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

Circular No. 10

REDISCOVERING THE RURAL FOLK

J. W. DECKER.

A Live Conference:—It is an oft reiterated fact that while about 80% of the Chinese live outside the walled cities, the Christian church has concentrated fully 80% of its program on the 20% city dwellers. Moreover it is a familiar complaint of those who are doing rural work that the plans projected, the materials prepared and leaders trained for that work all show a "city minded" character which greatly hampers, and in some cases destroys, their usefulness. But the church in China is becoming acutely conscious of these deficiencies, as was abundantly proven by the interest and enthusiasm of the recent Conference of Christian Rural Leaders, held at Nanking, February 2-5, under the auspices of the College of Agriculture and Forestry of the University of Nanking. In spite of the nearness of the new year holidays, there were 217 delegates present, not including students from the Nanking Seminary and University who attended. Of these 217, 82 were from Kiangsu, 39 from Anhwei, 33 from Chekiang, 13 from Shantung and 10 from Hupeh, nine other provinces being represented by less than ten delegates each. It was a Chinese conference, only 16 of the delegates being foreigners; foreigners were conspicuously absent, comparatively speaking, from the program and the floor. Fifteen or more denominations or churches were represented by 84 preachers, 35 teachers, 29 ordained pastors, 27 students, 24 farmers and 3 business men. It was distinctly a rural group. Under the able chairmanship of Rev. K. T. Chung of the N. C. C. and Mr. James Y. Yeh of Hangchow the three morning sessions were given over to the discussion of three main topics: The Religious Ideas and Practices of the Rural People, Ruralizing the

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Christian Rural Program, and Service Projects for the Rural Church. The first two were introduced by a few speakers chosen from among the delegates, while Dean J. H. Reisner introduced the last. In each case a wealth of unhampered discussion was called forth from the floor; the program committee had wondered whether the visitors would talk freely, but their doubts were soon settled! This forenoon session was closed each day by a devotional period.

Learning by doing:—The afternoon sessions were devoted to lectures given mainly by members of the faculty of the College on such subjects as The Extension Work of the College of Agriculture, Rural Education, Rural Surveys, How Crops are Improved, etc., lectures well illustrated by a lot of material, and of an extremely practical character. These were followed by trips about the college plant, giving the visitors an admirable opportunity for getting acquainted with its work. Bailie Hall was one array of exhibits of one kind and another, exhibits that made an immediate appeal to the eye, and left impressions even more valuable than discussions and lectures. In fact I think perhaps the greatest single benefit to be derived from the Conference was in the linking up of the rural workers with what is being done in Nanking, the facilities that the University is offering for the training of leaders in its regular and special courses, and the resources put at the disposal of rural workers for solving their peculiar problems. The wide awake visitor found a perfect mine of gold, to which he will return more than once. He will go back to his work greatly heartened to know that so much consecration and brains is being used to help him in his lonely, little appreciated task of rural evangelism and service. The evenings were largely used in the presentation of plays by the staff of the college, plays dealing with the problems of the farmer and the country preacher, and an intelligent Christian approach to their solution. The actors had evidently lived with and for the country people, and kept the audience in perfect gales of laughter as they depicted the harassed farmer, and those who prey upon him, and then his new friend—the rurally minded and informed country preacher who knew farming as well as theology. The acting was splendid and whatever else the visitors forget, they will not forget the lessons of those delightful periods of entertainment. Incidentally the dramatic talent which has been developed ought to be made more use of by missionary institutions in this section of China which touch, or ought to touch, the rural problem. Pastor Nyi Liang Ping of Hangchow, a veteran of many years' service in the country was fairly representative when he declared that he

had attended this conference in his 68th year, *in the twelfth moon*, and if it were held again he would be on hand!

The Rural Approach:—In the discussions large emphasis was laid on the necessity for studying more carefully the religious ideas of rural people, and adapting our approach to them accordingly. The strategic value of the practical approach was emphasized; it was necessary because, as one speaker pointed out, "The ordinary farmer has no desire to become a Buddha or a holy man; he will do just what is necessary to 'get by' the evil spirits and secure the most material happiness." It was shown how many of the superstitions of the farmer were rooted in the desire for good crops, and how they could be uprooted by linking Christian truth as to God and His relation to the world with a demonstration of better farming on the Christian basis. Ancestor worship was declared to be "the heart of rural worship" and it was finally declared that:—

"a. Each Christian home should have an ancestral and family Bible.

"b. Ancestor memorial services should be held at Easter.

"c. Methods which are adapted to Chinese psychology and at the same time are in harmony with Christian teaching should be substituted for the methods and ceremonies of the ancestral hall.

Findings.—The findings of the conference on "Ruralizing the Christian Rural Program" are so important that I give them in full:

"This conference is firmly convinced that the realization of the aim 'China for Christ' depends largely on the winning of China's rural population. But both the religious ideas and the living conditions of the rural population are so different from city ideas and conditions that methods of city evangelism cannot be applied effectively in the country. This conference has considered this problem and presents its conclusions as follows:—

I. The Propagation of the Gospel.

In addition to Education and Medicine which have been used hitherto, the rural church should pay attention to the improvement of rural life and conditions as a point of contact with the rural population. For this kind of service can most easily draw rural people to the church where they may receive the truth and accept Christ.

II. Qualifications of Rural Leaders.

At the present time rural preachers, teachers and leaders, both men and women, sorely lack special knowledge and training in rural

work. Therefore the Church in co-operation with the Christian colleges should at suitable times promote short courses and institutes in agriculture and rural service. All Seminaries, Bible Schools and Normal Schools should add courses in agriculture and rural life, through special departments or by co-operation with nearby agricultural schools, for the training of the skilled, active and persevering leadership which the rural church needs.

III. The Training of Rural Christians.

In the training of rural Christians self-activity and self-support should constantly be emphasized. We agree on five principles:

1. Rural people must be led to know the true God and consequently to give up faith in false gods and spirits.
2. Rural Christians must be taught to read, to read the Bible, to sing and to pray.
3. Rural Christians should grow by mutual encouragement and should themselves learn to lead services of worship.
4. They should learn to express their Christian life in service for the community.
5. They themselves should propagate the Gospel by constantly witnessing for Christ.

These five principles should be the ideal for the character and the spiritual development of all rural Christians.

Self-effort:—It is very significant that in the discussion which resulted in the foregoing pronouncement almost nothing was said about financial support from foreign mission societies, beyond help in the training of suitable leaders. It seemed to be taken for granted that if rural China is to be really won for Christ, it will have to be done by some less expensive and more indigenous method than that heretofore used by most of the missionary societies.

The time has seemingly come when Christian organizations must more consciously and intelligently recognize the rural approach to the establishment of the church in rural China, and admit distinctively rural services, among them the improvement of agriculture and rural life on an equal footing with the older and more established forms of hospitals and schools.

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OBSERVATIONS AND
EXPERIMENTS ON RINDERPEST

by

CHARLES S. GIBBS, PH.D.

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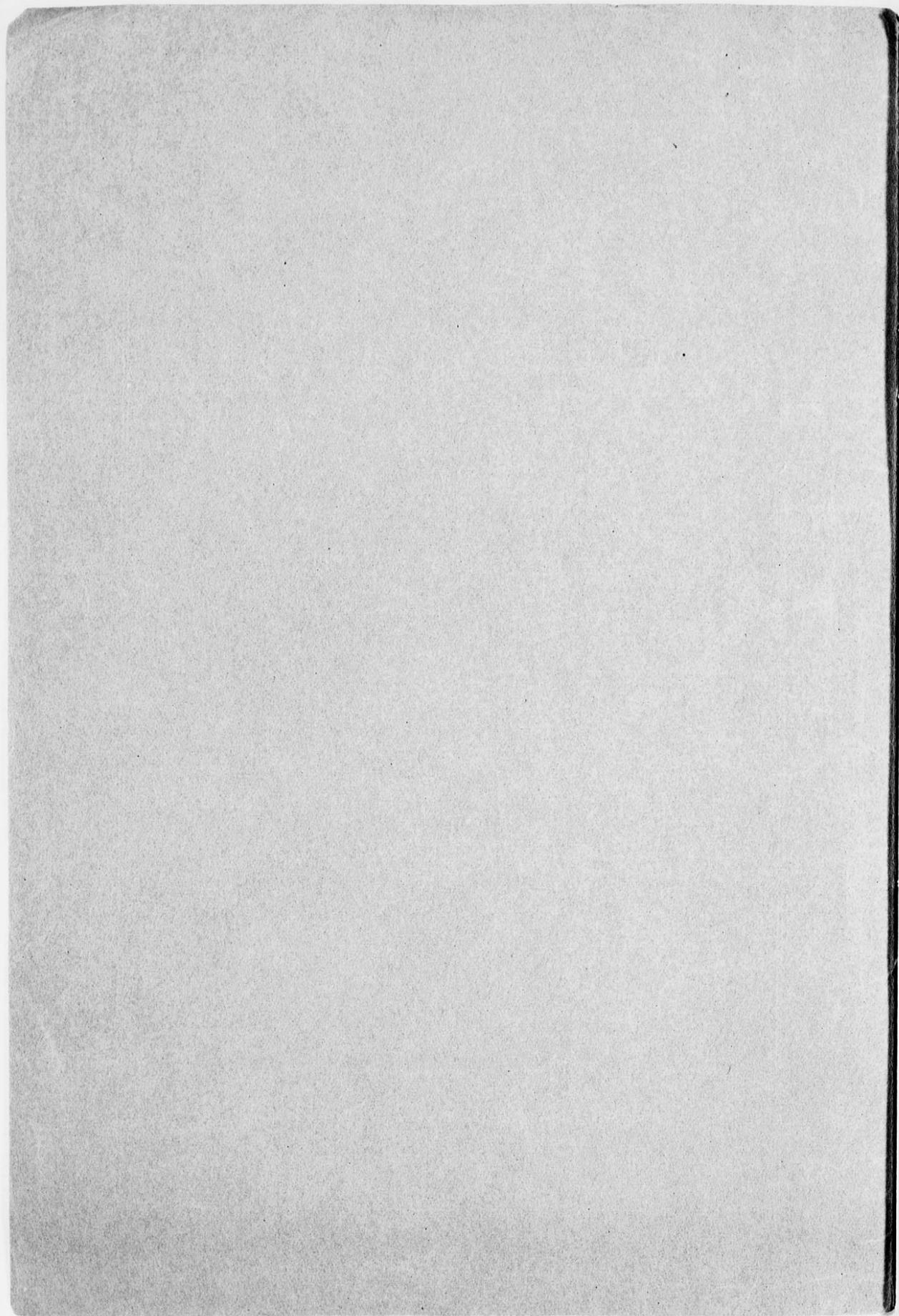
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OBSERVATIONS AND EXPERIMENTS ON
RINDERPEST

BY

CHARLES S. GIBBS, PH.D.

In January, 1924 the author was called to Kaifengfu, Honan, to combat rinderpest which had broken out in the splendid herd of foreign cattle owned by the Kaifeng Baptist College. On arrival one cow was found dead, her calf in the last stages of the disease, and four other cattle in the herd showing abnormally high temperatures. The calf was pronounced hopeless, since the disease had progressed so far that the lungs were affected, in addition to the alimentary tract and lymph glands. But an attempt was made to save the rest of the herd. The four cows having high temperatures were promptly treated with intravenous injections of anti-rinderpest serum, while the other cattle were given hypodermic doses of anti-rinderpest serum and rinderpest immune bile. Unfortunately the potency of the bile was not determined before use, and all but two of the herd contracted rinderpest, after the protection of the anti-rinderpest serum wore off, and had to be treated intravenously with anti-rinderpest serum. In this herd 36 head of cattle were treated with anti-rinderpest serum and all but five were saved. This is quite the reverse of the experience of 1919, when the same number of cattle in the same herd under practically the same conditions contracted rinderpest, and were not treated because it was not generally known in China at that time that rinderpest could be controlled. As a result all of the animals contracted cattle-plague and only five survived. This was a severe lesson, indeed. Hence, when rinderpest came again in 1924 the owners immediately called for help. In responding to the call, the author did not find rinderpest confined to the Kaifeng Baptist College herd, but there seemed to be a widespread epidemic of it raging in Honan, Shantung and North Anhwei.

Since it was impossible to control rinderpest over the vast territory in which it was found, intensive observations were made on the symptoms, pathology and epidemiology of the disease, followed by carefully planned experiments on its hygienic and medical control. This work was limited to Kaifeng and Chengchow, Honan; Pochow and Nansuchow, Anhwei; and Nanking, Kiangsu. Two hundred and thirty-six head of cattle, divided into 12 groups, were involved in these observations and experiments for a period of two months.

RINDERPEST SYMPTOMS.

