there are many such lines of development, and the more progressive Chinese are minded to avail themselves of the results of Western science even in this field.

One line of procedure which beyond all others should give good results and furnish China with richer harvests is the improvement of seed by modern methods. It is in the nature of things that the simple peasant cannot do very much in this department, but in fruit cultivation the success of the

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Chinese in grafting should be carefully studied. How else can it be explained that in some of the river valleys of Kansu are produced enormous and delicious peaches, apricots and melons, which according to the testimony of American missionaries rival the best of their kind that California can show?