

200 3428

UBCHEA ARCHIVES  
COLLEGE FILE S  
RG 11

Nanking  
Academic  
College of Agriculture + Forestry  
Publications  
Reisner, John H. 1920-1926

2

0

0

3

4

2

8

0756



# Modern Commercial Fertilizers in China

BY

JOHN R. REISNER

DEAN, COLLEGE OF AGRICULTURE AND FORESTRY,  
UNIVERSITY OF NANKING, NANKING, CHINA

1921

0757



## Modern Commercial Fertilizers in China

The statement is not infrequently seen or heard, to the effect that China should use modern commercial fertilizers, and that this would constitute an important step forward in the improvement of her agriculture. Ideally this may be true. Practically, it has still to be shown to what extent China can profitably use them, if at all; let alone substituting them for her present fertilizer practices. Nor is there any doubt that the most potent factor in China's maintaining her present agricultural production is her scrupulous care in the utilization of everything that has fertilizing value. One of the most important of her fertilizers is night soil, the supply of which is more or less constant, the price of which is cheap, the use of which is well established beyond the pale of objection so far as the Chinese are concerned, and will prove to be the keenest of competitors when commercial fertilizers enter the field. In order not to be misunderstood, it should be stated that commercial fertilizers in this article refer principally to organic and inorganic compounds containing nitrogen (N), phosphoric acid ( $P_2O_5$ ) and potash ( $K_2O$ ), that enter into fertilizer trade and fertilizing practices, as we understand them in the West.

Though our knowledge of night soil with particular reference to China is rather meager, for the purpose of this paper, detailed information is not necessary. On the basis of a population of 400,000,000 people, an annual production of 1,073.3 pounds per capita (data based on European sources), the total production of night soil in China would be 428,120,000,000 pounds, of which it is safe to say that two-thirds, or 285,420,000,000 pounds, is saved and used as fertilizer to produce crops. Taking the average of Japanese and European figures on the composition of night soil we find that the per cent. of fertilizing elements is as follows: Nitrogen (N) 0.63 per cent; phosphoric acid

( $P_2O_5$ ) 0.20 per cent.; and potash ( $K_2O$ ) 0.24 per cent. Calculating on the basis of the above figures, the amount of nitrogen, phosphoric acid and potash that would be used annually would be approximately:

Nitrogen .....	1,800,000,000 pounds	\$360,000,000
Phosphoric acid ..	570,000,000 "	57,000,000
Potash .....	685,000,000 "	85,000,000
Total .....	3,055,000,000 "	\$502,000,000

It must be kept in mind that these figures refer to the amount of fertilizing elements, not the amount of the "carriers." For example, if the nitrogen were furnished in the form of soda, a very commonly used nitrogen fertilizer, 6,000,000 tons (of 2,000 pounds) would be required. If the phosphoric acid were furnished in the commonly used form of acid phosphate, about 2,000,000 tons would be required. If the potash were used in the commonly used form of potassium chloride or sulphate, approximately 685,000 tons would be required. The significance of this latter figure is shown by the fact that the annual consumption of commercial mineral potash fertilizers in the United States is only about 200,000 tons. The transportation difficulties alone that would be involved, if these equivalents of night soil were substituted for the latter, are easily comprehended.

### Money Value of the Fertilizer

The gold value of the different fertilizer elements is also shown above opposite the amounts. These figures are secured by using the present retail prices of approximately 20 cents per pound for nitrogen, 10 cents for phosphoric acid and  $12\frac{1}{2}$  cents for potash. These amounts only represent equivalents, to be sure, but as such they are important in showing the difficulties if not impossibilities attended by the idea of substituting in part or in whole modern commercial fertilizers for night soil.

If we reduce the 428 billion pounds of night

soil produced annually, and the estimated 285 billion pounds used, to Chinese weights, we would have approximately 2,149 million piculs (picul = 133 pounds avoirdupois). Fresh night soil is usually sold for about six to ten cents a picul, depending upon locality and demand. Taking eight cents as an average, which is admittedly too high, the value in silver would be \$171,200,000. This sum would be more rightly considered the money value of the night soil annually used, on the basis of the commercial rates at which it is sold. It would be very difficult to determine the total money value of the night soil that was actually sold, or bartered for, but it would probably not be more than one-fourth or one-third the sum above noted, say approximately \$50,000,000 Chinese currency. It is estimated that from 75 to 85 per cent. of the Chinese population is rural, i. e., belongs to the farming classes, and if this is the case, the estimate of the percentage of total production being used and entering into barter or sale is not far wrong.

From the above it will be seen that the largest part of the annual production does not enter into trade—that it is used where it is produced, and represents no cash investment. The labor used in collecting, caring for, and applying to the soil would not be considered by the farmers as having a money value. It represents clear gain so far as he is concerned, and in no sense as costing anything. In other words, about fifty million dollars local currency would pay for all the night soil that is sold and bought annually, and be considered the annual investment in night soil fertilizers.

But to substitute an equivalent amount of commercial fertilizers for the total night soil consumption would require at present prices 502,000,000 gold dollars, and 502,000,000 gold dollars as against 50,000,000 Mexican dollars is argument enough to prove that modern commercial fertilizer will not for a long time dispossess night soil of the place it now holds in the maintenance of Chinese soil fertility and production of crops.

### Relative Price of Commercial Fertilizers

In Nanking, fresh night soil sells for about six cents Chinese currency a picul, and for this six cents the farmer gets about three-fifths of a gin (gin = 11.3 pounds avoirdupois) of nitrogen, one-fifth of a gin of phosphoric acid, and one-fourth of a gin of potash, which have a value of about twenty-three gold cents according to present prices for these fertilizers. This states the problem a little differently, probably a little more clearly, and suggests im-

mediately a number of questions. Suppose a farmer found he could pay twenty-three cents gold and secure modern commercial fertilizers, would he give up the night soil at six cents silver with the same results? And if he did what would happen to the sanitation of the city? What would happen to the cost of vegetables and other farm produce, for the consumer would certainly have to pay the bill? Would the people pay? What of the competition he would have to meet of those who still preferred six (Chinese) cents' worth of the same results to twenty-three gold cents' worth?

Could a farmer who used commercial plant food develop a special demand for his products, not because they were necessarily better, but because they had been grown under more sanitary conditions? If this could be done what per cent. of the whole market demand could be so developed? Would it be more than 2 per cent.? Would products generally be of higher quality, if raised with commercial fertilizers than if raised with night soil? What would be the effect on maintaining fertility? If a farmer had to choose between twenty-three gold cents' worth of night soil (about one-half ton at present exchange) and twenty-three gold cents' worth of commercial fertilizer, equal to four gin sodium nitrate, one and two-fifths gin of phosphoric acid and one-half gin potassium chloride—a total of about 6 gins (8 pounds)—which do you think he would buy? One thousand pounds of night soil would certainly look better to him than 8 pounds of mineral fertilizers, and his judgment would be quite correct. This may be a very homely way of suggesting the problem of substituting commercial fertilizers for night soil, but the above illustration points out the practical difficulties involved and what the outcome would likely be.

### Exports of Vegetable Meals

It has also been pointed out that China, instead of exporting vegetable meal fertilizer, such as bean cake, rape seed cake, etc., should use them at home. She does use them in very large quantities, but no one knows, nor is there any way of telling, just how large quantities this class of fertilizers is used. Certainly it looks like a bad policy to export so much, and it probably is, because it largely comes from a rather restricted area. In 1918, according to the Customs "Returns of Trade" and "Trade Reports," China exported over sixteen million piculs of bean cake, having a value of 29,882,829 Haikwan taels. The total exports of all fertilizing materials of this class was over seventeen and a half million piculs, with a total



value of a little less than 32 million Haikwan taels. Reduced to pounds and dollars, as fertilizer, the yearly export averaged \$1.92 Chinese currency per 100 pounds. Taking the average of several analyses, we find that the chemical composition of soy bean cake gives nitrogen 6.62 per cent., phosphoric acid 2.20 per cent. and potash 1.80 per cent. Accepting the relative price for nitrogen, phosphoric acid and potash as before the war as 20, 5 and 5 cents per pound respectively, we would have a proportion of 4-1-1. Calculating from the above we find that the nitrogen was worth 19.4 cents Chinese per pound, phosphoric acid was worth 14.5 cents per pound and potash, 17.8 cents per pound.

Comparing these figures with those found in the same way for night soil at 8 cents per picul, we have nitrogen in night soil costing 6.3 cents per pound, phosphoric acid costing 5.0 cents per pound, and potash 4.1 cents per pound.

The following table will serve to bring out the contrasts:

*Cost of Fertilizing Constituents in Chinese Currency on Basis of Pre-war Prices*

In soy bean cake.....	19.4	14.5	17.8
In night soil.....	6.3	5.0	4.1
Present U. S. prices in gold .....	20.0	10.0	12.5

The objection might be raised on the ground that the customs value would give a higher value than local market prices. This is probably true. Soy bean cake sells in Nanking for from \$1.50 to \$2 Chinese per 100 pounds. But if the figures above are changed on this basis, and on the corresponding basis that night soil sells locally at 6 cents per picul, the contrast is still more striking.

The figures given above show again, as in the case of commercial fertilizer, that the use of night soil is much cheaper than soy bean or any other kind of vegetable cakes at the same prices. More than that, the difference is marked and places a big handicap on bean and other cake fertilizers in coming into greater demand.

The objection is equally pertinent to both vegetable meal fertilizer and night soil that are both "unbalanced" fertilizers, by which term we mean an undue proportion of one element to the other two. In both, the per cent. of nitrogen is too great in proportion to the amount of phosphoric acid and potash, and this has a tendency to emphasize the effect of nitro-

gen on crops which the effects of the smaller quantities of phosphoric acid and potash cannot counterbalance. The disadvantage of an excessive quantity of nitrogen is, of course, well known, namely, to produce vegetative growth at the expense of the reproductive parts such as seeds, fruit, etc. The above statements are in large part true for most of the organic fertilizers, including farm manures, green manures, composts, etc.

#### **The Need for Phosphate and Potash**

Probably China's greatest needs in the fertilizer line is a more abundant supply of phosphate and potash to be used in connection with those she now uses most commonly, the organic fertilizers noted above. The phosphate fertilizers she supplies, singly, to a limited extent in the form of bones. However, in 1918 China exported—the largest share going to Japan—577,388 piculs of raw bones with a value of 721,153 Haikwan taels or at the rate of about one and one-third (Chinese) cents per pound. The export of raw bones should be prohibited and the bone phosphate industry encouraged. Potash is supplied singly, for the most part in the form of grass ashes. This the Chinese use widely, though it is questionable whether they fully appreciate the care necessary for properly handling them, nor the great ease with which the soluble potash leaches away. Hard wood ashes, unleached, carry from two and one-half to twelve per cent. potash and constitute one of the oldest sources of potash as a fertilizer.

Ambitious reports have given to China large deposits of both mineral phosphate and potash salts, but they have never materialized. A young Belgian-trained Chinese mining engineer made the statement a short while ago, that these earlier reports were without foundation, and that there were no such deposits known. It is to be hoped that such deposits will be found, and that they can be mined at a cost that will be attractive to the Chinese farmer. Before the war Germany was practically supplying the world's demand for potash. America was the greatest consumer and, during the war, her own production of potash salts through the development of new potash industries was only one-fourth her needs, so it is certain that America will again be one of the heaviest importers of potash. Considerable experimental work will have to be done in this whole matter of fertilizers in China, but it seems fairly safe to predict a big need for both phosphate and potash which the farmers will be willing to meet, when once shown they are profitable when used in connection with

their present fertilizers. This will create a considerable demand, which will have to be met in some way or other, possibly by importation from abroad if the supply cannot be found in China. The problem of phosphate is not so easy, America being the greatest producer, and her supply being a long way from China.