The first indication of rinderpest was a more lively appearance of the animal than usual, as if under a severe nervous strain. The nervousness usually wore off in a day or two, the coat became ruffled, the ears lopped forward, and sometimes the ungainly condition of the animal was

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further augmented by shivering. General debility set in, followed by loss of appetite and diarrhoea. After these preliminary symptoms a shiny discharge from the nose appeared. Whent his was followed by "rales" a pneumonic condition usually developed, after which the animal died. The urine was more deeply coloured than usual. It was seldom red unless complicated by other diseases. The Chinese claimed that if an animal lived eleven days it would recover. This observation was generally correct, because the disease usually ran its course within this length of time. When sick animals were spoken to they appeared stupid, and often became as tame as kittens, responding to caresses by placing the head in the hands or on the shoulder of the caresser in a most pitiful manner.

When the temperature was taken by means of a clinical thermometer, a rise was usually noted two or three days before other symptoms of rinderpest appeared. Some cattle did not have a temperature above 103°F, while in other cases the thermometer registered as high as 108°F. The temperature was more accurate in making diagnosis than the pulse, as the pulse beat varied not only in different cases, but it changed in different stages of the disease in the same animal. The temperature of those animals that remained sick until the tenth or twelfth day became normal again. This was found to indicate one of two things: either that death was only a few hours ahead, or that the resisting powers of the body had come to the rescue and the animal would live.

However, the temperature of the body did not always represent the severity of the disease. Two fatal cases of rinderpest were observed, which recorded comparatively low temperatures during the clinical course of the disease, while on the other hand one high temperature was found in a mild attack. In spite of these three discrepancies, the temperature was found to be important in the early detection of rinderpest, because the onset of the disease was nearly always first marked by pyrexia.

PATHOLOGY OF RINDERPEST.

The most marked lesions of rinderpest were found in the digestive organs, especially in the fourth stomach. Sometimes the mucous membrane of the whole digestive track was inflamed. In prolonged cases ulcers often appeared in the mouth and the anus. The fourth stomach was usually one mass of inflammation and ulceration. Sometimes this morbid condition extended into the intestines, while in other cases it was confined to the region of the pylorus. Cattle dying during the initial stages of the disease usually showed few lesions characteristic of rinderpest.

The mucous membrane of the respiratory tract nearly always showed catarrhal inflammation. In the more advanced cases it was often covered with dark-red spots, mingled here and there with grayish-yellow ulcerations. In cases presenting symptoms of pneumonia the lungs were hyperemic, sometimes oedematous, hepatized, or emphysematous. Frequently the whole lung was diseased. In other cases only the periphery was affected.

The liver was congested, often presenting a yellow, stained appearance. The gall-bladder was always enlarged and distended with

bile (500 mils. to 1,000 mils.); usually the bile was dark, green in colour, but in a few cases it was yellow or dark brown. The consistency of the bile was usually fluid, but it sometimes contained so much mucus that it would not flow.

The kidneys were often inflamed and ecchymotic either beneath the capsule or in the cortical structure.

The muscles were paler than usual and relaxed. Sometimes blood extravasations were found beneath the pericardium. Unclotted blood in the heart, large arteries and veins seemed to be common pathological symptoms.

There was emaciation, except in the cases which died early; the flesh was dark, capillary congestion being marked. Aside from the lesions found in the vital organs, the tissues of the body generally showed effusions, exudations and blood extravasations.

EPIDEMIOLOGY OF RINDERPEST.

The virus was found to be transmitted from the sick to the healthy animals in a variety of ways, both direct and indirect. Direct contact with fresh secretions, such as the discharges from the nose and mouth, and the excretions, urine and feces, transmitted active rinderpest in every case up to 48 hours. After 48 hours outside of the animal's body rinderpest lost its virulence entirely, except when preserved in glycerolized bile. Hides did not infect susceptible cattle two days after being removed from rinderpest carcasses. In three instances herdsmen did not carry the disease on their feet and clothes from sick cattle to healthy animals 200 yards away, while in three other cases healthy cattle kept 50 yards away from sick animals contracted rinderpest. Farmers frequently noticed that their oxen were sick with rinderpest after returning from several days, trip to the market or, after a family pilgrimage to distant temples during the Chinese New Year holidays. Apparently rinderpest in this region was scattered by much visiting during the leisure months of winter. In summer the farmers kept their animals at home to till the soil. Hence rinderpest gradually decreased until it was difficult to find any cases in mid-summer. But in most places it started up again soon after the harvests were gathered in the fall, and the trips to market were begun. The cases usually kept increasing, finally culminating in an epidemic soon after the New Year holidays.

GENERAL HYGIENIC MEASURES.

In all cases observed rinderpest paralyzed the stomach, interfering seriously with rumination. Hence in the Kaifeng Baptist College herd nothing but warm water was offered in small quantities several times a day, until the animal showed a real desire for food. Then they were fed sparingly on soft boiled rice and cooked millet, until the temperature became normal and the animal was apparently on the road to recovery. Thereafter the cooked liquid diet was gradually replaced by the normal fare. One valuable foreign cow was disposed to eat her bedding, which aggravated the symptoms, finally killing her. Postmortem examination revealed the straw caked on the manyplies, so that the organ could not

function. Persistent diarrhoea was successfully treated in many cases by the administration of small doses of castor oil combined with laudanum. Stimulants were helpful during convalescence, preventing relapse.

Rinderpest killed the foetus in practically all of the pregnant animals, causing abortion. In three foreign cows portions of the foetal membranes remained attached to the cotyledons. In one case the foetal membranes were not removed until decomposition set in, which finally caused the death of the animal. In two other cases the birth envelope was carefully removed and the uterus washed out with antiseptic solutions. These two cows recovered. Cesarean section was not successful in two cases. The calves were found dead and the cows were too weak to stand the operation. However, embryotomy was successful in two mild cases.

SERUM TREATMENT.

Since Chinese cattle have been in contact with rinderpest for many generations, one would expect them to possess some natural immunity which foreign cattle would lack. Hence active cases of rinderpest in Chinese cattle would respond to smaller doses of serum than with foreign cattle. The author is not aware that the doses of anti-rinderpest serum for Chinese and foreign (American and European) cattle have ever been carefully worked out. The significance of a study of this kind may seem trivial to the casual reader when such large doses of serum were used and a little more would make no difference as long as it controlled the disease. But it was found in Honan and North Anhwei that the amount of serum administered to each animal meant a great deal to the farmers, especially when they had several head of cattle receiving treatment and the expenses began to accumulate. Many farmers had to sell an ox or cow before they could pay the small fees we charged for the treatments. This was time consuming, often involving a second trip to villages in order to collect funds after the animals had been sold.

The average doses of hyper-immune serum sufficient to control rinderpest in foreign cattle were determined at Kaifeng as follows:

Cows	.. ..	500 c.c.
Bulls	.. ..	800 c.c.
Yearlings	.. ..	300 c.c.

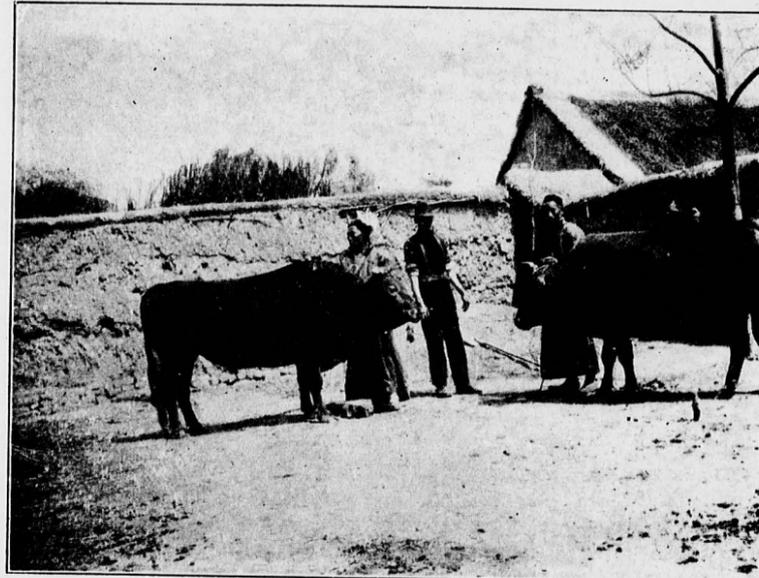
The average doses for Chinese cattle was determined at Kaifeng and Nansuchow to be:

Cows	.. ..	400 c.c.
Bulls	.. ..	500 c.c.
Oxen	.. ..	550 c.c.
Yearlings	.. ..	300 c.c.

The most satisfactory results were obtained in foreign and Chinese yearlings, when 300 c.c. of anti-rinderpest serum was given intravenously in 100 c.c. and 200 c.c. doses 12 hours apart. Of course the serum was gently heated immediately before use to body temperature (102°F). The dose of immune serum for foreign milch cows was found to be 500 c.c., divided into 200 c.c. and 300 c.c. doses 12 or 15 hours apart, while the



A Practical Lesson in Feeding a Cow Sick with Rinderpest.



A Splendid Pair of Oxen Owned by a Villager near Nansuchow.

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OBSERVATIONS AND EXPERIMENTS ON RINDERPEST

same results were obtained in Chinese cows by administering two 200 c.c., doses 12 hours apart. The greatest difference was found in the response of foreign and Chinese bulls to anti-rinderpest serum treatments. The average dose given foreign bulls was 800 c.c. divided into 200 c.c., 300 c.c., and 300 c.c. doses, respectively.

King Piebe, a large Holstein bull at Kaifeng, took 900 c.c. of serum and recovered from rinderpest in three days, without showing any ill effects except the initial rise of temperature. While prompt recoveries like this are desirable, they are unusual even in native cattle. The average dose of serum effective against rinderpest in Chinese bulls was found to be 500 c.c. However, the doses of serum required to control cattle-plague in foreign and Chinese bulls should not be explained on the basis of natural immunity alone, because the foreign bulls used in these experiments were much larger and heavier than the Chinese bulls, and the serum was administered somewhat according to body weight. The pure-bred foreign bulls referred to in this article may be quite favourably compared with the best Chinese oxen in regard to size and weight. In this comparative study it was found that rinderpest could be controlled in Chinese oxen with 150 c.c. to 200 c.c. less serum than was used in foreign bulls.

In general, anti-rinderpest serum was specific for cattle-plague. When it was administered hypodermically in small doses (50 mils.), it protected against natural infection from 10 to 14 days. Furthermore, when larger doses (200 to 500 mils.) were injected intravenously during the initial stages of rinderpest, it materially modified the course of the disease. It was very clearly demonstrated in this epidemic that anti-rinderpest serum was a preventive and not a cure. It seemed to neutralize the toxins of rinderpest before they united with the tissues. However, when these toxins once united with the mucous membrane and other tissues of the body, anti-rinderpest serum, circulating in the blood, had no effect upon the disease.

TABLE I.
Anti-rinderpest Serum.
Intravenous Injections.

Group	Breed	Number Treated	Mild Reactions	Severe Reactions	Deaths
1	Foreign	26	19	7	5
2	Half	3	3	0	0
3	Chinese	26	21	5	2

The 26 foreign cattle, Table I, Group 1, were treated with anti-rinderpest serum as soon as a rise of temperature was noted. Two of the

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five animals which died had rinderpest without complications. One of these was a large Ayrshire bull, who was so ugly tempered that it was impossible to inject the serum successfully into the jugular vein. Another cow might have been saved by muzzling or by providing her with bedding which was not edible. Three more died of complications following abortion.

The two Chinese cows, Group 3, which died of rinderpest, were treated too late to save them. The toxins had already destroyed the tissues of the alimentary canal to such an extent that the animal could not possibly live.

BILE TREATMENT.

Bile taken from animals which had passed through all stages of rinderpest contained both antibodies and virus. During the first 10 days virus was evidently present in excess of antibodies, for when bile was injected into susceptible animals within the 10-day period after collecting, it invariably produced active rinderpest. However, bile collected with due regard to asepsis, preserved by mixing with one-half its volume of pure glycerine and allowed to ripen in a cool dark place for 10 days, was safely injected into animals susceptible to rinderpest without producing the disease. Since the mixture of bile and glycerine was a viscous fluid it filtered through the tissues slowly, and a further period of 10 days was required to produce the full immunizing effect. However, after 10 days animals treated with ripened bile were immune to natural infections of rinderpest. This immunity lasted for about a month. Sometimes serum and bile were given simultaneously, producing immediate immunity lasting about five weeks. When this inoculation was followed every month by other injections of bile, cattle were kept immune for long periods of time, or, in some villages, until the epidemic wore itself out.

Unfortunately the practical value of the bile method was limited because bile could not always be procured until an epidemic was in full swing, and then 10 days were required for ripening. When serum could not be obtained another 10 days were necessary after inoculation for the full immunizing power to take effect. Toward the end of the epidemic it was discovered that the best results were secured when the potency of the bile was carefully determined before use. Several times rinderpest entered villages, took its toll and passed on before all of these precautions in regard to the bile could be taken. This limitation was partly overcome in Honan and North Anhwei by collecting bile in Pochow and Kaifeng, where the disease was especially virulent, and used to immunize cattle in Chengchow, Nansuchow and the villages around Kaifeng with satisfactory results.