It would seem then that China must continue her centuries-old use of night soil to maintain the fertility of her soil, and to keep up her agricultural production; that neither modern commercial fertilizers nor vegetable meal fertilizers can compete with night soil, and that her greatest needs at present are independent supplies of potash and phosphate to use in conjunction with the organic fertilizers, upon which she in largest measure depends.

#### **Some Export Figures**

Since writing the above, the export figures for China for 1919 have become available. The table below indicates the amount of fertilizer material exported from China for the year under review. Attention should be called to the fact that the largest part by far, of these exports, was from Manchuria—and must not be taken as indicating the condition of supply in China proper, where six-sevenths of her population lives on one-third of her area. The fact that in one year China exported over a million and a half tons of vegetable cake fertilizers and over 50,000 tons of bones, is impressive, to say the least. The table follows:

*China Exports of Fertilizer Materials in 1919*

	Piculs	H. K. Taels
Bean cake .....	20,724,769	44,173,118
Peanut cake .....	311,231	479,490
Rape seed cake .....	536,613	737,650
Sesamum seed cake.....	308	345
Other kinds cake.....	1,264,230	2,091,270
Total vegetable cakes .....	22,837,151	47,481,873
Equivalents are: 1,522,460 tons: \$62,251,616 gold.		
Bones .....	808,368	1,066,513
Equivalents, 53,893 tons and \$1,375,800 gold.		

What is needed now, so far as the problem of the use of commercial fertilizers in China is concerned, is a careful, scientifically-conducted series of fertilizer experiments to determine to what extent the use of modern fertilizers would increase production. Without these data we are in the dark, and will be, until they are obtained. The China market for commercial fertilizers will always be an unknown quantity until the data are secured.

In the meantime the demand for food pro-

duction in China will increase, not only because of her rapidly increasing population, but because of her rapidly extending industrial development along modern lines. Will China experience the same development in the use of commercial fertilizers as did Japan under similar circumstances?

[The following extracts from a letter to the editor from an American at Shanghai may appropriately be printed in connection with the above article.]

The fertilizer industry in China is by no means a monopoly. I might further add that there is very little attention paid to the "available" content of nitrogen, phosphoric acid and potash, neither is there any trouble over total and water soluble phosphoric acid. Probably 99.99 per cent. of all the "fertilizer" used in the flowery kingdom is applied from jars. It does not take much imagination to guess what the jars contain. There are no sewers in Shanghai.

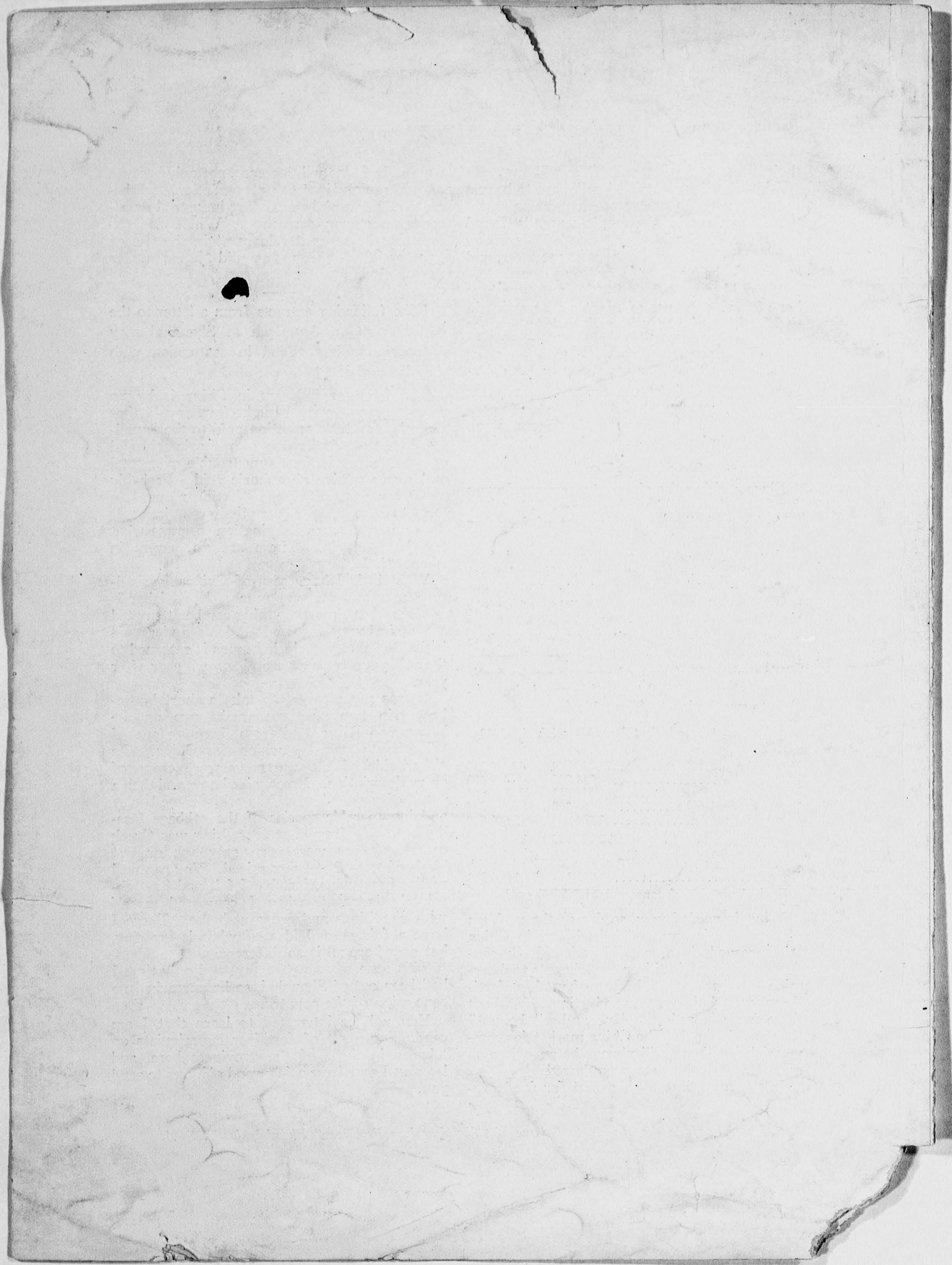
What little I have seen of Chinese agriculture impresses me very much. Hand labor is so cheap that almost anything can be attempted economically. One thing I don't understand is the fact that very little humus is returned to the soil, yet crop after crop is grown year after year.

It was my pleasure to take a short houseboat trip two or three weeks ago up the Whangpoo River, and from there up one of the many waterways which dot China. On either side of the waterway were crops of every description. I recognized now and then a patch of mustard, once in a while some barley and innumerable species of the cabbage family, but aside from that everything was Greek to me. There were even only one or two kinds of trees that I recognized. You can well realize how uncomfortable I felt and how absolutely ignorant, when I compared myself with conditions and crops at home. There I have a fairly good idea of what is growing, but over here all is so different.

This little trip was the first and only time I had been out of Shanghai, so have reached no conclusion of the country.

You will be interested to learn that I am conducting a set of fertilizer experiments on tobacco in three of the provinces here, and later on I may have a few good pictures to send you.





2  
0  
0  
3  
4  
2  
8

0760



1920

[From "The Chinese Recorder," October, 1920.]

## Foreign Missions and Agriculture

JOHN H. REISNER

**T**HE main interests of every nation, in which there is marked missionary activity on the part of "Foreign Missionary Societies," are agricultural. This statement applies to China, Korea, India, Persia, Arabia, Turkey, Egypt, Africa, and, to a somewhat less extent, to Japan where manufactures and commerce are developing so rapidly: for even Japan is essentially agricultural.

There is a theological school in Foochow, China, where, in 1920, fifty-four students, preparing for the Christian ministry, were enrolled. Four of these fifty-four students were recruited from the large city of Foochow; the remaining fifty came from the country districts and towns.

There is an American missionary society in Shantung Province, with a Church membership of 6,162, thirty-two of whom are city dwellers, the remainder are country, village, and town folk, distinctly rural in their daily life and habits of thought. To this same mission are attached 250 pastors, evangelists, and Bible-women, everyone of whom came from the country. Out of one hundred and eighty day schools for boys and thirty-five day schools for girls, administered by the mission, every school is in the country.

At the 1920 annual meeting of the Shantung-Honan Christian Educational Association, there were represented 678 mission schools, with a total enrollment of approximately 13,000 students, mostly of lower primary grade. Forty-seven of these schools were in cities; the remainder were in villages and small towns. Ninety-three per cent of the school work was in a distinctly rural environment. It would be wrong to say that 93% of the school work was distinctly rural, but would it not be infinitely better and more effective for the church if such country school work were definitely rural in its character and influence?

In China, at least, consciously or unconsciously, the Church is recruiting its workers, those on whom she is placing the greatest share of responsibility for the propagation of the Christian message, from country-bred folk. The following statements will help to make this truth more real. The Yenping



0901

Conference of the Methodist (North) Church in China has about 174 paid workers. Seventy-five to ninety per cent come from the small "hsien" cities and villages. Practically all of the paid workers of the Central China Conference (of the same Church) are recruited from the smaller cities and villages. (The interests of practically all the "hsien" or district cities are essentially rural as we understand the meaning of the term in the West). The West China Conference of the Methodist Church has about one hundred paid workers and practically ninety per cent are from the country. With 75 to 85 per cent of China's population rural, will the above ratios ever be any different? The answer—not a prophecy—is, they will not be materially different for generations to come; if ever.

The greatest resources of the Church in China, and it must be so in other missionary countries, are at the present time in the rural population. What is the Church doing to conserve these resources; conservation being used in the sense of developing and utilizing not only for the present generation but for the generations to come?

One evident answer would be, the church is preaching the Gospel of Jesus Christ with all that the clause "Gospel of Jesus Christ" connotes, such as transformation of individual lives, the development and maintenance of hospitals, education, social service, sanitation and so on. But is the answer sufficient, and are our methods efficacious? Christ said He came, not that men might have life, but that they might have more abundant life. Is He referring only to spiritual things, or does the term life have a more comprehensive designation, and include the elements (in addition to spiritual) that enter into the normal daily life that we live here on earth, producing necessities for ourselves and others, combating the stern realities of economic pressure, and otherwise trying to maintain ourselves as a unit of society, and possibly leaving the world a little better place for those who come after us? After a day's preaching and teaching, which doubtless touched upon more abundant living, Christ was unwilling to send his listeners away hungry, which the human instincts of the disciples, even after close contact with Him for a considerable time, prompted them to want to do.

The Church has seen fit, and rightly so, to develop, in addition to its churches, hospitals, schools, and so on, but the

idea of utilizing agriculture in any of its varied aspects, seems not to have taken much root in the minds of mission administrators or missionaries.

This condition, however, is passing and the possibilities of agriculture in connection with mission work are being realized from the missionary on the field to the Board secretary at home.

The enlarging vision of the missionary can best be shown by quoting an extract from the report of the Central China Conference of the Methodist Episcopal Church (North) to their Quadrennial Programme Statement Conference held in Peking in February of this year. "To broaden our base by some typical village plants. By villages, we mean communities of from 1,500 to 20,000 people, with from 40,000 to 80,000 within a radius of from four to seven miles. So long as we still have many compact communities of from 10,000 to 20,000 people without Gospel approach, we are far from the time when we can locate chapels and schools in small villages or homesteads or farmsteads; but whether following lines of least resistance or deliberately choosing strategic positions as we may now do, we feel that the time has come for a more scientific and adequate development of our country circuits. In Central China Conference most of our rural circuits are of sufficient population and areas to be constituted districts. It is our plan to build and equip a sort of primary unit in a centrally located town of the circuit; said unit to contain chapel of convenient size, primary schools for boys and girls' playgrounds if possible, quarters for housing the workers, reading rooms and whatever else may be necessary for reasonable educative and redemptive work in the town, making the church institution the social center of the community. In towns or villages within 15 or 20 li of this center will be opened primary schools and preaching halls, as fast as forces permit. Along with these usual forms of service should go others, specially adapted to rural and agricultural communities, occasional lectures,—illustrated if possible—on topics of interest to farmers, descriptions and demonstrations of approved methods, simple and cheap machinery, and better seeds. By helping to improve the grains, fruits, and vegetables, the cotton or silk, we shall win the confidence of the people and again save by serving. Our preachers should know how to bring information and help to people. No other agency contemplates this form of service and by co-operating with the

2  
0  
0  
3  
4  
2  
8



agricultural department of our colleges, we shall mediate between knowledge and need, and help improve the economic condition of the people. All this reacts on spiritual issues."

At the same Conference occurred what may seem to some to be a very radical step; namely, that in the accepted report of the Committee on Bible and Theological Education, it was recommended that special efforts be made to prepare ministers for country as well as for city churches. "We urge that in connection with each school of religion a specialist in agriculture offer such courses as deal with agricultural production, rural economics, and rural sociology, and that the vital relationship between these courses and practical evangelism be kept constantly before the minds of the students."

A Committee on agricultural education has recently been appointed by the China Christian Educational Association whose duty it is "to prepare an all China program, looking toward the introduction of agriculture into our mission schools through the development of provincial normal training centers for the suitable preparation of teachers." In this connection a budget of \$728,000, Mexican, on a five years' programme, has been approved by the China Christian Educational Association for inclusion in the Inter-church World Movement for the development of four agricultural training and extension centers.

The writing is on the wall. Missionary public opinion favorable to the utilization of agriculture in its various forms is rapidly crystalizing. Adjustments in due time will be made in the administrative machinery to include this new form of missionary service. It will find its greatest development in the mission schools where it will afford self-help, manual and vocational opportunities to the students. It will help save, by serving the people in their every-day interests and needs. It will attract the country folk, the tillers of the earth, and in affording a normal, helpful and permanent point of contact, will aid greatly in preparing the way for hearing the Gospel message gladly. The "preacher of the doctrine" will come to be looked upon as a friend, interested in more abundance, both spiritual and material, in the daily life of those whom he is trying to serve, and thus will he save by serving.

The day of agricultural missions is dawning, and there is beginning a new chapter of service on the part of foreign missions for those to whom the Gospel is preached.



John H. Reisner

## Progress of Forestry in China in 1919-1920

BY JOHN H. REISNER, DEAN

College of Agriculture and Forestry University of Nanking

**P**ROGRESS denotes correctly the present condition of forestry in China, this country so long used as an illustration of the dire results that follow the depletion of forests, and undoubtedly in greater need of scientific forestry than any other large country in the world. The year ending with the spring planting, 1920, showed much progress over the previous year, which was described in the author's previous article under a similar title. The outstanding developments of the year were the organization of a Provincial Forestry Service for Shantung Province; the enlarging of the forestry organizations in a number of provinces; the increased activity and services rendered by the Kiangsu Provincial Forest Station at Nanking, established in 1916; the extension of the forestry work being undertaken by three government railways, namely, Lung Hai, Peking-Hankow, and Tientsin-Pukow Railroads; increased educational interest in forestry, particularly as part of the curricula of government agricultural schools; the increased production of forest nursery stock; and the greatly increased number of district magistrates, agricultural societies, small companies, and individuals undertaking forestry work.

Although a numerical expression of this progress is open to criticism, it is fairly safe to estimate a conservative expenditure for various forestry enterprises mainly nursery work and forest planting at from \$200,000 to a quarter of a million dollars, the production of 100 million trees in more than one thousand nurseries, and the planting of twenty-five to thirty million trees on 165,000 acres of land. This may seem small when compared with

0764



some other countries, but large when one considers the background and the fact that China's interest in forestry is only a very few years old.

As indicated previously, forestry is not developing in China as it has in Western countries, with the Central government assuming a large share of financial and administrative control, but by individuals, societies, or companies, districts and provinces. And this condition may be expected to continue even in face of a marked activity on the part of the Central government. Individuals, companies, and small political units in China will have from the outset a much more important place in reforestation projects than similar bodies have had in the West. This is an important fact, and augurs well for the future of forestry in China.

The observance of Arbor Day is spreading widely and rapidly and is becoming of increasing significance. It is a national holiday. It is observed by high officials as well as the school children. With the development of the school nursery idea, that is for the secondary schools to have their own school nurseries, as many Western schools have their school gardens, and the children get to raising their own trees, it will add much to the influence of Arbor Day not only on the children but also on the community. Arbor Day is rapidly becoming indigenous and may be expected to be one of the important factors in hastening forestry development in China.

The outstanding forestry development continues to be that of the Kiangsu Provincial forestry station, started in 1916, located near the famous Ming Tombs in Nanking, at the head of which is Song Sing-moo, a graduate of the Philippine School of Forestry, with twenty-one assistants, two of whom also received their forestry education in the Philippines. The budget for this work last year was \$34,000, voted by the Kiangsu Provincial Assembly and paid wholly by the province through the Provincial Department of Finance. Thirty-four thousand mow of land have been replanted to date with two and a half million of trees, includ-

ing approximately one million of trees planted on 11,000 mow of land last spring. Three nurseries were maintained, with an area of 371 mow, carrying 1,275,000 transplants and approximately 3,000,000 seedlings, divided among seventy-three different species. Trees and seeds for nurseries and more than 50,000 trees for transplanting and for use in the observance of Arbor Day, were distributed to 186 district officials, agricultural societies, agricultural and forestry stations and companies or individuals. There are three substations already located in important parts of the province with two more being planned for. In response to a proclamation by the Governor two years ago instructing district officials to develop forest nurseries in their respective districts for demonstration purposes as well as for supplying trees for planting to the farmers, encouraging headway has been made, and a large number of such nurseries have been established. Sixteen students are now being given practical training at the central station in Nanking, having been sent from various parts of the province. They are given class work in the morning and field work in the afternoon, and after three years of such training they will be sent back to carry out forestry work in their home districts.

The newest provincial development has been in Shantung Province, which has come into world prominence through the "Shantung Award" of the Paris Peace Conference. This work was organized by D. Y. Lin, a graduate of the Yale Forestry School and at present of the forestry department of the College of Agriculture and Forestry of The University of Nanking, an American missionary institution at Nanking, China, who loaned him for the work at the special request of the Shantung Civil Governor. A provincial forest service has been established, with a chief forester and eleven assistants. Work was prosecuted so vigorously that the first planting season saw the organization of three forestry stations, the establishment of three nurseries with plans for two more for the following season, more than 550,000 trees planted on 2,000 mow of land and an additional



3,000 mow seeded. The budget calls for approximately \$22,000, payable through the Provincial Treasurer.

Three government railways are engaged in reforestation work looking forward to supplying their own ties and other timbers used in railroad construction and maintenance. Several other railways are contemplating similar developments. The budgets are voted by the various railway administrations interested. The forestry work of the Lung-Hai Railway, which is financed by Belgian interests, is under the direction of J. Hers, with a budget for the year of approximately \$17,000, which maintains a regular staff of fifty men, including laborers, a large central nursery with three smaller ones controlled by it, in all approximately 120 mow in nurseries with a million and a half seedlings, transplants, and cuttings. The reforestation has been mostly along both sides of the railway where 4,000,000 trees have been set out, including more than 800,000 the past season. The Tientsin-Pukow Railway forestry work has a budget of approximately \$6,000 and is in charge of a graduate of the Harvard Forestry School. Approximately 850,000 trees have been planted to date, three fourths of them this last year. There are two nurseries, one with approximately 640,000 seedlings and transplants. This work was begun in the late summer of 1918 and is just getting under way. The Peking-Hankow Railway's forestry work is under the direction of Ngan Han, a graduate of the forestry department of Michigan State University. A large tract of mountainous land in Southern Honan is being reforested, and while no detailed report can be given, the work is progressing nicely.

It would require a large volume to give the details of the various district forestry enterprises, which is not the purpose of this review. It should be noted, however, that out of the 1800 or more districts or counties in China, probably twenty to twenty-five percent have their own nurseries, or nurseries administered for them and for the upkeep of which they are taxed. A few instances will indicate this local interest and progress. The

Southern Chihli nursery has a budget of \$1,600 which is raised by allocating \$40. to each of the 40 districts served. The Kao-Yi district of the same province has its own nursery, with a budget of \$1,080 which is raised from a local tax on cotton. The second nursery of the Chekiang Forest School has a budget of \$1,500, a million and a half transplants and seedlings in its sixty mow nursery, and has direction over eleven smaller nurseries. The second nursery of Shensi province, with three local nurseries under its direction has a budget of \$2,400, with a production of five million seedlings. This nursery has adopted the policy of giving free to anyone in their nursery area fifty trees and up to five pounds of tree seeds. For larger amounts a slight charge is made. The Kiangsi Model Forest Plantation with its budget of \$1,590 from the provincial treasurer, in its two nurseries had approximately 2,000,000 transplants and seedlings and planted out approximately one-half million trees to the forest site. The Lin-Cheng district (Chihli) industrial deputy with his central nursery and four substations, his budget of \$1,350 raised from house and land taxes, and 3,000 mow reforested to date, is planning to have every family plant five trees annually for each male member. The Second Chekiang Provincial Nursery supplied free of cost more than a million trees, to sixteen districts in addition to schools, farmers and others, from its 190 mow nursery containing more than four million transplants and seedlings, on its budget of \$2,934 raised from local taxes.

Records secured from twenty-one forestry enterprises, including large and small, from North and Central China showed an expenditure for the year under review of \$106,000, a production of 26,500,000 seedlings (80 percent of the total) and transplants in the nurseries represented and three and a half million trees planted to forest sites on 15,000 mow of land. From data at hand and from first hand knowledge, conservative estimates of forestry expenditures and work last year would place the total amount of forest nursery stock raised at



100,000,000 trees, in considerably more than 1,000 nurseries, with an expenditure of from \$200,000 to \$250,000. In addition, there were probably between 25 to 30 million trees planted out to permanent sites on about 600,000 mow of land (100,000 acres). The largest nursery section is in North Kiangsu around Yangchow, where an investigation showed an annual production and sale of between thirty and forty millions of trees, approximately one-half of which are pines.

An interesting and encouraging development is in the introduction of courses, or departments, of forestry into many of the secondary agricultural schools of which every province has from one to five. Anhwei Province is now teaching forestry in four of her five agricultural schools, Chekiang Province has a secondary forestry school with a budget of approximately \$35,000, and a large enrollment. Graduates with forestry training will be in increasing demand, and the more imperative need would seem to be for more highly trained men than secondary schools can turn out. The present forestry education is an important factor in the situation both as it effects forestry personnel and development of an intelligent public opinion on forestry matters.

There is a phase of forestry development in China that America should be proud of, which is, that in practically all the large forestry enterprises men trained under Americans, or American trained, foresters are in the lead. Graduates of Yale, Harvard, Michigan, Syracuse and Cornell, of the Philippine School of Forestry, and of the University of Nanking, China, whose forestry teachers are Americans or American trained Chinese, are all holding positions of responsibility, and some are holding the highest in the country. A forest service in China with as high ideals as the Forest Service in the United States will be irresistible and to it will be entrusted one of China's greatest problems and needs.

Marlboro, N. Y. January, 1921.

0767

2  
0  
0  
3  
4  
2  
8





Transplanting 250,000 Mulberry Seedlings for Grafting Next Spring, at the University of Nanking.