Furthermore, it was not always safe to leave the preparation of bile to ordinary laymen, not only because rinderpest was often complicated with other diseases such as anthrax, foot and mouth disease, etc., which are contagious to both man and animals, but the collecting, testing and preserving of a product containing sufficient antibodies to protect against natural infection and free from contaminating micro-organisms requires special laboratory training.



Preparing an Ox for the administration of Rinderpest Immune Bile in a Chinese Village.



Injecting Anti-rinderpest Serum intravenously under conditions far from ideal.

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TABLE II.

Immune Bile not Standardized.

Hypodermic Injections.

Group	Breed	Number Treated	Protected	Contracted Rinderpest	Deaths
4	Foreign	32	8	24	6
5	Half	10	8	2	0
6	Chinese	6	6	0	0

The bile used in the experiments recorded in Table II. was taken from animals dying of rinderpest, pooled, preserved with glycerol and ripened in a cool dark basement. The bile was not tested. Twenty-five c.c were administered hypodermically to each animal. Apparently the dose was not large enough for the foreign cattle.

TABLE III.

Standardized Immune Bile.

Hypodermic Injections.

Group	Breed	Number Treated	Protected	Contracted Rinderpest	Deaths
7	Foreign	14	14	0	0
8	Half	21	20	1	0
9	Chinese	42	42	0	0

The cattle mentioned in Table III. were treated with some of the same bile as was discussed in Table II. The bile used in these experiments differed from the other only in one respect, namely, that its potency was carefully determined before use. Cheap Chinese calves were used for testing the bile. It was found that 5 c.c. of the bile was required to protect 100 pounds of bodyweight. According to this estimation the 24 foreign cattle referred to in Table II. as having contracted rinderpest received from 2 to 5 c.c. less bile than they should have received to fortify them against rinderpest.

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SIMULTANEOUS SERUM AND VIRUS METHOD.

The simultaneous inoculation of serum and virus has been employed extensively in Russia (1916). In this northern country far beyond the realm of tropical parasites it has been quite successful in the control of rinderpest. In Egypt (1904 and 1905) the simultaneous method had to be abandoned, because "a panic took possession of the cattle owners." In India (1924) and South Africa (1903-4) the products used in this method were prepared in laboratories by qualified scientists under Government control, while the inoculations were made by specially-trained laymen. When under proper control this method of immunizing cattle against rinderpest has been generally successful. Furthermore, veterinarians having experience with it claim that it produces permanent immunity in a large proportion of cases.

Representative experiments performed in Honan and Nanking with serum and virus are recorded in Table IV. as follows :

TABLE IV.
Simultaneous Serum and Virus Treatment.

Group	Breed	Number Treated	Mild Reactions	Severe Reactions	Deaths
10	Foreign	22	18	4	4
11	Half	19	19	0	0
12	Chinese	15	12	3	0

In all 56 head of cattle were treated with anti-rinderpest serum and virulent blood. Forty-nine of these animals had mild reactions and were found to be immune a year later. Seven had very severe reactions, of which five died. The four head of cattle which died were foreign calves belonging to the same herd. Sickness and death, like the above incident, due to rinderpest following simultaneous treatment, are called "breaks" or "vaccination rinderpest." If the deaths occur during the course of treatment they are called "serum breaks," the supposition being that the serum is impotent and allows the virus to kill the animals. If the disease breaks out after a longer time and kills some or all of the animals, "virus breaks" are said to have taken place, the effect being ascribed to the fact that inert virus has been administered, and the serum has produced only a temporary immunity which, as it disappears, leaves the herd again susceptible. Both serum and virus breaks may be controlled by using only standardized serum with increasing quantities of virulent blood beginning with small doses (0.2c.c.)

The vitality of the animals is also important. This should always be taken into consideration when the simultaneous method of producing immunity is resorted to. Cattle are especially susceptible to the influence of shipping. We have been up against this problem when foreign cattle have been imported, and we have been asked to immunize them at one of the outports before they were shipped to the interior. We have adopted a policy of using only serum and bile in these cases, leaving permanent immunization to a later period.

The break occurring in the foreign herd mentioned above was undoubtedly largely influenced by carelessness in feeding and hot weather. The owner of the calves insisted on changing the diet immediately after the inoculations were made from rice straw, soy bean milk and grain to green grass. The grass caused diarrhoea, which was exceedingly debilitating to the animals. Then a wave of hot weather set in, which was even more enervating than the change of diet. As a result four of the five calves had heavy attacks of rinderpest and died. This experience is argument sufficient against abrupt changes in the diet during the reaction period.

Furthermore, the virus blood had to be kept under proper diagnostic and laboratory control because of the danger of transmitting diseases other than rinderpest in the vaccine.

Cattle are sometimes carriers of diseases other than rinderpest. In such cases the resistance is lowered by the inoculations, and other diseases, such as piroplasmiasis or hemorrhagic septicemia, kill the animal. In regions in which these diseases are known to exist it is always well to make a careful microscopical examination of the blood for parasites before giving the treatment.

Since rinderpest blood maintained its virulence for only 24 hours a fresh supply had to be secured every day from animals just coming down with the disease and free from all other maladies. This practice limited the process of immunization to such an extent that an attempt was made to prolong the virulence of the rinderpest blood. After careful investigation it was found that the virus could be maintained in three-fourths its volume of glycerinated bile from five to eight days. This discovery greatly increased the usefulness of the simultaneous method because it was possible to keep the virus under proper laboratory control and work several days' journey away from rinderpest cattle.

SUMMARY.

1. The rinderpest epidemic of 1924 was especially virulent and widespread, extending through Shantung, Honan and North Anhwei.
2. The symptoms of rinderpest were not always constant. Usually there was fever, followed by violent digestive and respiratory disturbances.
3. The morbid conditions depended upon the virulence. However, the most marked lesions were usually found in the digestive organs, especially the fourth stomach. This organ was often a solid mass of inflammation and ulceration.

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4. The virus of rinderpest was transmitted from the sick to the healthy animals in a variety of ways. Direct contact with fresh secretions, such as the discharges from the nose and mouth and the excretions, urine and feces, were especially active agents.

5. While no cure was discovered for advanced cases of rinderpest, the disease was successfully treated prophylactically and immunologically. Prophylaxis was secured by injecting large doses of the immune serum intravenously during the early stages of the disease. Immunity was developed in healthy animals by specific vaccinations.

6. Chinese cattle had some natural immunity which foreign cattle coming from America did not possess. This made it possible for pure Chinese cattle to be treated with smaller doses of anti-rinderpest serum at less expense than foreign cattle.

7. Bile collected from animals which had passed through all stages of rinderpest, ripened for 10 days and tested before injection into susceptible animals, produced passive immunity lasting one month.

8. Since immune rinderpest bile filters through the tissues slowly, 10 days were required to stimulate the production of sufficient anti-bodies in the blood of susceptible animals to resist natural infections of the disease.

9. When standard anti-rinderpest serum was administered along with tested immune rinderpest bile, the protection against natural infection was immediate and lasted about five weeks.

10. The simultaneous inoculation of anti-rinderpest serum and rinderpest blood produced indefinite immunity. The virus was administered in increasing quantities, beginning with small doses. This method of immunizing cattle was safe only in the hands of experienced technicians.

11. It was found that "breaks" were influenced by the lack of vitality in the animals due to shipping, carelessness in feeding and hot weather.

12. Rinderpest blood maintained its virulence for 24 hours when in use on the field and for 48 hours when kept in the ice-box. However, the best results were obtained when it was used within 12 hours after drawing from the diseased animals.

13. The fact that rinderpest blood maintained its virulence for only 12 hours was a serious handicap when an attempt was made to immunize cattle on a large scale in villages, because a fresh supply had to be secured every day.

14. Rinderpest blood mixed with three-fourths its volume of glycerolized bile maintained its potency in use on the field in Honan and North Anhwei five and eight days respectively.

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CONCLUSION.

In conclusion the writer wishes to acknowledge his sincere thanks to Messrs. Sallee, Middleton, and Lee, of the Kaifeng Baptist College, Kaifeng, Honan ; to Messrs. Hood, Irwin and White, of the Presbyterian Mission, Nansuchow, North Anhwei ; to Dr. W. E. Macklin, Medical Missionary, Nanking, Kiangsu, and to others for practical advice, kindness and assistance rendered while these observations and experiments were in progress.

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Agriculture and Forestry Series

Volume One, Number Six

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- I. Report of Three Years' Cotton Improvement Work
- II. Observations on the Behavior of Cotton Plants especially during Acclimatization

J. B. GRIFFING



Issued by

The College of Agriculture and Forestry

September 1923

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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, China.

ACKNOWLEDGMENT

March first 1923 marked the completion of three years of cotton improvement work by the University of Nanking carried on in accordance with the agreement entered into with the Cotton Mill-owners Association of China and the Shanghai Cotton Anti-adulteration Association, who have supported our activities along this line during this period. In these three years the two associations have contributed the sum of approximately twenty-eight thousand dollars Mexican which has been expended in accordance with annual budgets and programs duly submitted by the University and approved by them. The writer was engaged at the beginning of this period by the University of Nanking to carry out the improvement program and from the beginning of the work has been very greatly encouraged by the cordial appreciation and the deep interest that has been expressed on numerous occasions by the members of the two associations. It is fitting that this printed report present a summary of the work of the whole period rather than of the past year alone, since a typed report concerning the past year has already been submitted.

It is a pleasure also to acknowledge the loyal co-operation in the cotton work on the part of the many associates and assistants without whose help it would have been impossible to prosecute the undertaking on such a large scale or to keep in intimate touch with the cotton farmers and local problems and conditions.

JOHN B. GRIFFING,
Department of Cotton Improvement.

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Part I

**REPORT OF THREE YEARS COTTON
IMPROVEMENT WORK**

EARLY ATTEMPTS AT COTTON IMPROVEMENT

Cotton Improvement Work at the University Previous to 1920.—Since 1915 the University of Nanking had undertaken experiments in cotton growing, particularly with reference to the introduction of American cotton, and had demonstrated the practicability of successful production of American cotton in the region of Nanking.

New Basis of Cotton Improvement Urged.—On his visit to China in 1918, when he visited Nanking, Mr. Walter T. Swingle, Head of the Office of Crop Physiology, Bureau of Plant Industry, United States Department of Agriculture, became much interested both in the need for and the possibilities of cotton improvement in China. Having observed in his travels in China diverse mixtures of cotton varieties wherever experiments were being carried on, he urged that the fundamental procedure of acclimatization and pure seed production of one or more suitable types be undertaken.

Chinese Cotton Mill-owners Association Cooperates.—In 1919, the Chinese Cotton Mill-owners Association asked the University to undertake some experimental work in connection with cotton improvement and agreed to provide \$600 for expenses. During this year, in addition to tests carried on in Nanking, variety tests were also carried on in twenty-six centers, largely mission stations, in Chekiang, Kiangsu, Kiangsi, Anhwei, Chihli, Honan, Hupeh, and Hunan provinces. Through Mr. Julean Arnold, United States Commercial Attaché, Peking, there were made available for these variety tests a number of standard sets of cotton seed representing widely differing types of American grown cotton, which had been sent to him by the United States Department of Agriculture. The significance

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of that year's work is indicated by the fact that it provided material for observations, on the suitability of certain varieties for cultivation in China, that have been used as the basis for the work subsequently undertaken by the University of Nanking and by the Improvement Committee of the Chinese Cotton Mill-owners Association.

Survey of the Cotton Situation in China.—Upon returning to the United States, Mr. Swingle persuaded Mr. O. F. Cook, the noted American authority on cotton, and Head of the Office of Crop Acclimatization, Bureau of Plant Industry, United States Department of Agriculture, to visit China not only for the purpose of studying the behavior of American varieties, but also the native cotton of China and Chinese cotton problems in general. Mr. Swingle also persuaded the writer, who had previously been engaged in pure seed production in the Pima (Egyptian) cotton community of Arizona, to make the survey in China together with Mr. Cook.

This tour of investigation and observation in eight provinces served to verify the fact that, although much American cotton had been brought to China, yet no acclimatization or pure seed work had been done, with the result that nearly all plants showed varying degrees of degeneration. The success of the Trice and Acala in the variety test of 1919 was fairly encouraging in the regions away from the coast and to the north, indicating that the commercial production of the higher yielding and better quality American type was evidently practical. The superior strains of Chinese cotton that were discovered in the lower Yangtze valley indicated that great possibilities of improvement existed with this native stock. That progress with these native stocks would be comparatively rapid was evident from the wide diversity of forms existing in nearly every field. There seemed to be practically no instances of pure Chinese varieties of cotton but rather only mixtures of various strains. In some localities certain general types predominated, such as the black seeded cottons around Nantungchow, while in other places white fuzzy seeded varieties were the rule. The need of giving attention to Chinese

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cotton was evident from the relative failures of efforts in growing American cotton near the coast.