# PRACTICAL WORK TO IMPROVE CHINA RAW SILK

By JOHN R. REISNER  
Dean of the College of Agriculture and Forestry

*IT IS agreed by all students of the raw silk industry of China, that it can be greatly improved as to quality and amount of production if given assistance of a practical nature that will help to place the production of cocoon on a scientific basis, eliminating disease and adding to the silk yield. Among the different movements that have been started to aid the China raw silk industry, the work being done by the University of Nanking has already progressed to the point where it is producing good results, and with financial support from American silk interests, can be extended to become an important factor in the building-up of the raw silk industry of China. Mr. Reisner gives an interesting description of the work being done in the following Report for 1919-1920, of the College of Agriculture and Forestry, Section on Sericulture and Mulberry Work, University of Nanking. Though he makes no direct appeal for assistance for financial co-operation from American silk manufacturers, the need of assistance is made very evident.—Ed.*

IT IS impossible to give in my report here a complete account of the sericultural and mulberry work, because of the detail that would be necessary. The time has come when this report should be gotten out separately, setting forth fully the results of our work along these lines. The following, however, will outline briefly the main developments and results of the past year, for which Mr. Chien Fien-ho deserves full credit and our heartiest support.

Our report to the International Committee for the Improvement of Sericulture, submitted early last December, was approved by them, as well as the enlarged budget asked for the work for the present year. The total amount requested (which has already been received) was \$2,820 as against \$2,683 for the preceding year. In addition, two payments of \$600 and \$750, total \$1,350, have been received as capital on mulberry production. The total capital guaranteed for this purpose was \$2,700, all but \$750, of which has been paid. In addition to the grants made by the International Committee, the University has invested, in buildings and mulberry orchard, \$1,749.56. For our sericultural work as it should be developed, we should have an annual income of \$10,000, to be used on salaries, egg production, extension work, investigations, and publications.

## Sericultural Investigations

**Prevalence of Pebrine:** Mr. Chien utilized the opportunity afforded by the short course, to which students had brought eggs from their own districts for their rearing work, to make a study of the prevalence of pebrine. The results of his investigations with twenty-eight different lots of silkworms from widely separated sections of the country showed an average incidence of disease of sixty-two per cent. This is probably the most reliable and inclusive information that has been secured in China, showing as it does, the general prevalence of the disease and suggesting the tremendous problem involved in eradicating it from the industry.

**Yield of Silk:** The opportunity also presented by the short course for gathering information about the relative yields of silk from different varieties of silkworms was taken, with the result that in twenty-eight different lots, the quantity of silk reeled from two hundred selected cocoons of each variety showed a range of from .93 oz. to 1.99 oz. The best was more than twice as good as the worst, and this indicates the range for improvement which can be made by careful selection, and propagation only of the best.

**Silkworm Incubator:** Mr. Chien has adapted an American egg incubator for use in hatching silkworm seed. The matter of the temperature regulator has given greatest concern, but tests being made at this writing are sufficiently good to call it successful. There is a big need for such a machine, and active steps will be taken to make it a commercial success, adapted to both the need of schools and farmers. The present commonly used method of hatching out the seed by rearing the egg card next to the body is undesirable because of the irregularities of the temperature and poor ventilation.

**New Method of Individual Egg Production:** There are two commonly used methods of certified egg production, the European and the Japanese, by which individual layings of the moth are obtained, and the individual moths segregated until they can be tested under the microscope. The European method, which has a small paper bag in which the moth is placed to deposit her eggs, and kept until microscopic examination has taken place, is better adapted to present conditions in China than the Japanese method, but it has the serious objection of making the eggs difficult to handle. The bags must be cut open and pasted on card-boards, or the seed must be removed from the paper and kept loose. The Japanese method is too complicated and allows room for too many errors to be well adapted where the percentage of disease is as high as it is in China.

One of the Temporary Sericultural Buildings of Nanking.



**Silk**





University of Nanking Students Grafting Improved Varieties of Mulberry on to Wild Seedlings.

Mr. Ch'ien has worked out a combination of features of both methods, that maintains the card feature of the Japanese and conserves the individual features of the European method. A small cardboard box, ventilated, with an easily removable ring inside, holding a removable piece of paper on which the eggs are deposited, and a box lid, constitute the necessary equipment. The amount of labor involved is possibly more than by the bag method, not more than by the Japanese method. The amount of space needed is somewhat larger. The cost is not greater than either, and the best features of both are conserved. We are experimenting with 7,000 of these boxes this year, but the present outlook is most hopeful that they will succeed. It will be one of the greatest contributions yet made to the work of certified egg production in China.

**Hybridization:** A number of crosses were made last year, the results of which will not be available until after the present cocoon season is over.

**Purifying of Varieties:** Much work is being done on the purifying of strains for future crosses, and for a more careful study of silk yields. This work is absolutely fundamental and necessary.

**Undescribed Diseases:** Two undescribed protozoa have just been discovered by Mr. Ch'ien. The symptoms of the diseases are distinct from the commonly found pebrine. Tests will be made to determine whether or not the diseases are hereditary. An unnamed and undescribed bacteria has also just been found, on which more work will be carried on. An intensive study of silkworm diseases in China by a high expert is a pressing need.

Other investigations being carried on are comparison of food consumed by different varieties of silkworms, variation in time required from hatching to spinning, raising worms from cold storage eggs, rearing of summer and autumn crops, etc.

#### Egg Production

The arrangement which was entered into with the International Committee last year concerning certified silkworm egg production, but which could not be carried out because of the loss of the crop when our sericultural building burned, has been carried forward to this year. At the writing of this report, the rearing season is about half over, and conditions are favorable for a good crop of cocoons, from which, after careful selection, seed will be produced.

#### Short Course in Sericulture

The short course in Sericulture this year lasts for three months, from March 25 to June 30. Forty-two students are enrolled from seven provinces, as follows: Kiangau, eleven; Hunan, eight; Shantung, six; Honan, five; Chekiang, four; Anhwei, four; Hupeh, four. Thirteen students were sent by district magistrates, thirteen came of their own will, eight were sent by agricultural schools, five

were sent by agricultural associations, and three were sent by experiment stations. The average age of the students is twenty-three years, the oldest being thirty-nine and the youngest, eighteen. Twenty-nine middle schools are represented, and four higher primary. Forty-one of the students were formerly in government schools, and only one from missionary schools. There are eleven Christians, two Mohammedans, and twenty-eight Confucianists.

The type of short course student appears to be changing somewhat, more coming from the teaching or prospective teaching class than direct from the farm. Mr. Ch'ien's suggestion that a change be made in the course, making it six months in duration, and adapting its content to the preparation of teachers and extension workers in sericulture, is a good one and should be put into force as soon as possible. This immediately raises the question of a short course for farmers, the practicableness of which at the present time in comparison with extension work reaching him directly in his village and home, is questionable. The silk season is the farmer's busy time, when he cannot drop his work for six weeks or longer, or at least he will not until he has more preliminary information about its value than he has now. Extension work would open the way to persuade him to come to a short course session, and in the meantime be serving a much larger number of people.

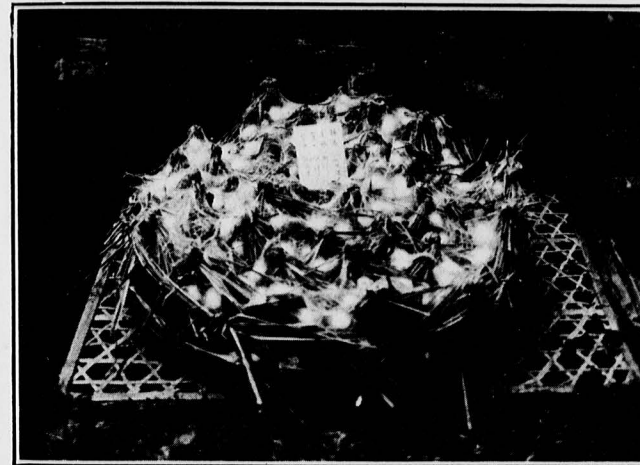
#### Mulberry Collection

The mulberry collection work was continued this year, principally in the province of Kiangsu, and somewhat in Hupeh. About sixty different lots were secured, from all sources, probably including a number of duplicates. The mulberry collection now represents the work of three years, covering the provinces of Chekiang, Kiangsu, Kiangsi, Anhwei and Hupeh. It contains about twelve hundred trees covering fifteen mow of land.

The mulberry production is going along successfully, although the past season has not been particularly favorable. This spring we grafted 76,000 mulberries, and indications are now that there will not be much over a seventy per cent. take, whereas, normally we would expect at least ninety per cent.

Two hundred and fifty thousand seedlings were transplanted this spring, for grafting next spring and for sale and distribution in the spring of 1922. This is a hundred thousand more than the original plans called for, but we feel justified in doing it, because of the small cost of production, and because of the fact that we shall not have ready for sale the amount originally expected from first-year work. It is too early to estimate cost of production, but indications are that we can produce much cheaper than estimates originally accepted.

A Section of the Mulberry Collection, Covering Two and One-half Acres, Including 1200 Trees, and Representing About 175 Different Lots, Including Different Varieties.



Silkworms "Climbing the Mountain." Note the Silkworms Not Yet Begun to Spin Their Cocoons.

#### Mulberry Experiment

Our mulberry experiment with cuttings last year, was not successful, due first to too little callousing and, second, unfavorable weather conditions in early stages of growth. With a longer time for callousing, the appearance of the cuttings at this time is good and they appear to be taking root in good shape.

#### Co-operation with Chinese Customs Chefoo

We have co-operated with Mr. A. Cugden, Commissioner of the silk industry of Shantung. We have furnished con-



## BELGIAN ARTIFICIAL SILK

HOPEWELL, VA., has been selected as the spot where the famous Belgian artificial silk industry will have its American re-birth. The former munitions town, cluttered with great plants, equipped with railroad siding radiating in all directions just as they were needed and used during the war, with a splendid labor market still available, will thus remain on America's industrial map; and those who have made a study of its location and advantages claim that, before many years have passed, the site of every one of the old munitions factories will be covered with a textile mill of some sort.

The artificial silk mill which is now being erected, it owned and will be operated by the Tubize Artificial Silk Company, makers of the most famous of the Belgian brands. To put the matter briefly, neither the artificial silk mills now operating in the United States, nor those in Europe, are able to supply the full demand of the various American industries which are using this product. The country's requirements are so great, that the Viscose corporation, which manufacturers the American silk from wood pulp in two plants, is planning to erect a third, and the Du Pont interests, which are expert in the handling of nitrate cellulose products, have also announced their intention of entering the field. The new Tubize enterprise may be able to add enough to the total production to saturate the market—and it is nothing less than saturation that it needs if any number of textile branches are to be put in a position to manufacture the needed supplies at reasonable prices to the public.

Tubize artificial silk is made of cotton linters by the nitro-cellulose process. At present, all the material needed for its manufacture is bought abroad, most is still coming from the surplus war stock of the Allies, the linters as well as the chemicals. All this will be changed, however, so soon as the first wheel turns at Hopewell. For months past,



Mulberry Trees from Cuttings, First Year, a Method of Production Little Used in China, on Which the University of Nanking is Experimenting.

siderable information, seed for starting an oak nursery, oak trees for transplanting, and have recommended several Shantung men, who attended the short course in Sericulture last year.

#### Visit of American Silk Mission

On April 9 and 10, the members of the American Silk Mission visited Nanking, and inspected the work in sericulture and mulberry being carried on at the University. The Mission included Mr. Charles Cheney, President, and Mr. Ramsey Penguet, Secretary-Treasurer, both of the American Silk Association and the United States Conditioning and Testing Company; Mr. D. E. Douty, General Manager, United States Conditioning and Testing Company; and Messrs. E. J. Stehli, J. D. Dunlop, and W. C. Cheney.

Belgian chemists have been in the United States, experimenting with American cotton and American acids. Their reports have been to the effect that these materials are in every way satisfactory—in some respects even superior to the European product. As a result, every ounce of the material needed for the American brand of Tubize will be purchased here, as much of the machinery as can be produced in the United States will be constructed here, the working staff will be recruited from the local markets—in fact, Tubize, so far as Hopewell is concerned, will be an all-American product.