The majority of the experiment stations that were visited during the course of the survey, or that have been investigated since, have been devoting their attention to elaborate tests of varieties or to various cultural methods, the spacing of rows or of plants, and, in general, what seemed to be an attempt to rediscover common facts already known to experienced cotton growers. With nearly all variety tests the fact of cross pollination was disregarded and the seed replanted year after year, so that in most instances no actual varieties were really being compared, but only degenerating mixtures. Fortunately the work of the majority of the stations has been limited to the conducting of such plot tests and no serious attempts have been made to introduce the seed to the farmer.

PROGRAM OF THE UNIVERSITY OF NANKING

Co-operation of Cotton Mill-owners Association of China and the Shanghai Cotton Anti-adulteration Association.—Upon the completion of the survey, the work was placed on a more permanent basis when, through the farsightedness of Messrs. Kerfoot, Beswick, McNicol, Pearce, and others, the Cotton Mill-owners Association of China and the Shanghai Cotton Anti-adulteration Association, both of which organizations are largely British, agreed to finance a program of cotton improvement over a three year period under the direction of the University of Nanking and in charge of the writer.

Essentials of the Problem.—With the background of information obtained from the preliminary investigations, the University proceeded to organize its improvement work. The plan that was undertaken was in no sense one of establishing an experiment station. Practically nothing could be gained by adding one more to the list of stations already in China comparing varieties, cultural methods, fertilizers, etc.

An attempt to view the cotton problem of China in a proper perspective led to the conclusion that there were two tasks of

primary importance upon which attention should be concentrated: first, the creation in the shortest possible time of a commercial supply of improved seed and, second, the organization of a plan of introduction to the farmer with a suitable system of maintenance and control of the improved seed supply.

Besides these two main issues, so-called research problems in study of details of the cotton plant, in cultural methods, fertilizers, or even in insect problems, save in keeping out the boll weevil, may not be expected to affect appreciably the commercial production of cotton in China in the near future; and the testing of varieties, in spite of the attractive show and museum effect that it gives to station work, is altogether preliminary to the actual problem. Variety testing and pure seed production can by no means be managed on the same land because of the natural crossing through the activity of insects even within a radius of one mile.

In the first stage of the University's program two parallel lines of work were undertaken: one, an effort to acclimatize an American type of cotton, and the other to create from the native cotton one or more improved strains for development in the areas near the coast to which American cotton seems poorly adapted.

ACCLIMATIZATION OF AMERICAN COTTON

Difficulties Involved.—In acclimatization work it was hardly to be expected that results could be easily obtained. An abundance of evidence indicates that efforts to introduce American cotton into China have been carried on for many years, but in no instance has the original quality and character been maintained. The general experience was apparent success at first, followed by degeneration, even to the grade of Chinese cotton, in a very short time. As a result of numerous importations, specimens of degenerate American cotton are now widely distributed and can be found in nearly every field of Chinese cotton, save where an enterprising farmer hoes out such plants in disgust at their appearance.

The experience of the United States Department of Agriculture in acclimatizing cotton from foreign countries has indicated the certainty of a radical change in the behavior of cotton plants when brought to a new environment, the change being largely degenerative.^(a) By careful selection, however, it was possible to develop new strains out of the introduced stock that proved well adapted to the new climate, and some of the best varieties of cotton now grown in the United States have had such an origin. The selective processes in this period of readjustment continued from five to as many as thirteen years, as in the case of the noted Pima cotton derived from Egyptian stock.^(b)

Period of Acclimatization Shortened.—The essence of the problem in China however was time; that is, the creation of an improved seed supply adapted to the climate of this country, together with speedy introduction on a commercial basis. The plan of the acclimatization work was therefore organized on a more extensive scale and in a more thorough going manner than has probably ever heretofore been attempted. Thousands of plants were selected and their product studied in order to give a larger working stock of material. Then, when select seed was produced, its planting was guarded in such a way as to give a maximum multiplication of the desired strains.

Plan of Acclimatization Followed.—Summarized briefly, the process followed was: first the importation of pure seed supplies of the two most favorable varieties, Trice and Acala, and the establishment of these on well separated seed farms to prevent crossing; next, during the summer of the first year, about 30% of all "off type" plants were pulled up and thrown away. Following this, 7,000 of the best plants were tagged, picked separately, and their product studied in the laboratory. The next year, in 1921, the best 300 of the selected plants were grown in progeny rows. These were picked separately and carefully studied for evidences of superiority or degeneration. A few were kept to be perpetuated as pure strains; the greater



Fig. 1. One of many shipments of improved cotton seed sent out for distribution in the spring of 1923. This particular shipment was consigned to Shansi Province.



Fig. 2. The first shipment of cotton baled by the modern press at the University of Nanking custom gin.



Fig. 3. Picking Trice cotton on one of the University pure seed farms.

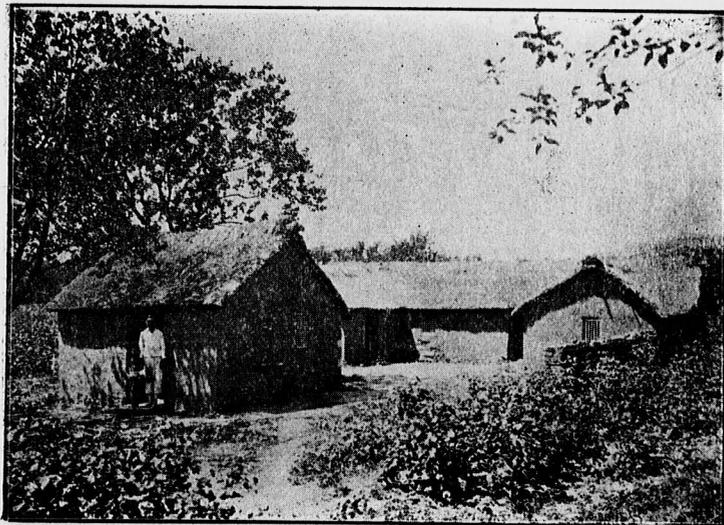


Fig. 4. Headquarters at the 150 mou Shen Tze-men pure seed farm.

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portion furnished the seed for planting an extended seed farm area in 1922, which, as will be shown in detail in Part II, have been sufficiently acclimatized to warrant distribution; while the superior strains grown separately showed characteristics of quality and yield superior to the original varieties imported. The process of acclimatization may be said to have been accomplished therefore within the period of the three years.

The burden of detail involved in carrying out such a plan would have presented an insurmountable obstacle under ordinary circumstances, but the large number of interested students available for technical measurement work and the low priced labor for simpler operations made possible the consummation of the task. During the three years, a total of 12,500 plants were individually tagged and picked. Besides general studies of each plant and lint sample, the lint of ten seeds from each was carefully combed out and measured, and a hundred seeds of each were separated from the lint by hand and carefully weighed with and without lint on an analytical balance. A total of 630 progeny rows were picked separately, studied in detail both by sample and in toto, and thirty-seven different multiplication fields were separately picked, sampled, and ginned.

The pure seed farms upon which the highly selected seed was grown in 1922 were as follows:—

	Number of mow
Central University farm.. .. .	40
Shen Tse Men farm	90
Tai Ping Men farm	70
San Chia Chwan farm	40
Chi Ling Men farm	120
Ming Tomb farm	150
Total mow of seed producing area	510

Of these areas 360 mow were operated directly by the University and 150 mow by Mr. Hu Chia-tao, a cooperating gentry farmer. Besides these central farms where seed was being grown for distribution, less highly selected seed was being grown in Tang Chuan in Kiangsu and in Hochow, Chuchow, and Shuiko, in Anhwai, on small demonstration

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farms to prepare the way for the introduction of seed that would follow. In addition to these points that were directly operated by the University, seed supplies were sent to many schools, missions, and individuals. Of these, the mission agricultural stations at Nansuchou, Anhwei, and Kaifeng, Honan, secured notable results. These stations have also local seed farms established from the seed furnished, and distribution campaigns are under way.

IMPROVEMENT OF CHINESE COTTON

Only Chinese Cotton Practicable for Lower Yangtze.—Not only the experiments conducted in 1919 with foreign varieties but also all subsequent work both by ourselves and others have only served to verify the conclusion that American cotton cannot successfully and profitably be introduced near the coast. The reasons may be briefly cited as follows: (1) the American cotton is three to four weeks later than Chinese cotton and, as the growing season for cotton in the cooler area near the coast is shorter than in the interior, a large percent of the bolls never open; (2) the greater humidity of this area stimulates the destruction of the plant and of the bolls, even when opening, by fungus diseases, and render such as may be picked low in quality and discolored; (3) the fact that the bolls of the American cotton turn upwards, unlike the pendent Chinese bolls, renders them more liable to such destruction; (4) the whole area near the coast is practically a two crop area where cotton follows in rotation after a small grain or beans; this rotation can hardly be changed for a one crop system for various economic reasons, and the illy adapted American cotton would stand little chance of giving the value of two crops; and (5) the growth of American cotton in this area is attended with a high risk according as the climate of the season averages wet or dry. The Chinese farmer has so small a margin over subsistence that he necessarily therefore plants the crop where the income is most certain.

During this same period, therefore, when the acclimatization of foreign varieties was being done, the development of

a superior strain of Chinese cotton was vigorously promoted. Hitherto practically no interest had been taken in Chinese cotton by any experiment station, as attention was attracted to the apparently more spectacular possibilities of the foreign varieties.

Methods of Chinese Cotton Improvement Followed.—In order to create a better variety of Chinese cotton, two general methods have been followed. First, that of endeavoring to discover some superior individual plant and to make of its progeny a new superior variety, and, second, that of mass selection or securing stock of seed from a large number of selected individuals. The latter method has been used only as a basis of securing material for further selection and of maintaining interest in a number of areas at once. But little actual progress may be expected by this procedure.^(c) Moreover, success by means of the former method can hardly be attained without extensive search over a wide territory. Therefore, immediately upon our taking up the work at the time of the survey in the autumn of 1919, hundreds of fields in several different provinces were visited in the search for superior individual native specimens. Professor K. S. Sie aided the writer quite materially at this time by locating many superior types in the Kiangyin district. In all over 1,000 specimens of marked superiority over their surrounding plants were discovered in the autumn of 1919.

These selections were given careful laboratory study and 300 of the best were planted in the spring of 1920 in a large breeding plot. Here the plants of each progeny were kept from crossing with others by the self pollination of all blossoms by means of paper bags. Of all the progenies so grown three gave great promise from the standpoint of both yield and quality, and their product was carefully multiplied in isolated places in 1921; and in 1922 a community nucleus of one progeny was established in Shanghai and of another in Kiangyin. In 1923 the plantings from these pure strains are expected to produce over one hundred piculs of seed cotton.

The Million Dollar Cotton.—The most promising of the three strains is the one named by the students the "Million Dollar" cotton. The original plant was discovered near Woon-sung and, when first seen, was strikingly different from surrounding plants in all respects. Its characteristics have been uniformly maintained in the progenies and are somewhat as follows: plant large for Chinese cotton, growing four to five feet in favorable soil; vegetative branches few; leaves coarse, broad lobed, and not so susceptible to disease as the average; red color abundant in stem and at base of leaves; bolls very large, 60% four locked and with occasional five locked; seed large, covered with very white fuzz; lint very white, very strong, much softer and finer than any Chinese cotton yet seen, and 1 1/16 inches in length. A sample of lint was examined by an expert sampler and broker in Shanghai and was pronounced equal in value to standard American cotton.

The effort to establish a better Chinese variety was by no means discontinued upon the early discovery of a few superior strains, but each fall the Chinese fields in the most favorable places have been searched for superior specimens. In all a total of 40,000 selections have been made and studied. From the best of these a total of 1,500 progeny rows have been grown. The self pollination of all blossoms of the most likely plants has involved the making, the placing on the square, and the removing from the withered blossom, of several hundred thousand paper bags.

No Improvement from Transferring Native Seed.—Casual mention may be made of still another attempt to improve the Chinese cotton by a method that has been repeatedly urged on the ground of its rapidity and expediency. This is the procedure of locating a supply of seed derived from the crops of farmers situated in a community noted for the excellence of its cotton, and transferring such seed to the area which it is desired to improve. Such a supply of seed from native cotton of an excellent character according to local stands was secured in a place quite noted for its product, about sixty li from

Kiangyin. Seed from this stock was distributed to about twelve farmers near Shanghai where the cotton is much inferior to the Kiangyin product. The result, as might have been anticipated, was by no means successful, none of the farmers finding any difference in favor of the Kiangyin cotton as grown on their land, and several holding it to be inferior in yield to their own product. Such shifts of seed from one area to another may scarcely be expected to accomplish very much in the way of results for two reasons: first, the difference between native stocks in general is not marked enough to impress the farmer with the difference and to facilitate keeping such a seed supply pure or to organize community production on the basis of such a supply; and, second, when any strain of cotton is moved from the location to which it has become adjusted perhaps for centuries, it will not give as favorable results as in its home environment.(d)

QUALITY AND YIELD OF IMPROVED COTTON

A fundamental question is, what increased return from better quality and increased yield may be expected from improved Chinese or acclimatized American cotton. With reference to quality, the same expert who rated the lint from the "Million Dollar Cotton" as equal to American Middling classified the Trice lint as also equal to the imported Middling grade and the Acala above it. The Trice tends to have a larger proportion of its crop damaged by storms, which reduces the quality from the standpoint of luster and whiteness as compared with the Chinese improved, with its pendent bolls, or with the Acala, with its later ripening date. Trice is thus better adapted to areas farther north and toward the interior, where its quality and out turn are better than about Nanking. The Acala excels in the Yangtze Valley removed from the coast.