In the meantime, experiments are now being conducted in the laboratories of the Belgian plant which, to some extent, will determine just how much artificial silk the United States will be able to buy in the future. At present, our various textile industries are using about 6,000,000 pounds per year. If it were advisable at this time to produce with the machinery on hand enough of the fine threads to meet the requirements of the underwear weaving lines and the ribbon trade, another 2,000,000 pounds could conveniently be added. To some extent, Tubize is resuming the production of these fine "deniers," as they are called. In the trade, they are known as 60, 70, 80, 90, etc. Even 35 is being turned out, but in limited quantities.

To get a close-up view of why there is a shortage of these threads, and of artificial silk in general in the United States, it is necessary to get information from the vicinity of the famous battlefield of Waterloo. Fifteen miles from there is located the main Tubize plant. During 1913-1914, this establishment sent three million pounds to this country. Then, with the first shot on the other side of King Albert's border, production ceased abruptly and, with it, all exportation. But no sooner was the armistice a fact, than the Belgian resumed the manufacture of the famous silken

SILK

SILK



strands and in July 1919, the first shipment since the war, about 10,000 pounds, reached the United States. Last June, the weekly importations climbed to 100 cases, or 22,500 pounds.

The speed with which this industry came back has often been commented on as one of the marvels of European reconstruction. There was a reason. Better than any other nation perhaps, they knew what to expect once the enemy was on their soil. So they took time by the forelock as soon as the arrival of the invader seemed inevitable, and buried about 3,000 tons of delicate machinery, motors, belting and other appliances and buried them so well that the Germans tramped right over the caches. When Belgium had been cleared of the last man in field-grey, these industrial treasures were unearthed, and while Tubize seemed to be in pretty bad shape generally, vats smashed, piping broken and twisted and some of the buildings half demolished, thousands of laborers were set to work and in less than a year's time Tubize silk was again in the American market. Today, almost full pre-war production is the rule. Five thousand operatives are turning out an average of 15,000 pounds per day.

Elsewhere, too, Tubize silk is being wound around the spindles. The great Belgian factory at Sarvar, Hungary, with its output of 7,000 pounds daily, had been seized by the Austrians as enemy property and was converted into a munitions plant. In a manner, this was a bit of good fortune for the owners, because it precluded destruction. So when the Austrians and their former dependents, the Hungarians, laid down their arms, it required but a few months work to re-transform the machinery to its pre-war uses. Likewise at Tomazow, in Poland, where operations had to cease when the war started, full production has been resumed, 9,000 pounds being the daily harvest. In addition, this plant has been enlarged to include a powder department, the output of which is making the fight of the Poles against the Bolsheviks possible.

While the war was on, the United States was entirely dependent upon the American product, called Viscose. It is being turned out by 4,000 hands in two plants. Some textile interests claim advantages for Viscose over Tubize. Others say that each has certain advantages over the other. The following table, giving the percentages of tenacity and elasticity of the two products tells its own story:

	Tenacity%	Tenacity%	Elasticity%
	Dry State	Wet State	Dry State
Viscose	145	48	13.5
Tubize	170	65	13.2

The above table is the result of tests made in the same room at a humidity of 65% and temperature of 22° centigrade.

Thus it will be seen that both silks, so far as elasticity is concerned, are practically on a par, with Viscose a trifle in the lead. On the other hand, tenacity, considered both in the dry and wet state by many makers to be a main feature, gives the preference to Tubize.

What the artificial silk industry in general means to the United States in dollars and cents, in tons and in pounds, has often been a matter for discussion. The seasons change the demand. Likewise, the upset of the war has been such that figures computed during the past four years hardly tell a reliable tale. But a general idea of the country's immediate needs can be gained from the following tabulation:

Industry	Average Consumption in Pounds per Month
Sweaters	50,000
Neckties	20,000
Braids	15,000
Mufflers	10,000
Tricolettes	100,000
Hosiery	200,000
Shirtings, etc.	50,000
Broad silks	50,000
Fancy weaves	25,000
Plushes	5,000
Carpets	5,000
Fringes, tassels, etc.	5,000

This makes a total of approximately one-half million pounds per month, or six to seven million pounds in the year. And it does not include minor lines such as gas mantles, shoe laces, garters, elastics, etc.

But for the fact that the present silk slump has somewhat decreased the normal demand for both the artificial and the real product, the aggregate present supply, furnished by the American, Belgian and other plants, would not meet the demand by thousands of pounds weekly. As it is, it barely answers requirements. With the Fall, there

will be a tremendous discrepancy. It is due to this expected demand that the mill at Tubize restricted the production of the fine deniers to the merest necessity, despite the fact that the Belgian process is the only one which can turn them out successfully. However, reports from abroad indicate that quantity production is likely in the near future, but in the meantime the United States will have to be satisfied to share the output with European interests which have standing contracts.

#### GRAMERCY BOYS' CLUB

CONSIDERABLE interest is being shown on the silk district in the Gramercy Boys' Club, an organization of boys in the Gramercy district. There are in this locality upwards of 6,000 boys, who may be an asset or a liability, according as they are handled.

The point to be considered is not only that the boys should be kept off from the streets now, but that they will develop into men that have a distinct commercial value if they receive the proper attention. A great deal has already been done, but there is still more waiting. It is desirable that a small house in the neighborhood should be leased, in order that the boys may have a club home, a place that will be attractive, socially.

It is believed that the attention of the market need only be directed toward this movement for it to receive a ready response. O. H. Cheney, president of the Pacific Bank, has consented to act as treasurer of the movement. Some help has already been given, but more is needed. If it does not come, it will be the first time the silk trade ever refused to respond to a legitimate call.

#### COMING SILK EXPOSITION

AT A meeting of the organization committee of the International Silk Exposition, held Wednesday, September 1, at the headquarters of the Silk Association of America, tentative plans were discussed at length, and the proposed date of the initial silk show in the United States favorably acted upon. As a result of the meeting the first exposition of the silk industry in America will be held in Grand Central Palace, during the week of February 7, 1921. The exposition will be under the joint auspices of the Silk Association of America and the Silk Travelers' Association, Inc.

A "National Silk Week" will be the aim of the promoters of the exposition, but while the idea is to show American progress first, there will be exhibits from Japan, China, France, Italy and South America, and these will lend an international tone to the big display. Two floors of the Palace have been engaged to house the show, but it is likely that more space will have to be taken, so great is the interest shown by American manufacturers.

Committees to handle the various details of the exposition were appointed at the meeting.

Silk manufacturing circles in Rhode Island are interested in the appointment of a Federal receiver for the Rudolph Saenger Company, Inc., of New York, because of the fact that this corporation has a mill at Pawtucket in that state. The mill there, employing about 100 hands and operating approximately 100 looms, is located at 110 Tweed Street, that City. The plant was erected five years ago and during that time has been operated by two concerns other than the silk firm. When completed it was operated by the American Hair Net Works and later passed to a lace manufacturing firm, in whose hands it remained until two years ago when it was changed to a silk manufacturing plant by the Saenger corporation.

It is reported that the Hamlet Textile Company, silk manufacturers with plants at Woonsocket, Pawtucket and Valley Falls, R. I., and one of the biggest exclusive silk manufacturing plants in Rhode Island, is soon to discontinue its Valley Falls plant. The company, for the past few years, has utilized one of the buildings formerly owned by the Chase interests in that town, silk throwing being the principal business conducted.

**SILK**

0770



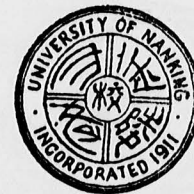
CHINA UNION UNIVERSITY  
CENTRAL OFFICE  
150 FIFTH AVENUE  
NEW YORK, N. Y.

University of Nanking  
Agriculture and Forestry Series

Volume One, Number One.

# SCHOOL NURSERIES

John H. Reisner



Issued by  
The College of Agriculture and Forestry

February 1920

Revised and Reprinted, January 1924

0771

2  
0  
0  
3  
4  
2  
8



This bulletin is issued in Chinese also. Additional copies of either the Chinese or the English edition will be sent on request. Address all communications to the College of Agriculture and Forestry, University of Nanking, Nanking.

## CONTENTS.

	Page
Objects of School Nurseries ... ..	1
Arbor Day ... ..	1
Value of a School Nursery ... ..	
What is needed for a School Nursery ... ..	3
Why Species listed are used ... ..	3
Local Trees, Identification of ... ..	4
Layout of Nurseries ... ..	6
Nurseries for Central and North China ... ..	7
School Nursery for Yangtze Valley, One half mow ... ..	7
School Nursery for Yangtze Valley, One mow... ..	8
Special Offer to Schools ... ..	7, 8, 9, 10
Hedge around the nursery, A ... ..	8
School Nursery for North China, One half mow ... ..	9
School Nursery for North China, One mow ... ..	10
Planting Directions... ..	10
Management of the Nursery ... ..	11
Seeds for the Nursery ... ..	12
Nursery Site, Selection of... ..	13
Seed Bed, Preparation of the ... ..	14
Laying off the Seed Beds ... ..	14
Fertilizers ... ..	14
Protection ... ..	15
Marking Board for planting ... ..	15
Cultivating the Nursery ... ..	15
Irrigating the Nursery ... ..	16
Digging up and Heeling in ... ..	16
Transplants ... ..	17
Stratifying seeds ... ..	17
Stem Cuttings ... ..	18
Seed Collection ... ..	18
Preparation for Second Year ... ..	19



## SCHOOL NURSERIES

### Objects of School Nurseries

The objects of the School Nursery are: 1st, to get the children to understand the value and uses of trees; 2nd, to teach them how to raise trees from seed and cuttings; 3rd, to teach them how to plant trees correctly; 4th, to teach them to recognize the more important trees of their neighborhood; 5th, to use the trees grown by the children for beautifying the city, village or countryside; 6th, in some cases to develop sources of income; 7th, to make Arbor Day a real influence in the life of the school and country; 8th, to develop public consciousness on forestry matters; 9th, to use in connection with other subjects taught such as arithmetic, essay writing, etc.

### Arbor Day

Arbor Day is deserving of a wider celebration, and of becoming one of the most important holidays in the school calendar. It can never mean much without plenty of trees for every school boy and girl, and it will mean most if the boys and girls have raised their own trees—prepared the ground, planted the seeds, watered the young seedlings, cultivated the soil, and watched the trees grow day by day, until they feel and understand the accomplishment to be their own. The Government has proclaimed Arbor Day a national school holiday, and it is already widely observed. Its significance is beginning to be understood. China has room, and the need is very great, for millions upon millions multiplied by tens and hundreds of trees. There should be trees everywhere, on the mountains, along the roadsides, in waste places, in gardens, yards, parks, villages, everywhere, in abundance! China will be reforested, and reinvested with the beauty of trees which she must have once enjoyed—by the children, if not of this generation, certainly of a later one. The development of school nurseries and the making of Arbor Day



prominent in the life of the school can aid tremendously in solving the very pressing and important problem of afforestation in China.

#### Value of School Nurseries

The value of a school nursery is very evident. In the first place the children will learn how to raise trees, and in considerable quantity. In this way interest in the production of trees to reforest China's mountain and country sides can be begun and stimulated. The school nursery can be made to furnish all the trees used in celebrating "Arbor Day"—not only those that the students use themselves, but trees for the community as well. In some cases, the nursery can not only be self-supporting, but can be made a source of revenue. In a mission school at Antung, the students pay for their own teachers from the profits secured from the sale of the trees they raise in the large school nursery. A school in Shanghai is utilizing part of the campus for the school nursery because it is so profitable. The children will very readily become acquainted with the different kinds of trees grown in the region, and their different uses and value. It will be a very great aid in helping the children to an appreciation of the value and importance of trees, and these are all lessons of national bearing and importance. Many of the problems in arithmetic can be taken from the nursery, which will help to fix in the mind of the children, in a quantitative way, the value of the work which they are doing. There will be many opportunities in the nursery for nature study of a very simple yet interesting and valuable sort. When a boy or girl has learned how to plant a tree correctly and well, he will have learned something of which he may be proud, and will be of as much educational value to him as is much of the school work which he is compelled to do in order to pass from a lower to a higher grade. The element of real work connected with the nursery, which the students will be doing, is not the least of its values. It will result differently in different places under the guidance and enthusiasm of different people, its values will appeal differently,

but its values are unmistakable in whatever way they may be interpreted.