A special method of planting the highly selected seed to secure a maximum number of plants was practised, by which each seed was carefully spaced at the desired distance at which the plants were to grow, instead of sowing twenty times more

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seed than the number of plants which were to be left to mature and of later thinning to a proper stand. Losses of plants or seed in some hills by insects or accident therefore caused thinner stands than commercial plantings and rendered the computing of possible yields impracticable. Even in such circumstances, however, the multiplication plot of Progeny 141 of Trice American Cotton gave 221 pound per mow after having suffered heavy typhoon damage. This would be 1,326 pounds of seed cotton or 400 pounds of lint per acre. At the Nanhsuchou station a plot of Trice planted commercially gave a yield of 174 catties (232) pounds) as compared with 96 catties (128 pounds) of Chinese cotton.

One of the marked differences in the improved Chinese cotton over the common stock is in the much larger boll and yield per plant. The multiplication of these plants by thin stands in isolated places to hasten the seed production has prevented the obtaining of their comparative yields on a commercial basis with that of common Chinese and American cottons. With the present enlarged seed stocks thorough yield comparisons will be obtained during the present year (1923).

EXTENSION CAMPAIGN

The second step in the improvement program began in 1922 with the establishment of demonstration farms in potential producing areas and in making surveys of these sections. In the fall of this year a vigorous campaign of seed introduction was inaugurated with distributions throughout the winter and early spring.

In general it may be said that there was no great difficulty in distributing the seed supply to the farmers providing it could be given to them free of charge. In fact a far wider distribution could have been made had not the supply been limited.

Difficulties Encountered.—Nevertheless certain specific difficulties were encountered which are worthy of mention. In the first place practically all farmers depend absolutely for their living on a comparatively small area of land and the margin

of subsistence is so small that no risks may be taken. Any new crop, even though it seems to give promise of greater returns, is tried with reluctance and then only on a very small area, for the farmer feels that only the crops that he has grown all his life and are true and tried may be counted dependable.

Throughout the Wukiang district in Anhwei, another peculiar difficulty was frequently encountered. The farmers, though amazed at the comparative magnificence and size of the bolls of American cotton and fully convinced of its greater yield and value, repeatedly suggested, "We should not dare to raise cotton as fine as that, for if we did others would steal it." A further investigation of this problem disclosed the fact that petty banditry and thieving were so prevalent in parts of the area that even the cotton was picked from fields at night unless gathered by the farmer himself prematurely.

Again our extension workers were often looked upon with suspicion as being agents of scheming officials attempting to work some new ruse for extorting money. When the plan of giving out tickets good for a small quantity of cotton seed was tried, the farmers about Hochow all shied at them, inasmuch as a previous distribution of mysterious tickets had turned out to be a forerunner of a special tax collection. At Wukiang many farmers were afraid to accept pure seed samples. Their objection was that their local officials under the guise of agricultural improvement had recently made a free distribution of mulberry trees and later returned to collect for them at treble value.

Added to these and many other peculiar problems was the conservatism that is characteristic of the farmer group throughout the world, but here intensified by illiteracy, age old customs, farm practices ingrained with superstitions, and the indifference of city landlords who control the cropping policy of their tenants and resent any change in the fixed habits of rent collection.

Use of Demonstration Areas.—In the existing circumstances, therefore, the extension program was founded upon the

experiences in similar work in that part of the United States where the farmers are the most conservative and illiterate; viz., in the cotton belt of the south. In that area the agriculture has been revolutionized in recent years through demonstration farms, boys clubs, exhibits, and other simple concrete methods of demonstration. With this principle in mind small areas of four to five mow alongside main traveled highways were planted to demonstrate the improved cotton and its methods of culture to passing farmers.

Use of Fairs and Plays.—During the autumn at cotton picking time country fairs and exhibits were held giving a display of the improved products, the improved cotton being ginned by a modern gin, and of pictorial charts illustrating both the benefits to be derived from growing cotton and the methods of growing it. A feature of the fairs which were given in eleven different points throughout the season was the staging of a play in which the advantages of growing improved cotton were set forth.

Mission Stations an aid to Extension.—The most hopeful channel of extension work has been found to be the country mission stations. The value of these lies partly in the fact that the mission stations are especially appreciative of the value of crop improvement, being manned by trained educators and pastors, often foreign, who are working for community improvement, and also because of the view point of the farmers towards a new proposition when introduced by the mission. They have learned in times of famine or sickness that the mission works for their good and without mercenary motives. Therefore agricultural workers introduced (and proper introductions are always indispensable) through other channels often find the farmers predisposed to suspect some form of tax increase and to resent with fear all offers of help.

The majority of the stations developed outside of Nanking so far owe the success of their growth to the introductions by, and cooperation of, mission workers. Other mission stations in many places are endeavoring to establish pure seed intro-

duction centers on their own responsibility by using the improved seed of the University. To this end many stations send their country pastors and teachers to the University summer school that they may study cotton culture and extension methods. The various mission bodies with their large number of outstations ramifying throughout every important rural district constitute a machinery for extension that is unequalled in China. The University of Nanking is in a most efficient cooperative relation with this machinery on account of its central location and by nature of its union mission organization.

Wild Land an Opportunity for Expanding Cotton Production.—In several provinces, Western Kiangsu and Anhwei in particular, there are considerable areas of so called wild land that at present grow nothing but grass. This is due in part to the difficulties involved in breaking sod land and putting under cultivation and partly because many areas once cultivated reverted to natural conditions when practically depopulated during the Tai Ping rebellion and have not yet been settled to the point of intensive cultivation. The University of Nanking on an area near Purple Mountain during the spring of 1923 plowed thoroughly and rapidly considerable areas of raw grass land and in a few weeks prepared the soil for an excellent stand of cotton. The establishing of this precedent has opened up a considerable field of opportunity in the expansion of the cotton growing area.

Experience of a Gentryman-Farmer.—Already certain gentry farmers, with the aid of the foreign plow and a few modern implements of cultivation, have taken advantage of this opportunity and have opened up considerable areas of this low priced rolling upland, which, being high and well drained, is eminently fitted for cotton production. Such a man is Mr. Hu Chia-tao, who last year on 150 mow of upland grew cotton from seed provided by the University of Nanking which yielded him an income from the cotton alone, aside from stalks, of \$1,561.00, or slightly over \$10.00 per mow. Moreover the

yield was somewhat below normal due to the severe drought of 1922, which rendered the rice crop on the higher priced lowlands almost an absolute failure, thus giving a return for the season much lower than that of the nearby cotton fields

Mr. Hu has been able to produce his crop with low production costs as he is a careful student of both Chinese and modern methods of farming and is able to work out a semi-extensive system of operation that combines the economics of both.

Failures in "Land Company Operation."—The success of such men, while an excellent demonstration of the possibilities that lie in this system of farming, may not be easily duplicated by those who are less skilled in the art of farm management because of no practical experience. Stimulated by the modern agricultural teaching, many men, especially of the young, agricultural school graduate type, have undertaken extensive farming, particularly with so-called modern methods and with the aid of high priced, imported, agricultural machinery. Most often these undertakings are in the nature of land companies with several men supplying the land and capital and with an agricultural school graduate as operator. The number of such undertakings that has come to the writer's notice is astounding, but not a single instance has yet been discovered where the operation has proven profitable, and the majority of such operations that have come to notice are already in a bankrupt or abandoned state. The reasons for this universal failure are not far to seek. In the first place the graduate of even an agricultural school by virtue of the fact that he is a scholar has been deprived through his boyhood of actual participation in farm work, even though in some instances he may come from a land holding family. In the second place, agricultural schools in general as yet give much theory but little practice. Moreover the theory and practice which is given, on account of the effort to be modern, is most often that which is foreign and expensive or impractical rather than that which is a skilful selection and adaptation of those modern tools, methods, and

ideas from foreign countries which tend to effect efficiency and economy under Chinese conditions.

With these facts in mind it has been the policy of the University to discourage attempts to use extensive farming machinery under the intensive conditions of this section of China, such as the use of tractors where plowing costs under local conditions would mount up to more than six times the cost of the same operation with the presumably old fashioned buffalo. On the other hand an effort has been made to devise and readapt such tools as can be purchased cheaply and used profitably.

Installation of Modern Cotton Gins at Outstations.—One successful experiment in extension that should be developed more fully in a number of stations in the future was the installation of a modern cotton gin at Shuiko, Anhwei, one of the demonstration centers. The gin was installed in a rented building on a public corner of the market street. One room was fitted up as a permanent exhibit and educational display, and another was used for ginning the cotton from the farmers. Their inferior native seed was retained and they were urged to receive for future planting the improved American seed. This interchange proved successful to a marked degree and the greater efficiency of the modern gin over the native types permitted a lower custom rate to be offered to the farmers than other gins demanded and still permit the operation to pay its own expenses. Owing to the fact that American cotton can be ginned only with difficulty on the native gins, the subsequent plantings where American seed is used will practically all be brought to our modern gin, which can thus gain the control of the seed supply and distribution which is one of the essential steps in organizing a successful introduction on a permanent basis.

The Power Saw Gin Unit at Nanking.—The power gin unit at the Nanking central seed farm, which has a capacity of four piculs of seed cotton per hour, handled the crop of the cooperating farmers about Nanking as well as that of the

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University and in addition ginned ninety piculs of seed cotton for Southeastern University. The lint so ginned was pressed into compact regular foreign style bales. The press used for this purpose was constructed in Nanking by local artisans with the aid of blue prints and iron parts secured from the Continental Gin Company of America. One of the most serious problems with which the cotton mills of China contend is loose packing. This involves great losses in transportation, package covering, damage through moisture both accidental and intentional, and an increased fire risk. It should be the duty of every seed farm to demonstrate not only efficient ginning but compact pressing and efficient marketing of the product in high class condition.

The present plan is to follow up the distribution in every locality outside of the central ginning radius by installing small modern gins, thus completing the organization necessary for permanent seed control.

Disposition of Lint.—An important factor in bringing about the expansion of the improved cotton area is the matter of the price the farmer receives for his product. He will, as already suggested, sell the cotton in the seed. Now the seed of Trice cotton averages slightly lower in lint per cent than common Chinese cotton with its very small seed. Acala cotton has however a percentage nearly equal to Chinese cotton. If then the price of Chinese cotton lint were taken as the basis in computing the price to be paid the farmer, he would receive even less for his improved product than for the common cotton. This fact in its psychological effect would tend to offset any enthusiasm aroused in him by even a greatly increased yield. On the other hand a slightly higher price for the improved seed cotton combined with its heavier yield will be a powerful incentive to the farmer and make the introduction more rapid.

In order to secure a higher price for the lint for the encouragement of the cooperating farmers, the Cotton Department operated a retail store for two seasons where the lint was worked up into padding and bedding rolls. The unusual

softness of such a padding drew a lively trade from both Chinese and foreigners. The stock handled in such a manner, however, was necessarily limited, and the department was greatly aided by Mr. R. J. McNicol of the Mill Department of Jardine, Matheson & Company, who took over surplus stocks at a liberal figure.

Distribution for 1923 Planting.—A summary of the distributions for the 1923 planting are as follows:

	Number of farmers receiving seed samples.					
Central Seed Farm Area	150
Shuiko	120
Chuchow	50
Tangchuan	150
Wukiang	500
Poochiatsi	450
Hochow	400
Total farmers receiving seed	1,820

In addition to the above distribution under our own control there were shipped to cooperators, other experiment stations, and seed farms, seed supplies to the total amount of 5,200 catties.

In this stage of introduction, farmers receiving trial samples plant as a rule only one or two mow, and tend to use their old methods of culture. Some will naturally secure better results than others. It is the policy, therefore, during 1923 to keep an extension worker going about over the areas where seed is distributed not only giving advice to the farmers but noting which ones are successful in growing the improved cotton in order that the next distribution may be limited to the farmers that are successful. Instead of giving these a trial sample they will be persuaded to buy seed for their whole farm. Such a step will mark the achievement of extensive commercial production.

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LABOR SAVING IMPLEMENTS FOR COTTON CULTIVATION

Limitations of Foreign Implements.—The introduction of foreign agricultural implements as an aid to cotton production is subject to rather severe limitations and very naturally follows the economic law of increasing and diminishing returns. In other words an implement may be able to give an increased yield of cotton, but when such an increase is less than the increased cost of operation due to greater investment then the use of such an implement is of no benefit. Some of the handicaps in the way of implement importation besides the above named factor are: lack of working capital on the part of the farmer which keeps all equipment down to an absolute minimum; conservatism of the farmer in taking up something strange and foreign; the inability to secure repairs and parts; the mechanical complication of most implements with parts easily lost or broken if the operation is not understood; and the general lack of adaptation to the type of fields, animals, and workmen in this country.

Introducing a Satisfactory Plow.—In carrying on a careful investigation of this problem one type of plow was found which could be imported to advantage. This particular plow was the type with chilled metal points and mold boards which last a long time without need of sharpening, and which can be sharpened at a low cost by simply changing the points. The steel pointed plows hitherto introduced into China have nearly everywhere been thrown into the scrap heap because of the inability of country blacksmiths to sharpen and temper a steel share. The popularity, however, of the low-priced chilled-point plow may be evidenced by the fact that the University has imported, for Chinese friends and foreigners interested in demonstrating them, ninety such plows at a cost to the farmers of only M. \$12.00 for the standard one animal size to \$20.00 and \$24.00 for large two and three animal plows.

An instance of the superiority of the foreign implement has been demonstrated in a number of places where new land

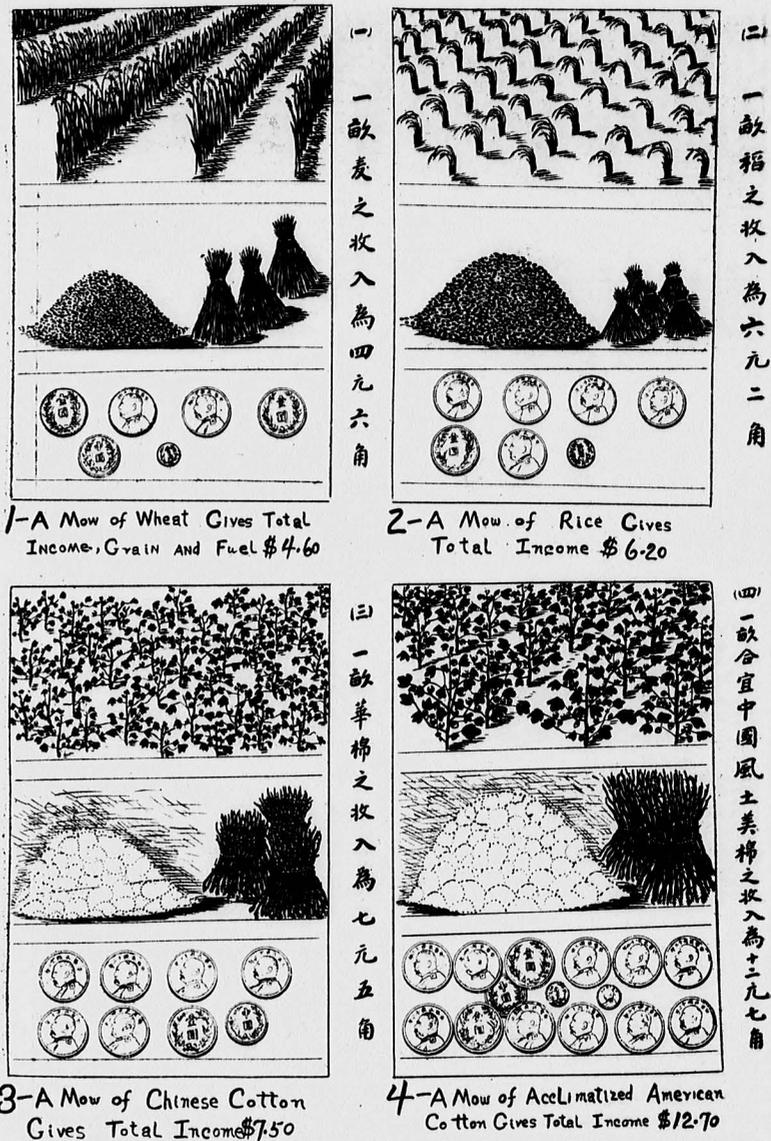


Fig. 5. An example of teaching through pictorial charts. Even the illiterate farmer can catch the idea of a greater income from improved cotton.

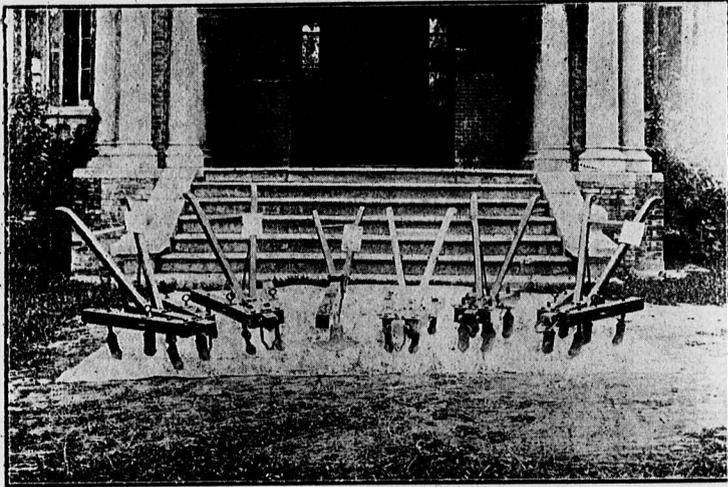


Fig. 6. Types of cultivating implements designed to meet the conditions of the Chinese farmer.

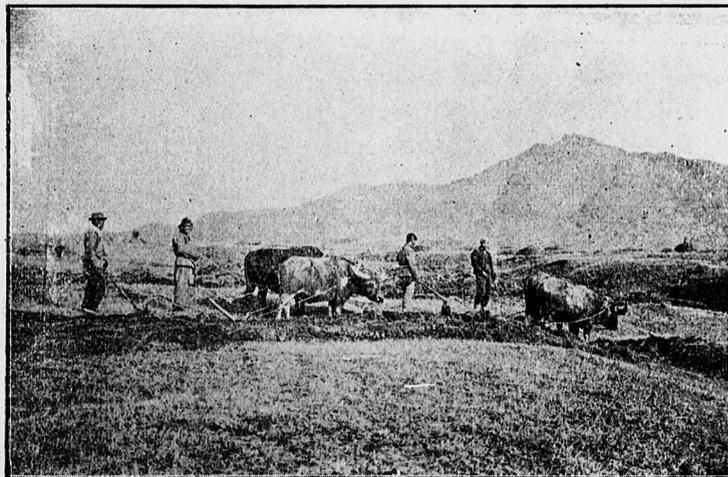


Fig. 7. Breaking waste grass land for cotton with foreign plows, and teams of water buffaloes.

was to be broken up. The opening of sod land has hitherto been a most laborious process, only possible by means of a hand tool called the "Ting Pao," as the native plows are too dull and too fragile to penetrate the sod. The cost of this tedious method often runs as high as \$5.00 per mow. Moreover the land is rather unproductive during the first year, while the big lumps of sod are rotting and being worked into shape.

Cotton Cultivators.—One such implement that has been worked out is a cultivator for cotton with one shovel or sweep which can be used for marking, furrowing for fertilizer, making rows for planting, and all the cultivating operations. This can be made locally at a cost of about M. \$5.00 and can quickly pay for itself in the labor saved by cutting down the hoeing operations. Another type of cultivator has five shovels and can be contracted or expanded for width of row. This has an even wider range of usefulness and can be made locally for about \$8.50.

The Saw Gin.—Besides the one type of foreign plow and the simple cultivating tools, another form of modern machinery that seems destined to play an important part in cotton improvement work is the American cotton gin. Where American cotton is grown this machine can be used with little or no adaptive changes and proves to be a key factor in establishing seed control through the fact that the longer and finer American staple can be removed only with great difficulty by the native home machines, thus compelling all farmers to take the product grown from improved seed to ginning stations.

Adapting Saw Gin to Native Cotton.—For areas where Chinese cotton is to be ginned, however, the American saw gin requires a change in the spacing of saws on account of the smaller seeds and a very careful adjustment on account of the danger of cutting the stiffer, coarser lint of the native cotton with the saws. Such a gin has been devised at the University, and was operated all last season successfully in ginning native cotton, cleaning the seed as well as the native gins, and turning out a lint free from cut staple, which scored higher in classifica-

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tion with an expert buyer than the same kind of cotton ginned on the native gin. The possibilities of the saw gin for Chinese cotton in large centers and operated by power may be illustrated by the facts brought out in the investigation of a large power gin in the Nantungchow area. This gin had twenty-four stands of the roller type and was turning out in loose packed bales what would amount to approximately fifteen standard bales of 500 pounds each in a continuous day and night run of twenty-four hours. The stands seemed rather poorly adjusted and nearly all were peeling the seeds, reducing the value of the lint at least a tael per picul through the passing of seed and particles of hull with the lint. In weighing, ginning, handling seed, bagging lint, and other general operations there were about seventy-two men employed. In the cotton belt of America a custom gin, if operating day and night with a total crew of ten to twelve men, turns out sixty to 100 hard packed bales of 500 pounds each. Moreover, the machinery is so designed that it cleans the cotton, raising the grade by removing trash instead of lowering the value by creating it.

Experimenting with Irrigation Pumps.—Another line of investigation has been with irrigation pumps. Throughout the plains of North China there is an immense area eminently fitted for the growing of American cotton but suffering great uncertainties of production through the difficulty of getting a proper stand in the spring and sometimes in making proper growth during the summer due to insufficient rainfall. In a considerable portion of this area there is a stratum of ground water at a distance of from five to twenty-five feet of the surface which only needs to be drawn upon by efficient methods in order to make yields both certain and heavier in production. The present methods of irrigation are the bucket and windlass or some form of the "noria" operated by cow or donkey. The former is so slow in operation that the area watered is limited to from one-half mow to two mow per well. The donkey power lift has a greater capacity but offers so many points of friction that the proportion of water to power supplied is necessarily small.

In taking up this problem two types of pump have been constructed, one of which, a chain type, operated by man power, has demonstrated more than double the flow of the windlass and bucket lift and hence more than quadruple the area capacity on account of the increased duty of water when irrigating at considerable distance with a large flow.

The improvement not only of pumps but also of wells, which in some places as at Nanhsuchou, Anhwei, are pear shaped pockets in the earth only twelve to eighteen feet deep, and because of their shallowness quickly drawn dry, is a line of procedure in which famine prevention endeavor may also be most profitably directed.

COTTON INSECTS

The cotton insect problems of China are mainly two: (1) guarding against importation of the dreaded boll weevil, which as yet has not reached China, through reckless importation of seed from America; and (2) diminishing the damage of the pink boll worm which is already everywhere present.

Many Minor Insects Prevalent.—Incidental to these are certain other pests which are present in varying numbers throughout different sections, always taking their annual toll in proportion to weather conditions which favor their operation. For example, in dry springs the aphid gives a considerable set back to seedling plants until overcome by heavy showers or the development of parasitic enemies. Following these during the summer comes the red spider, which also prospers under conditions of drought. A boll worm, commonly called by the Chinese "Diamond worm", begins during the summer attacking especially the squares and very young bolls; the later generations are even more destructive because of greater numbers as fall approaches. Midsummer sees the beginning of the leaf roller, of which the early damage checks the development of plants attacked and causes premature opening of what few bolls develop on plants early stripped of their leaves. The later generations do little damage and in some instances even aid

by their removal of surplus foliage at the end of the season. The admitting of sunlight to the ripening bolls helps in preventing their decay while opening.

Leaf Hopper and Cyrtosis.—Toward the close of the season, especially in the Yangtze valley and in a considerable area to the north, the leaf hopper, which also infests the leaves of peach and plum trees, brings all the plants to a premature finish through the distortion of the leaves that are attacked. This disorder of the leaves has been described by Mr. O. F. Cook in the *Journal of Heredity*, where he termed it "Cyrtosis".(e)

Local Infestations.—In addition to these rather general pests, there are sporadic outbreaks of local pests as natural circumstances favor their sudden development. Such a pest is the geometrid called by the Chinese the "Bridge Worm", which caused considerable havoc especially during one season in the Pootung area.

Minor Pests of no Great Economic Importance.—With regard to these minor pests, most of which are comparable to similar forms in other cotton growing districts, but little effect upon the national cotton production may be expected by their detailed study or any specific program for combating them. The study of their life histories and habits by professional entomologists, while adding its contribution to the world's knowledge, will be of scientific rather than economic interest. As in other cotton growing countries, certain minor pests will always exist which can not be economically handled and in spite of which good yields may be usually obtained. It is evident that, with a general field crop such as cotton, mechanical or insecticidal remedies for any insect are practically prohibitive from the standpoint of cost.

Damages of the Mexican Boll Weevil.—There are two cotton insects however with which every cotton improvement movement should concern itself vitally, viz., the boll weevil and the pink boll worm. The former insect may well be

dreaded, as its damage in the United States has already reached the enormous figure of \$600,000,000 per year, and as it is now spread practically all through the cotton belt, any shipment of seed from America may introduce this destructive pest to China.