#### What is Needed for a School Nursery

1. A piece of land, no matter what shape or size. Of course, a piece of land carefully laid off can be used to better advantage but this is not essential. The half mow and one mow nurseries are recommended where enough land is available. The half mow nursery should measure 50×60 feet (Chinese or foreign); the one mow nursery should measure 60×100 feet. If you have not the land about the school—usually it is there or close by—rent it. It will be worth while. (See also, Selection of the Nursery Site, page 13).
2. Seeds. The College of Agriculture and Forestry furnishes the seeds in accordance with its special offer to schools. The students should by all means collect seeds of the local trees for the next year's work. See page 12.
3. Labor. The students should provide the labor. It may be well to have some one plough up the field to begin with, but the preparation of seed beds should be done by the students.
4. Direction. The teacher should provide direction as is necessary. A manual for teachers is being prepared in Chinese. The students should manage the labor as much as possible. It should be *their* nursery.
5. Interest! Enthusiasm! Work!

#### Why Species Listed are Used

We have chosen the particular species as listed because in most cases they are easy to grow, and make a rapid growth in one year, so that they are ready to plant on the permanent site within a year. The land can then be used again for the nursery next year. The students do not have to wait a long time for results. By using these species, success the first year is better assured, and with the experience gained the students will be ready to undertake a larger



nursery the next year, containing some new, slower growing, and more difficult species.

Every nursery contains one or more species of special economic importance, such as the walnut, which are sold both locally and exported; the candleberry, from which vegetable tallow is secured; and the soap tree, the pods and seeds of which are used as a substitute for soap. Planting of these trees should be encouraged, and the students have in the nursery an opportunity to learn about them, and particularly how to produce and plant them.

In the one *mow* nurseries, one or two species are included that have to be transplanted in the nursery. They make a slow growth of less than one to two feet in a year. Only a small quantity of seeds of these is included, because of the larger amount of land that is required. It is important, however, that students learn to do the transplanting (see under nursery directions), for many of the most important species must be grown this way. These are recommended for the older students.

#### Identification of Local Trees

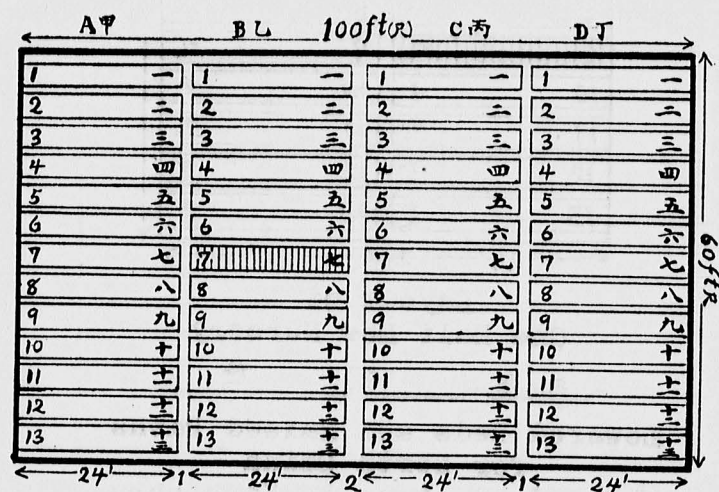
All the local trees should be identified, and all the students should learn them. For the larger trees and more important species it will almost always be possible to get the Chinese names locally. Those that can not be identified, however, may be sent to the College of Agriculture and Forestry, University of Nanking, for identification. The specimen sent should include at least a twig with leaves, and, if possible, with flowers or fruit, for each species. The specimens should be sent numbered, and corresponding numbered specimens should be kept by the senders. The names of the identified species will be sent according to the numbers. Trees are named according to their local name, classical name, and scientific name (and common name in English for many species). For the young students the scientific name is not necessary, though they should learn all the Chinese names that the species possesses.

#### One Half and One Mow Nursery Layouts

The school nurseries have been worked out on the basis of one half and one mow. One mow is about 6,000 square feet Chinese standards. One mow therefore is 60 x 100 feet and a half mow 60 x 50 feet. There is so little difference between the Chinese and foreign feet that either standard may be taken in laying off the beds, or in planting the seed.

The following diagrams have been made to show the arrangement of the beds and planting lines, also the raised and lowered beds and paths.

#### Layout for One Mow Nursery

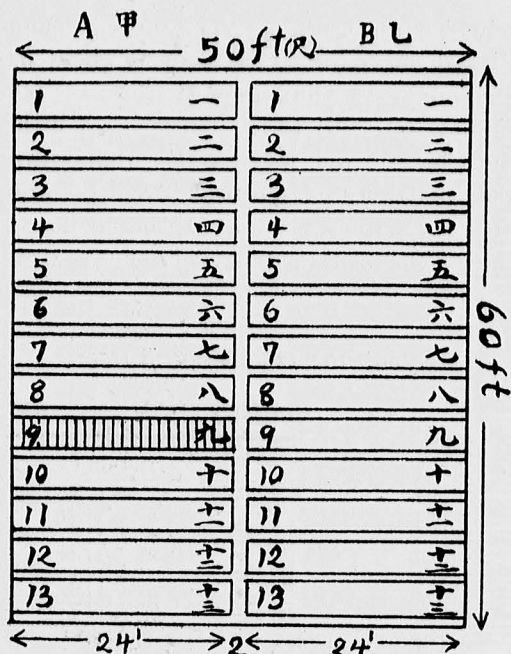


The plan of *lowered beds and raised paths* for North China as well as *lowered paths and raised beds* for Central China and details of a single nursery bed are shown on the opposite page. The beds are 24 feet long and 3½ feet wide. The height or depth of the paths will vary from 3 to 8 inches according to local garden practice.

The distance between beds is one foot. The distance between the A & B and the C & D rows of beds is two feet.



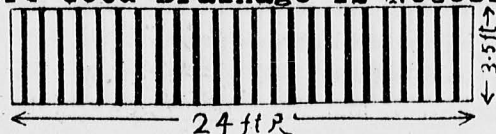
Layout for One Half Mow Nursery.



Layout of  
One Half Mow Nursery

Lowered Beds and Raised Paths  
for North China  
Where Irrigation is Necessary

Lowered Paths and Raised Beds  
for Yangtze Valley  
Where Good Drainage is Necessary



Single Seed Bed  
Showing Planting Lines

### Nurseries for Central and North China

In order to be as specific in our directions as possible, two nursery plans have been drawn up. These plans are given on pages 5 and 6.—It did not seem wise at this time to try to include the southern provinces, though we hope later on to develop a scheme for these also.

### School Nurseries for Yangtze Valley

This territory includes all of Chekiang, Kiangsi, Hunan, Hupeh, and Szechuan provinces, and the southern part of Kiangsu and Anhwei provinces. It has been difficult to choose a half dozen or ten species to include in a nursery suitable for such a wide area. However we anticipate no trouble with the trees chosen as they are all adapted climatically and are easy to grow, and are ready for transplanting after their first season.

### One Half Mow Nursery for Yangtze Valley Six different tree species

Common name.	Chinese name.	Number of beds.	Amount of seeds needed.	Planting distance between seeds.	Depth to plant seeds.
Black locust	洋槐	9: A1-A9	9 oz.	½ in.	¾ in.
Pride of India	楓楊	4: A10-A13	2 gin	2 in.	1½ in.
Chinese ash	楝樹	3: B1-B3	8 oz.	1 in.	1 in.
Candle-berry	烏桕	6: B4-B9	1 gin	2 in.	1 in.
Maidenhair tree	白葉	1: B10	12 oz.	3 in.	1½ in.
Privet	女貞	3: B11-B13	1½ gin	½ in.	½ in.

### Special Offer to Schools Only

Seeds of each of the above six species to the amount indicated, totaling 6 gin 5 ounces valued at \$3.80, postage and bagging included, will be sent, postage paid, to any school upon the receipt of \$1.50.



### One Mow Nursery for Yangtze Valley

#### Ten different tree species

Common name.	Chinese name.	Number of beds.	Amount of seeds needed.	Planting distance between seeds.	Depth to plant seeds.
Black locust	洋槐	13: A1-A13	13 oz.	½ in.	¾ in.
Pride of India	槐樹	8: B1-B8	3 gin	2 in.	1½ in.
Chinese ash	楓楊	5: B9-B13	13 oz.	1 in.	1 in.
Candle-berry	烏柏	9: C1-C9	1 gin 4 oz.	1 in.	1 in.
Maple	三角楓	6: C10-D2	½ gin	½ in.	½ in.
Maidenhair tree	白葉	1: D3	12 oz.	1 in.	1½ in.
Pine	馬尾松	1: D4	2 oz.	½ in.	½ in.
Phoenix tree	梧桐	1: D5	1 gin	1 in.	1 in.
Oak	櫟	2: D6-D7	5 gin	2 in.	1½ in.
Privet	女貞	6: D8-D13	3 gin	½ in.	½ in.

#### Special Offer to Schools Only

Seeds of each of the above ten species to the amount indicated, totaling sixteen gin, valued at \$8.40, postage and bagging included, will be sent postage paid to any school upon the receipt of \$3.00.

#### A Hedge Around the Nursery

A hedge will help make the school nursery site attractive. The evergreen privet is fine for the purpose inasmuch as it is easy to grow and makes an excellent as well as beautiful hedge. The seed is sown in the nursery the first year and transplanted the next spring as the permanent border. A separate leaflet will be published for use next year on hedges for the school nursery.

### Schools Nurseries for North China

The territory included in this area covers roughly the provinces north of the Hwai River, including Chihli, Shantung, Shansi, Shensi, Honan and Kansu provinces, and northern Anhwei and Northern Kiangsu provinces. Care has been taken in selecting the six and ten trees for one half and one mow nurseries, respectively, to get species not only adapted to the climate of the area but which are fairly sure to grow easily and successfully. A second year, more difficult as well as possibly more local species may be attempted.

### One Half Mow Nursery for North China

#### Six different tree species

Common names.	Chinese name	Number of beds.	Amount of seeds needed.	Planting distance between seeds.	Depth to plant seeds.
Black locust	洋槐	12: A1-A12	12 oz.	½ in.	¾ in.
Pine	松樹	1: A1	2 oz.	½ in.	½ in.
Chinese locust	槐樹	8: B1-B8	2 gin	1 in.	1 in.
Soap tree	皂莢樹	3: B9-B11	1 gin	2 in.	½ in.
Elm	榆樹	1: B12	1 oz.	2 in.	½ in.
Maidenhair tree	白葉	1: B13	12 oz.	1 in.	1½ in.

#### Special Offer to Schools Only

Seeds of each of the above six species to the amount indicated, totaling 4 gin 11 ounces valued at \$5.20, postage and bagging included, will be sent postage paid to any school upon the receipt of \$1.50.



One Mow nursery for North China  
Ten different tree species

Common name	Chinese name.	Number of beds.	Amount of seeds needed.	Planting distance between seeds.	Depth to plant seeds.
Black locust	洋槐	13: A1-A13	13 oz.	½ in.	¾ in.
Chinese locust	槐樹	8: B1-B8	1 gin	1 in.	1 in.
Soap tree	皂莢樹	6: D9-C1	2 gin	2 in.	½ in.
Elm	榆樹	8: C2-C9	8 oz.	2 in.	½ in.
Oak	櫟	2: C10-C11	4 gin	2 in.	1½ in.
Pine	松樹	2: C12-C13	2 oz.	½ in.	½ in.
Walnut	核桃	1: D1	1 gin	4 in.	2 in.
Arbor vitae	側柏	5: D2-D6	4 oz.	½ in.	½ in.
Maiden hair tree	白葉	3: D7-D9	2½ gin	1 in.	1½ in.
Privet	女貞	4: D10-D13	2 gin	½ in.	½ in.