The only preventive measure is an effective quarantine against cotton seed not only at ports of entry but also by the post office, combined with a campaign of education against the danger of introduction of the weevil by this method.(f)

Problem of the Pink Boll Worm.—The pink boll worm is probably the most generally distributed of all Chinese pests and takes through boll damage and deterioration by discoloration a greater toll from the cotton farmer than all the other pests combined. It passes through several generations during the season, becoming more destructive by virtue of numbers as the season advances. The seed cotton when gathered will usually be found to contain great numbers of larvae which, when the cotton is stored in the farmer's house, will crawl out and hibernate in the cracks of the wall or the thatch of the roof. The number and kind of places in which the freshly picked seed cotton is stored make practically certain the continued perpetuation of the insect in considerable numbers through hibernating larvae which have been known to live in this resting larval state for more than two years.

The only two methods at present known for ameliorating the damage of this pest are the burning of all cotton stalks and especially old bolls from the fields and the using of some method of treating the planting seed to kill the live worms that it contains. In China there is little need of emphasizing further the burning of the cotton stalks as the demand for fuel automatically provides for their disposal. Fumigation methods which have been tried by the University so far, while effective, are too expensive to be applied on a large scale, and an effort is now being made to adapt a system of hot air treatment similar to that in use in Egypt, which is rapid, effective, and inexpensive.

EDUCATION AND PROPAGANDA

Besides the extension methods already indicated, such as the holding of exhibits, country fairs, entertainments, and personal visitation of farms of interested farmers, many demonstration lectures have been given before student bodies with the idea of setting forth the modern methods of cotton improvement, acclimatization, and pure seed control, the danger of boll weevil introduction, etc.

Publications Dealing with Cotton Culture.—The campaign of education was also furthered by the publication and distribution of bulletins on these essential subjects. Bulletins were of two kinds: (1) those for study by students, which were somewhat detailed and written in ordinary mandarin; and, (2) those of a simple nature in easy "bei hwa" for use by country teachers and evangelists among such farmers and landowners as could read a little.

The publication and distribution of these bulletins has been as follows:—

	IN ENGLISH		IN CHINESE	
	Pages	Copies	Pages	Copies
Roguing of Cotton, by J. B. Griffing ...	8	2,000	10	3,000
Cotton Culture, by J. B. Griffing ...	13	500	10	3,000
Dangers and Control of Cotton Seed Importation and Distribution in China, by J. H. Reisner; translated from "Millard's Review," 29 January 1921 by Shao Teh-hsing ...	4	300	7	600
A Disorder of Cotton Plants in China, by O. F. Cook; translated from the "Journal of Heredity" by Shao Teh-hsing ...			7	1,000
Selection of Cotton by Character of Leaves, Stalks, and Bolls, by O. F. Cook; a bulletin translated by Shao Teh-hsing ...			22	2,000
Cotton a Community Crop, by O. F. Cook; translated from the "Journal of Heredity" by Shao Teh-hsing ...			8	1,000
Possibilities of the Introduction of American Cotton into China, by J. B. Griffing; translated by Shao Teh-hsing ...			6	1,000
American Cotton Culture by J. B. Griffing; translated by Shao Teh-hsing into simple bei hwa ...			11	6,000
Cotton Insect Problems of China by J. B. Griffing; translated by Shao Teh-hsing	8	500	7	3,000
Report of Cotton Improvement for 1920; translated by Shao Teh-hsing ...	20	500	16	3,000
The Acclimatization of American Cotton by J. B. Griffing; translated by Shao Teh-hsing ...			6	2,000



Fig. 8. A cotton market at Lin-I in Shantung. The farmers and cotton dealers were invited to the play shown below.



Fig. 9. The doctrine of Improved Cotton being imparted to the farmers and gentrymen at Lin-I, Shantung, by means of the theatre. The play being given by University of Nanking students was specially written by the Department of Cotton Improvement and sets forth in a dramatic way the benefits to be derived from growing improved cotton. A most effective way to arouse the interest of the conservative farmers. These plays are usually followed up with distribution of improved cotton seed.

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Fig. 10. Giving practical training to the cotton course students in proper methods of cultivation.



Fig. 11. A branch of "Million Dollar" Chinese cotton showing three four-locked bolls and one with five locks.

Instruction in Cotton offered at the University of Nanking.

—In addition to these general methods of instruction, courses have been given in the University both as regular courses among students of advanced standing, with the idea of training well qualified assistants and cotton specialists, and also as summer courses and short courses, in which the end sought was the imparting of sufficient knowledge about cotton to teachers, pastors, and other community leaders that they might be able to link with the University's program as local extension workers, growing improved cotton or introducing improved seed.

Training of Foremen.—In addition to the above, an effort has been made to train selected workmen, making of them foremen of seed farms, ginners, operators of outstations, etc.

A summary of these phases of educational work would be as follows:—

Specially trained as assistants..	..	..	..	..	..	..	..	16
University Senior College Students..	..	..	..	..	..	..	..	14
University Short Course	..	..	..	..	..	..	..	47
University Summer School	..	..	..	..	..	..	..	84
University Special Practice	..	..	..	..	..	..	..	12
Special workmen	..	..	..	..	..	..	..	9
Total	..	..	..	..	..	..	..	182
Counted twice	..	..	..	..	..	..	..	11
Net total	..	..	..	..	..	..	..	171

OUTLOOK

Interest in Cotton Improvement is Widespread, but Rapid Development Unlikely.—There is no phase of agricultural work in which there is more general interest throughout China than cotton improvement. Besides the special cotton improvement programs of the Chinese Cotton Mill Owners Association with headquarters at Southeastern University, and the Bureau of Cotton Improvement at Tientsin, there are four national cotton experiment stations, and several provincial experiment stations in every province, besides the many substations of these various units. Moreover cotton culture is made a chief study and activity at all of the agricultural colleges and numerous second-

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ary agricultural schools. This interest and study is hopeful and is aided by the stimulation of high prices, which are due not only to local consumption in China but also to the sympathetic reaction to high prices abroad. A natural conclusion would be a rapid development in cotton production both through expansion of area and improvement of product. However a more careful appreciation of the circumstances can hardly expect such a result in the near future. In fact there has, in the face of improvement efforts and high prices, been an actual decline in cotton production during the past few years. Unfortunately the efforts of many students and workers of cotton in China have been diverted to so called "experimental" work rather than to the development of pure seed growing on a commercial scale and the working out of plans for extensive distribution and control.

National Cotton Convention.—During August 1922 a national convention of cotton workers was held in Nanking at the invitation of the Cotton Departments of the Southeastern University and the University of Nanking. At this time a program of action was outlined which, it was hoped, might shift the center of interest from experimentation to pure seed production and extension. As with many such organizations that start with high hopes, the progressive program adopted still exists only in the form of printed resolutions, while the participating constituency follows each his own procedure as before, and no effort has been made to carry out the ideas formulated in convention.

Many Factors hinder Cotton Extension.—Unsettled conditions of government, banditry, restriction from likin, difficulties in transportation and marketing, indifference of officials, and conservatism of both farmers and land holders, are all factors that tend to prevent any rapid progress in changing the cotton production of China. Moreover, to make such a change will require a more aggressive attack than students or experimenters seem likely to give. In the opinion of the writer it would be highly advantageous for 95% of the ex-

perimental work and most of the theoretical study about cotton to be discontinued, and all funds and energy available for such work to be concentrated on developing seed farms and community distribution centers of a single pure variety, grown from the purest available seed supply. Education in cotton which consists of memorizing descriptions of foreign varieties, mathematical systems of breeding, and foreign systems of culture, which make up most of the existing literature on the subject, are not only confusing but harmful to the average station operator. What is needed is more education in the practical phases of growing, harvesting, and ginning cotton, and the methods of keeping seed fields pure; a promotion of seed farm development instead of detailed experimentation; and an aggressive campaign of extension based upon demonstration farms, boys' clubs in country schools, small ginning and buying units, etc. With such a policy an actual advance might be expected.

SUMMARY OF WORK FOR THE THREE YEARS

The activities of the Cotton Department for the past three years may be summarized as follows:

1. A general survey has been made of cotton problems in parts of Anhwei, Shantung, Chihli, and Honan provinces, with a more intensive study of the leading cotton producing areas of Kiangsu.
2. Two varieties of American cotton have been successfully acclimatized by a process of severe selection involving the careful study of 12,500 individual plants and their product and hundreds of progeny rows and plots.
3. The improved strains have been multiplied into a seed supply which in 1923 was planted on 740 mow of pure seed producing farms, besides a distribution to 1,820 farmers and an exportation to other stations of 5,200 cattles.
4. Three new improved varieties of Chinese cotton have been originated of which one has a quality of lint that promises to be equal to American cotton. In accomplishing this result

more than 40,000 selections have been made. The seed supply of these improved strains will reach a commercial basis in 1923.

5. Extension campaigns with fairs, exhibits, plays, etc., with seed distribution have been promoted in eleven different centers.

6. There have been devised and adapted two types of cotton cultivators, an improved gin for Chinese cotton, and a pump for well irrigation. More than forty foreign plows have been introduced into the cotton producing areas.

7. A total of 171 young men have been given some form of training in cotton work.

8. Several magazine and press articles and four bulletins have been published in English, with a total of 49 pages and 3,800 copies. In Chinese there have been eleven publications, with a total of 106 pages and 25,600 copies.

Part II

OBSERVATIONS ON THE BEHAVIOR OF COTTON PLANTS ESPECIALLY DURING ACCLIMATIZATION

While scientific research in cotton problems is, as we have previously pointed out, altogether premature as an end in itself while great practical problems remain unsolved, yet in the procedures necessary to acclimatization a number of statistics have been collected in the study of individual cotton plants and in the testing of their progenies for uniformity in transmission of the desired characters.

These studies, on account of the unusual circumstances and the peculiar nature of the problems involved, may serve to contribute to the rather scanty store of information on the phenomena of acclimatization. Moreover the vital bearing of such observations on the subject of creating and maintaining a pure seed supply may justify setting forth such data as will be of special interest in this respect.

The fundamental question is, of course, what degree of success may be expected in fixing the desirable characters of the foreign cotton plant after the disturbing change of environment from America to China.

The radical breaking up of the uniformity of plant characters and the development of large numbers of off types or "rogues" has been previously described and illustrated in the bulletin "Roguing of Cotton" published by the Cotton Improvement Department in 1920.^(g) Although the discussion in that case was based upon work with the Trice variety, the same phenomena have been observed with the Acala and again with the Miller and College No. 1 varieties, which were later grown from freshly imported seed to give a basis of comparison. To overcome this difficulty would mean that the throwing of off type plants practically ceases, that quality and yield are maintained, and that uniformity is re-established.

In order to obtain a measure of the progress of acclimatization by the third year, certain special studies were made in some of the multiplication plots. These studies consisted in

tagging a series of either one hundred or in some cases fifty successive plants, taking them in two or three groups from typical sections of the plots in order to get the most representative sample of plants possible. These tagged plants were then picked separately and studied in the same detail as other individual selections. The data taken from the study of these average samples gives a basis for a number of comparisons and conclusions with reference to the degree of acclimatization.

Although many studies were made, the results from the Trice variety give a more elaborate series of gradations and may be taken as the basis of discussion.

As has been stated, the seed from the best 300 of the 7,000 plants selected in 1920 was grown in progeny rows. When these were picked and studied separately in 1921 their seeds were divided into four grades. The product from the inferior ones was discarded. The large intermediate group gave the seed for general planting on the seed farms for distribution, the Trice progenies being planted on the Tai Ping Men farm. A few of the rows of very high standard were mixed together and planted in a small isolated field designated as A., while the most excellent were perpetuated individually in multiplication plots of which the one used in the comparison was from progeny No. 141.

The records of the sample studies from these three grades or progenies were compared with records of plants from the original stock of 1920 and also with the studies of twenty-three individuals selected for their excellence out of the 141 multiplication plot.

ELIMINATION OF DEGENERACY.

In one such comparison the degree of elimination of degeneracy was considered. In this consideration an arbitrary standard of 20 mm. in lint length, 6.5 in seed index, and 3.2 in lint index was taken and any specimen which fell below any one of these three marks was considered as degenerate. Safely above this standard, but below either 23 mm. in lint length or 8.0 in seed index or 3.6 lint index, was called

inferior. Above this, but below 25 mm. in lint length or 9.5 in seed index or 4.0 in lint index, was called medium. Above this, but below 27 mm. in lint length or 11.0 in seed index or 4.8 in lint index, was called good; and above these figures the specimen was classed as superior.

TABLE I

	No. Plants in sample	Superior		Good		Medium		Inferior		Degenerate	
		No.	%	No.	%	No.	%	No.	%	No.	%
*1920 S.F. ...	200	34	17	113	56.6	25	12.5	14	7	14	7
T.P.M. ...	93	17	18.3	31	33.3	21	22.6	17	18.3	7	7.5
Field A ...	49	19	38.8	24	49.0	6	12.2	0	0	0	0
Progeny 141	95	32	33.7	55	57.9	8	8.4	0	0	0	0
Selections from 141 ...	23	15	65.2	8	34.8	0	0	0	0	0	0

* Taken after 30% were rogued out.