Special Offer to Schools Only

Seeds of each of the above ten species to the amount indicated, totaling 14 gin 3 ounces valued at \$10.00, postage and bagging included, will be sent postage paid to any school upon the receipt of \$3.00.

Detailed Planting Directions for Each Species

Planting directions for each species are given below. All rows are one foot apart.

- Arbor vitae, 側柏, *Thuja orientalis*, should be planted one half inch deep and about one half inch apart in the row.  
 Ash, Chinese, 楓楊, *Pterocarya stenoptera*, should be planted one inch deep and two inches apart in the row.  
 Candleberry, 烏柏, *Sapium sebiferum*, should be planted one inch deep and two inches apart in the row.  
 Elm, 榆樹, *Ulmus pumila*, should be planted one-fourth inch deep and about one-fourth inch apart in the row.

Locust, black 洋槐樹, *Robinia pseudoacacia*, should be planted three-fourths of an inch deep and one inch apart in the row. The seeds should be soaked in water for two hours before planting.

Locust, Chinese, 槐樹, *Sophora japonica*, should be planted one inch deep and two inches apart in the row. They should be soaked in water for two hours before being planted.

Maidenhair tree or Ginkgo, 白葉, *Ginkgo biloba*, should be planted one and a half inches deep and three inches apart in the row.

Maple, 三角楓, *Acer trifidum*, should be planted one-half inch deep and about one inch apart in the row.

Oak, 櫟, *Quercus serrata*, should be planted one and a half inches deep and two inches apart in the row. Oak seed should ordinarily be layered or fall planted.

Pine, 馬尾松, *Pinus massoniana*, should be sown one-half inch deep and one-half inch apart in the row.

Pine, 松樹, *Pinus sinensis*, should be sown one-half inch deep and one-half inch apart in the row.

Pride of India, 楝樹, *Melia azedarach*, should be planted one and a half inches deep and three inches apart in the row.

Privet, 女貞, *Ligustrum lucidum*, should be sown one-half inch deep and one-half inch apart in the row.

Soap tree, 皂莢, *Gleditsia sinensis*, should be planted one-half inch deep and two inches apart in the row. They should be soaked five hours in warm water before being planted.

Walnut, English, 核桃, *Juglans regia*, should be planted three inches deep and four inches apart in the row. Ordinarily they should be layered, or fall planted.

Steps in the Management of the Nursery

There are distinct steps in the development and management of a school nursery which must be observed and which the students should understand clearly. After the seeds are secured, which might be considered as the first step, the soil



in the nursery must be ploughed or dug up and cultivated carefully. Then comes the laying out of the seed beds and the fertilizing, then the planting of the seeds, care of the nursery after planting, including protection and irrigation, then the cultivation of the young seedlings as they appear and grow, including fertilizing, if it has not been done previously, and irrigation, and finally the digging of the trees after growth has stopped in the autumn, heeling in for transplanting in the spring, and the preparation of the nursery for a second nursery the following year. These steps follow naturally, and the student should be taught to consider each one with reference to all the rest. The different steps are taken up separately in the following paragraphs.

#### Seeds for the Nursery

Unless the nursery has been planned for at least six months ahead, so that the seed of local trees can be gathered, it will be necessary to secure seeds from outside sources. Seeds for six nurseries as described in this bulletin can be secured from the College of Agriculture and Forestry, University of Nanking, according to the special offer for school nurseries. It will be noted that some seeds should be planted in the autumn as soon as they are ripe. For example, oak seeds in the Yangtze Valley are planted in the autumn as soon as they are collected. Others are "layered" (see under "seed layering"); and the majority can be planted without any special attention in the spring. Special planting practices for certain tree seeds will be found described under "planting directions." However, all the seeds listed in the six nurseries may be planted in the spring, although in some cases the better practice would be to plant in the autumn. The reasons for using the particular species found in the nurseries have been noted above.

For the second year, an attempt should be made to become independent of an outside seed supply by collecting seeds of the local trees as they ripen. The boys and girls should do the collecting, and the work should not be delegated

to the school coolie, though it may be wise in many cases to have his help in climbing trees and in other ways. But the important thing to keep in mind is that the students should be led and encouraged to do everything that can possibly be done by them in collecting the seeds.

Seeds of new tree species, or of local species if the local seed crop is a failure, as sometimes happens, must be secured from seed distribution centers, and this is entirely justifiable. In introducing new species care must be taken that they are adapted to the new condition in which they will be placed. As a general rule it is best to emphasize local species, and avoid species the seeds of which must be imported from some distance. A leaflet on the collection and cleaning of tree seeds will be issued shortly by the College of Agriculture and Forestry to aid schools in their seed collection work for succeeding nurseries.

#### Selection of the Nursery Site

Where a choice has to be made of several available places, state of cultivation, fertility, drainage, and texture of the soil are the factors most to be considered. It must be remembered that a nursery can be developed on almost any kind of soil, but that if there is a choice, a lighter, sandier soil is usually to be chosen before a heavy clay soil. If possible, choose a site that has already been under cultivation, one that is fairly fertile or can be made so, and one that has good drainage, gently sloping if in a region of considerable rainfall, or level if in the North, where irrigation must be practised. Consideration should be given to the water supply; the nearer, the better. Protection against animals is also desirable. A site within the school compound, other things being equal, is much to be preferred. On the other hand, it may be best to rent a small piece of land. Usually, however, enough vacant land easily obtainable is available if it is but looked up. Students should be able to help locate a piece of land if it is not readily obtainable and such services should be used.



### Preparation of the Seed Bed

The first step in the preparation of the seed bed is ploughing or digging up the land which is to be used for the nursery. This is usually best done in the autumn or winter and the soil allowed to freeze and lie fallow until the soil can be worked in the spring. As soon as the frosts are over, and the ground is in good condition, particularly not too wet, the land should again be ploughed, if possible, or at least harrowed or otherwise cultivated to get it in a fine, pulverized, loose condition.

### Laying off the Beds

When the ground is ready, the nursery should be laid out according to the plans shown in the drawings on pages 5 and 6. If the nursery is in North China where irrigation will be necessary, the beds and paths should be constructed as shown by the plate on page 6. If the nursery is in the Yangtze Valley, or Yangtze Valley south, the beds and paths should be constructed as shown by the plate on page 6. The arrangement of sections, beds, and paths is shown in the two drawings noted above.

### Fertilizers

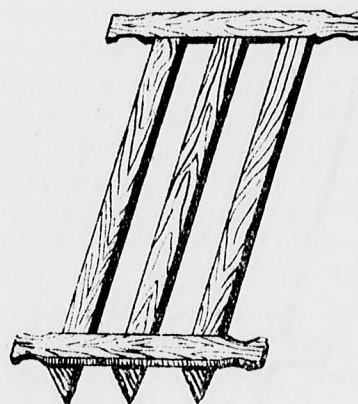
If solid fertilizers are to be used, such as bean cake, sesamum cake, cotton seed cake, farm manure, dried night soil, etc., they can best be worked into the soil when the nursery beds are being made. The finer and the more decomposed the texture of the fertilizer used, the better it will be to keep it shallow. That is, the fertilizer should be worked into the upper two or three inches of soil. It will be better not to use liquid night soil fertilizer on the young seedlings, if other kinds of fertilizer can be secured and used as above. If this must be used, however, it should first be well rotted, and applied immediately after cultivating the soil, somewhat diluted so as not to injure the foliage of the young seedlings. The vegetable cake fertilizers should be ground up fine

before using. About 100 gin of bean or other cake per mow should be used. It will be seen that the cost of such a fertilizer would be small, even for the very generous application recommended.

### Planting and Protecting the Seeds

The general rule for planting depth is two to three times the mean diameter of the seed. Where the climate is dry, however, and the soil light, deeper planting is necessary, as is also the case where heavy rains are apt to wash off some of the top soil into the paths, and leave the seeds with less covering. A good precaution to take in every case is to cover the bed with straw, after the seeds are planted. This prevents rapid evaporation, the loss of water, and, with heavy soils, their drying out and caking. The straw is held in place by straw rope stretched lengthwise over the bed and fastened with small stakes. Only a light covering of straw is necessary.

### Use of the "Marking" Board



As the seeds are all to be planted in rows, and should be as uniform as possible, a marking board with v-shaped battens is often used for making the drill rows in which the seeds are to be dropped. The triangular battens are two inches on each side, of a length suitable to the width of the nursery bed, with cross pieces used as handles. The cost is very small. If this is not available, the drills can be made with a long-handled hoe, such as is commonly used in the garden for such purposes.

### Cultivating the Nursery

The nursery should be cultivated as soon after the seeds are up as possible. This is for two principal reasons: first,



to keep down the weeds; and, secondly, to keep the soil mulched (loose) in order to prevent loss of water by evaporation. The soil should be cultivated as often as is needed, and always as soon after a rain as possible. Small hand hoes are very desirable, as each student can easily afford to have one. Expensive or special hoes are quite unnecessary. Implements used locally will almost invariably be found adaptable. The same result can be secured with a variety of implements.

The depth of the cultivation will be governed by the soil. One to two inches deep for heavy clay soil and three to four inches for sandy soil is quite deep enough. Too deep cultivation near the plant should be avoided.

As soon as the plants are large enough to shade the ground fairly completely, no further cultivation is necessary, except enough to keep the weeds chopped out of the paths and between the rows.

#### **Irrigating the Nursery**

This may be found to be one of the most difficult parts of the nursery management. An adequate water supply is absolutely necessary for a successful nursery, and this will be found particularly true in North China. It will not be as much of a problem in the Yangtze Valley, or south. In locating the nursery, the water supply should be an important factor. Moisture is absolutely necessary for the germination of the seed, and, on the other hand, if the land is too wet and cold, the seeds may rot. The difference between a wet soil and a moist soil should be studied, and it should be remembered that the latter condition is the more desirable. The larger the young trees in the nursery the greater the drought they can stand, as well as the greater the amount of water. Experience and practice will be a better guide than directions.

#### **Digging up the Young Trees and "Heeling in"**

This takes place after the leaves have fallen in the autumn, and before the ground freezes. The trees are dug

up with shovels and picks, and then "heeled in." To heel in, a trench about one foot deep is made, a row of trees is placed close together in it, and the roots carefully covered with the soil immediately in front. Then a second trench is made, trees placed in it, covered with the soil in front, and a third trench made by so doing, and so on. The most important thing to note is, that the earth must be packed in around the roots of the trees very carefully, that no large empty spaces are left, and that the roots are thus kept moist. The most important fact to know and to follow in handling trees is always to keep the roots of the trees moist, and to prevent them from drying out.

Where the winters are very dry, windy, and cold, the trees, after they have been heeled in, should be covered with straw or leaves, to prevent dry freezing. This is not necessary in the Yangtze Valley or south.

After the trees have been dug up and heeled in, there is no occasion to move them until they are to be transplanted in the spring.

#### **Nursery Transplants**

In case the trees are still too small at the end of the season for transplanting directly to the street, road, compound, or forest site, they should be transplanted in the nursery. This is always necessary with some species such as *Thuja orientalis* (arbor vitae), *Juglans regia* (English walnut), *Cunninghamia lanceolata* (fir), camphor tree, and others. These are usually set out again, in rows one foot apart, and one foot apart in the row. If the weather is dry, water should be added at the root of the plant as it is being transplanted, and great care must be taken in having the soil firm about the roots of the young trees.

#### **Stratifying Seeds**

This consists in alternating layers of seeds three or four inches thick in between layers of moist sand or gravel of the same thickness. Seeds can be stratified in a box in the cellar or other cool dry place, or in the ground. In the latter case



a pit should be dug large enough to accommodate the full amount of seeds, and protection provided against freezing and rodents. The purpose of the stratifying is to keep the seeds from drying out and to hasten germination in the spring. In the Yangtze Valley, seeds that should be stratified in the north can be planted out in the autumn direct to the nursery bed. The following seeds should be stratified: oak, chestnut, walnut, peach, pistachia, apricot, and the like.

#### Stem Cuttings

Trees such as the willow, poplar, plane, and mulberry are most easily propagated by cuttings. In the autumn after the leaves have fallen, branches of the current year's wood should be taken and cut into sticks from six to twelve inches long. The wood should be from three-eighths to three-fourths of an inch in diameter, and should contain from four to eight buds. The upper end of the cutting should be cut slightly slanting away from and about one-half inch above the top bud, which should be a good one. The cuttings should be tied into bundles of 50 to 100, and placed one layer deep, in a cool place covered with moist sand, straw, or leaves, to callous.

In the spring the cuttings are taken out and placed in v-shaped trenches, in beds four to six feet wide. The cuttings are placed in the trench at an angle of 75 degrees against the front of the trench, four inches apart, and the dirt is backed closely against them. The top one or two buds should be left above ground. The second trench is made about one foot back of the trench in front, and so on.

Poplar and willow are propagated very easily, with little or no callousing in favorable seasons, if they are not allowed to dry out after planting. It would be well to try a bed or two, if cuttings can be secured. Both trees are rapid growing and are usually propagated in this way.

#### Seed Collection for Second Year Nursery

Careful note should be taken of the time of flowering and ripening of seed of the local trees. Collection of the

seeds of these trees should be made as they ripen. This will add a new interest in the nursery work, and help to make the students feel that they are doing the whole thing. It may be necessary to buy seeds of certain species that are not found locally, but this is of course unavoidable. The securing of seeds of new trees will in many cases be entirely advisable, particularly in localities where there are few species.

#### Preparation for Second Year

In many cases, the same piece of land will want to be used again the second year. Where this is necessary, the trees should be dug up in the autumn as soon as the leaves have fallen, and "heeled" in. (See "heeling" in process on page 16.) The soil should then be plowed up and allowed to lie over until spring. The only exception to be made is in case of those species which should be planted in the autumn.

#### PUBLICATIONS

##### AGRICULTURE AND FORESTRY SERIES

##### VOLUME ONE.

- Number one. School Nurseries. By John H. Reisner. (Translated into Chinese by Li Tai-fang.)
- Number two. Roguing of Cotton. By J. B. Griffing. (Translated into Chinese by Shao Teh-hsing.)
- Number three. Cotton Culture. By J. B. Griffing. (Translated into Chinese by Shao Teh-hsing.)
- Number four. The Control of Plant Diseases and Insects. By G. E. Ritchey.
- Number five. A Study of Weeds. By G. E. Ritchey.
- Number six. I. Report of Three Years' Cotton Improvement Work.
- Number six. II. Observations on the Behavior of Cotton Plants especially during Acclimatization. By J. B. Griffing.
- Number seven. A Social and Economic Survey of 102 Farms near Wuhu, China. By J. Lossing Buck.



0783



Publications of  
THE UNIVERSITY OF NANKING  
COLLEGE OF AGRICULTURE AND FORESTRY  
NANKING, CHINA

Circular No. 7

REVALUATING THE RURAL CHURCH.

JOHN H. REISNER

**I**N producing food, man becomes in a very real sense a cooperator with God. No single economic process is so vital to the welfare of mankind. It transcends all others in importance to the human race. On it the wealth and prosperity of people everywhere depend. The number of non-food producers that can be released for all other activities is conditioned by the surplus of food production. This same surplus predicates all culture. All services are in the final analysis paid for by products of the soil. This process of food production, however, has become so commercialized, so complicated by economic, sociological, scientific, comic and pseudo-presentations of its many phases and relationships—to say nothing of its relegation to an inferior place in the mind of man, even of the farmer by the subtle influences of the superiority complex of the non-food producers—that its religious significance for the most part has become dimmed if not in many places entirely obscured.

The promised land of Israel was described by an inspired mind as “a land of hills and valleys and drinketh water of the rain of heaven, a land which Jehovah thy God careth for: the eyes of Jehovah thy God are always upon it, from the beginning of the year even unto the end of the year.” Moreover, “the earth is the Lord’s and the fullness thereof,” a statement as correct as its religious significance is little comprehended in the bustle and hustle of the twentieth century.

If, as generally accepted, religion has to do with man’s relation to God, then agriculture—the cultivation of the fields—is basically religious. When I prepare the soil for planting, I am conscious that God is manifest in the soil; when I plant the seed, I know that God is in

Reprinted from *The Chinese Recorder* for April, 1926.

0784



the seed; when the sun shines on the soil to warm it, and on the plant to provide it with energy, I am conscious of the workings of the laws of God. The crop that grows, the soil that feeds the crops, are manifestations of God and of His love and provision for the needs of mankind. These processes of production, planting, cultivating, harvesting, which are commonly and almost only thought of as economic processes, are of great religious significance and may be made vital, spiritual influences.

In the past, missionary work in addition to evangelism has included chiefly healing and teaching, medical work and education, because these were two forms of service in which Christ most commonly engaged and which had been most highly developed as essential parts of the western Christian culture on which missionary work consciously or unconsciously has been projected. But Christ also fed the multitudes; it was the disciples who were willing to send the people away hungry.

The time is long overdue when any form of service, that will help the farmers make the best use of God's creation, including the improvement of agriculture and the enrichment of rural life shall be placed on an equal footing with medical, educational or other forms of mission work in China—and indeed everywhere. Furthermore, if the rural Christian church in China is ever to become a serving church in imitation of the love and life of Christ who came that man might have more abundant life the improvement of rural life and agriculture must be taken into account. The individual—preacher, teacher, layman, missionary or whoever the server may be—who can help a farmer to secure better seeds, to control the insects and diseases which reduce his crops, to control diseases which carry off his cattle, his pigs, or his poultry or help him to get better credit facilities that will protect his home from the unscrupulous money lender, is doing a Christian service that must rank with any other service, no matter how much more “cultured” or “traditional” may be its background.

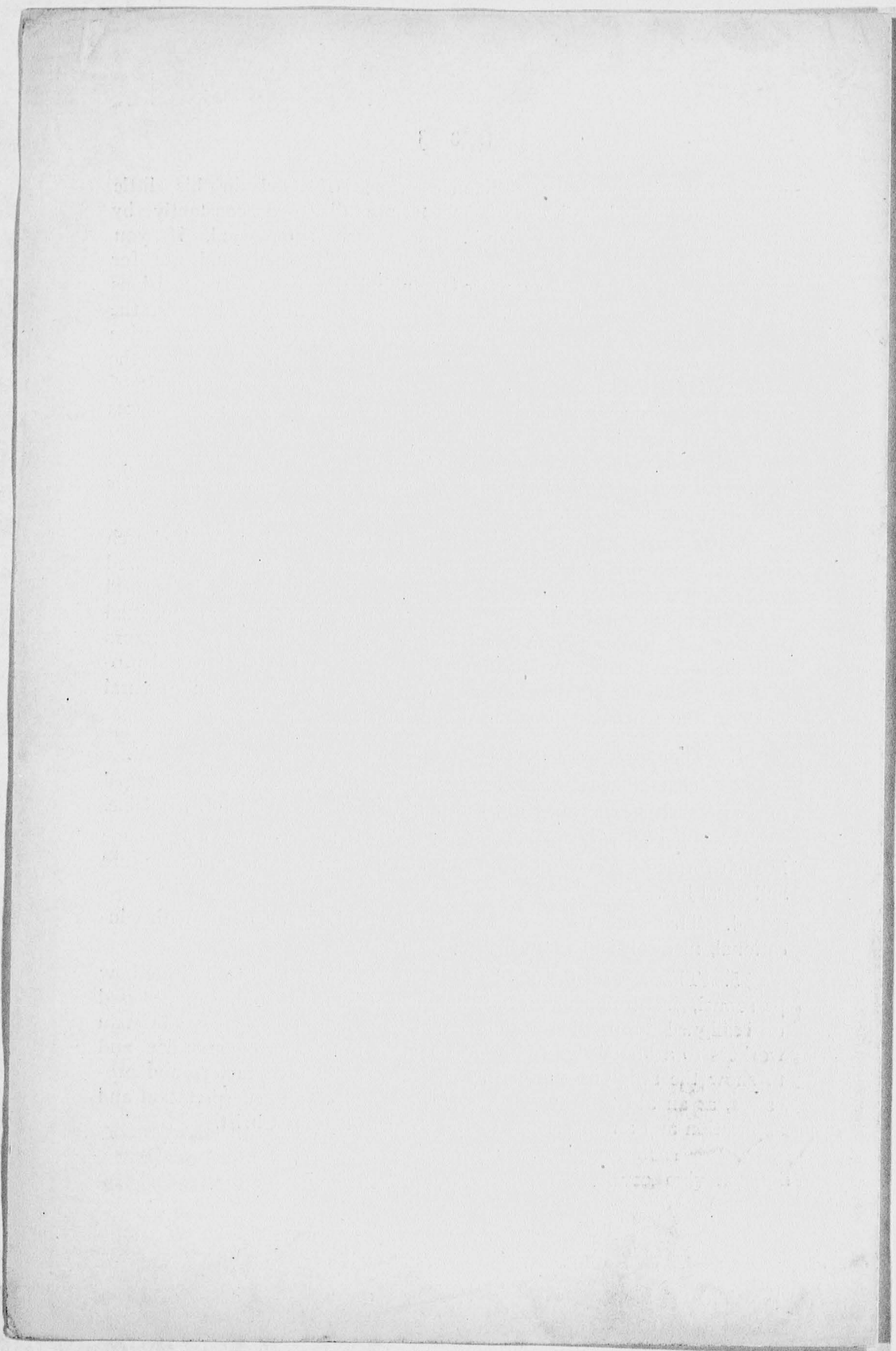
Man comes to know God largely through his own experience. A cultured man, if he is a Christian, may draw upon the records of the experiences of past generations; but to the uncultured and unlettered this is not altogether so. Yet the latter is none the less religious, and the fount of his religious life is the same. The farmer is a producer of food, a toiler of the soil, a dependent upon the free gifts of God in the sunshine and the rain, in the soil and in life, and over these he holds control only as he has come to understand their manifestations through his own experience, projected on the experience of the generations which have preceded him. Moreover, only through

an understanding of these manifestations of God in his little world—new manifestations of which are disclosed constantly by science, the search after truth, the search after God, if you will—can he hope to gain control of his environment and use for his own good and for the good of mankind the bounteous provisions God has bestowed upon him. In other words, improved seeds, the control of insects and diseases, the use of new fertilizers, cooperative efforts to secure honest and protecting credits can be made to teach the farmer of the God that loves him—in contradistinction to myriads of unappeased spirits with which his life is now beset. These experiences he can understand because they are of the very essence of his daily life. He, too, can comprehend in love, and in spirit, if not in more intellectual ways, that Jehovah, indeed, careth for the land and that His eyes are upon it always.

What then shall be our attitude to the Christian rural church in China? Shall it be largely an exotic institution, or shall it be allowed to find expression for its own personality and individuality, in a rural environment, in rural forms of service, prompted by the same spiritual dynamic that makes religion real and makes us conscious cooperators with God—even to the production of food. To this end, I would propose the following suggestions as a basis for the revaluation of rural work in the Christian program for China:

1. That the rural Church be magnified.
2. That all rural workers, preachers and teachers be encouraged to secure such specialized rural training as is or may be made available.
3. That all rural preachers and teachers be encouraged to engage in such forms of service as will bring about improvements in agriculture and rural life.
4. That such forms of service be considered on a par with educational, medical, and evangelistic activities.
5. That a careful study be made of the China field to indicate how personnel, institutions, funds, equipment including land, can be used or realigned to provide training that will help prospective Christian workers to a knowledge of the methods of improving country life, and to show the religious significance of rural productive factors and processes, as an aid to a knowledge of God, and to the interpretation and application and an experience of the Gospel of Jesus Christ.





2  
0  
0  
3  
4  
2  
8

0786