In Table I the comparison of the studies from the five groups previously mentioned is set forth. Figure 12 gives the same comparison graphically, showing the percentage of each class of individuals.

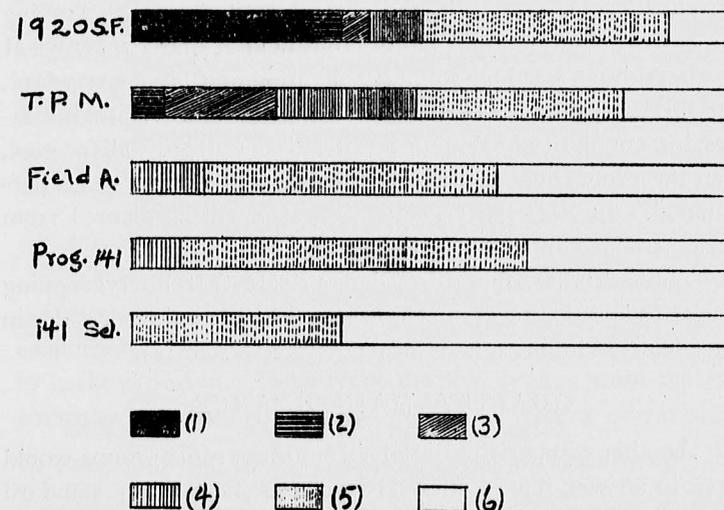


Figure 12. Graphic representation of percentage of individuals in each class indicated in Table I. Block (1) represents the group rogued out, (2) degenerate, (3) inferior, (4) medium, (5) good, and (6) superior.

In considering these figures allowance must be made for the fact that 30% of off type plants were thrown out of the 1920 field before plants were tagged, while in the other instances the sample was taken without the removal of any by roguing in order to make a more accurate estimate of the present status. With this fact in mind it is evident that all of the fields of cotton grown in 1922 were superior in quality to the original stock of 1920. The Tai Ping Men general planting, as was expected, still contained a considerable number of inferior individuals. In Field A the inferiority disappeared and the per cent of plants of medium character dropped to 12.2%. The fact that progeny 141 had slightly fewer superior individuals in per cent than field A, as well as fewer of a medium type, may possibly be explained by the narrower variation of a progeny over a mixture. The progressive stage of cotton improvement on the community basis may be well founded with this series. For example, the seed from Tai Ping Men farm has been distributed and will be grown by farmers in 1923. Much of it will be lost from circulation and perhaps very little will be perpetuated in the introductory process. On the central seed farm at Nanking the general planting for 1923 is from field A and Progeny 141 which, with its freedom from degeneration and higher standard, can follow up and replace the first distribution. With the increasing popularity of the improved cotton and demand for seed, a larger proportion of this distribution will doubtless be perpetuated. In 1924 the central seed farm will be planted from stocks similar to the No. 141 selections.

These studies, therefore, demonstrate that heavy roguing at first followed by severe selection and line breeding, results in the effective elimination of degenerative tendencies.

QUALITY MAINTENANCE.

Another comparison of data from these same groups would serve to answer the question just what is the average standard of quality and yield in the third year of acclimatization as compared with the original stock.

Table II therefore gives the means of the same five groups in lint length, seed index, and lint index.

TABLE II

	Mean Lint length in mm.	Mean Seed index	Mean Lint index
1920 seed field	26.50	11.16	4.31
Tai Ping Men farm	26.37	10.54	4.22
Field A	26.81	11.75	4.78
Progeny 141	26.46	12.23	4.81
Selection of Progeny 141	27.25	12.91	5.146

Lint length is the most satisfactory single measurement of quality or value from the spinner's standpoint, lint index or the amount of cotton per hundred seed is closely correlated with yield, and seed index or weight of 100 seeds, as will be shown later, is perhaps the most delicate indicator of degeneracy.

In Table II, then, we see that quality of the lint as to length is almost identical throughout, except for a slight increase in the selections of 141. The lint index indicates a marked and progressive improvement. The same improvement with marked superiority in the selections is shown in the seed index.

FIXING OF TYPE.

As Mr. O. F. Cook has pointed out, the breaking up of uniformity is the first stage of degeneration.^(h) The re-establishing of uniformity is therefore a criterion of success in acclimatization. Data from the five groups were therefore compared as to standard deviation and coefficient of variability. In computing the standard deviation the formula $s = \sqrt{\frac{s(f.d^2)}{n}}$ was used and for coefficient of variability the formula $C = \frac{100 s}{M}$. Table III gives a comparison of the five groups in this respect.

TABLE III

	STANDARD DEVIATION			COEFFICIENT OF VARIABILITY		
	Lint Length	Seed Index	Lint Index	Lint Length	Seed Index	Lint Index
1920 Seed farm	2.04	1.418	.93	7.45	12.70	21.54
Tai Ping Men farm	1.75	2.319	.815	6.64	22.01	19.31
Field A	1.60	1.57	.398	5.97	13.36	8.32
Progeny 141	1.80	1.421	.567	4.46	11.62	11.79
Selections from 141 ... ..	.91	1.026	.51	3.34	7.94	9.91

An interesting fact developed in the above is that length of lint is the least variable of the three characters compared. Although the figure for the standard deviation fails to disclose this fact, yet when the relation of this deviation to the total length of lint is figured, by the formula for deriving the coefficient of variability, then we find that lint length has only about a third of the variability of lint index. The essential feature of the comparison, however, is the narrowing of the variability, or in other words the establishing of uniformity by selection. This was notably true of progeny 141 and the selections from it.

In figure 13 data from both Table II and Table III are set forth graphically to indicate the actual progress in acclimatization work through both raising the standard and narrowing the range of variability. The size of the circles is in exact proportion to the coefficient of variability of the particular factor set forth in a given square. The height of the center is in proportion to the magnitude, or, in other words, the degree of excellence of that factor. The significant fact is the marked contraction of the circles and the raising of the centers in progeny 141 and in selections from 141.

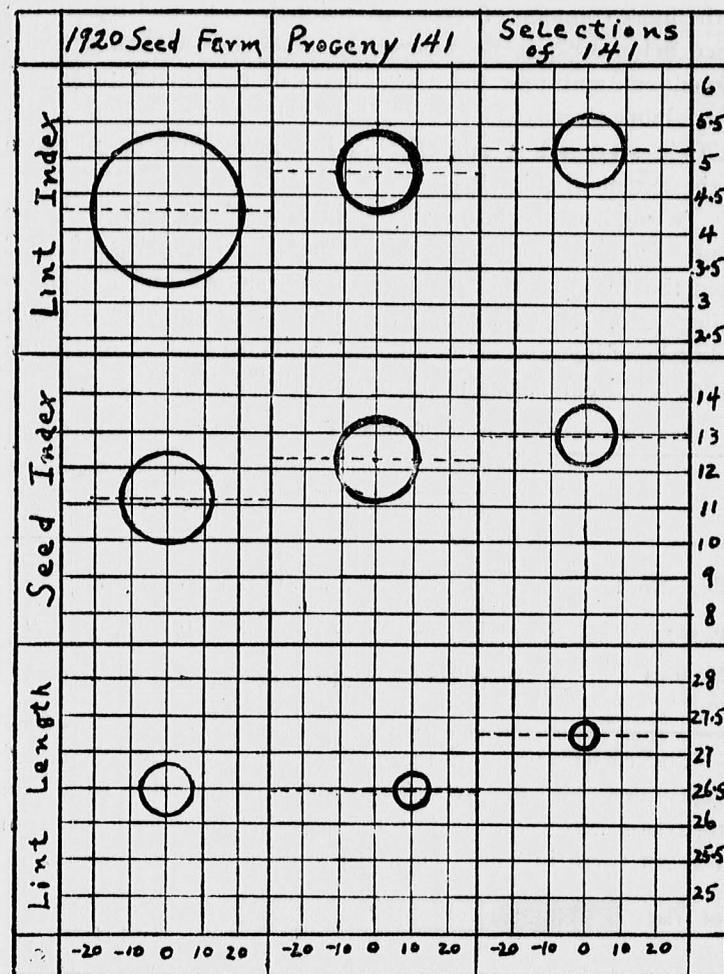


Figure 13. Diagrammatic representation of progress in type fixing. Horizontal lines indicate class values of lint length, seed index, and lint index respectively. Vertical lines represent coefficient of variability.

EFFECTS OF CHANGE IN ENVIRONMENT

The fact of a radical break-up in uniformity of characters and a profuse throwing of off types has been pointed out in the previous bulletin "Roguing of Cotton," where cuts of some

of the more common off types are printed. The fact that in the Trice fields 30% were considered sufficiently abnormal to be rogued out and that the more uniform remainder presented a variability already set forth in Table III of 7.45 in lint length, 12.70 in seed index, and 21.5 in lint index gives a measure of the extent of this effect.

A further check on this point may be cited from the results from a sample of seed obtained in the spring of 1922 from the Georgia State College of Agriculture and known as College No. 1. This strain of cotton is presumably a result of line breeding, and being a progeny offspring of an individual plant should emphasize uniformity to the highest degree.

TABLE IV

	No. Plants in sample	Superior		Good		Medium		Inferior		Degenerate	
		No.	%	No.	%	No.	%	No.	%	No.	%
College No. 1	95	8	8.4	24	25.3	21	22.1	23	24.2	19	20
Progeny 141	95	32	33.7	55	57.9	8	8.4	0	0	0	0
Selections of 141	23	15	65.2	8	34.8	0	0	0	0	0	0

The classification of the individuals from the sample of 95 specimens into the five groups indicated in Table I and the comparison with the record of Progeny 141 and selections from 141 is set forth in Table IV and graphically in Figure 14.

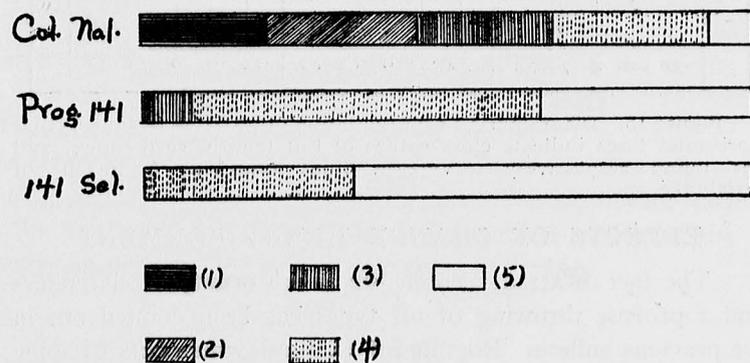


Figure 14.

The diversity of the College No. 1 group contrasts vividly with the narrowed range of variability of an acclimatized progeny. The variation is not only wide but in the direction of inferiority. The four lower grades are nearly equal in numbers, indicating a flattened modal curve.

DOES CHANGE IN ENVIRONMENT STIMULATE MUTATION?

Another interesting question which arises is this; does the stimulation of the change of environment throw the cotton plant into a mutating condition? This phenomenon seemed to result when Egyptian cotton was grown in Arizona, U.S.A., and to give rise to the new superior strain of Pima cotton that has been produced in that area in recent years, according to Mr. T. H. Kearney in the Journal of Heredity.⁽ⁱ⁾

On this point Progeny 141, derived from the Trice variety, appears to the writer to be a diversion from the parent stock, just as the Pima seemed a mutation from the Sakellaridis. In external appearance the 141 is more compact than average Trice, has shorter internodes, fewer vegetative branches, and is more prolific. The most evident difference, however, is in boll type. The bolls of Progeny 141 are remarkably uniform in character and are noticeably blunt as compared with the Trice. They are also slightly smaller. A measurement of sixty-nine bolls from twenty-three plants of this progeny gives an average diameter of 38.6 mm., a length of 44.88 mm. and an average ratio of diameter to length of 1:1.16. As compared with this a study of 294 bolls from the Trice grown under the same conditions shows an average diameter of 40.25 mm., a length of 48.55 mm., and a ratio of 1:1.208.

Again in the Acala acclimatization work a number of progenies are noted for certain outstanding characteristics that breed uniformly true. Most important of these is progeny No. 105. Among the specimens selected from the original field in 1920 a certain plant had the remarkable average 35.25 mm. in lint length. In 1922 the multiplication plot was tested

by the 100 plant sample method already described. The average lint length of ten combed specimens from each of these 100 plants was 35.67 mm. (1.40 in) with a standard deviation of 1.56 and the narrow coefficient of variability of 4.37, less than that of Progeny 141 which was 4.46. The average length of other strains of Acala is 31.1 mm. (1.22 in). This for a variety as early as Acala may be considered to be a remarkable length, as long length of lint and lateness seem correlated. A new form, therefore, not differing appreciably in earliness but breeding true with a length of 35.67 mm., is certainly a novelty in the cotton world.

There are other physical characters which mark this plant as distinct from the parent variety, such as a longer and narrower boll and much finer and softer lint, which in the seed cotton is readily distinguishable from other specimens of Acala.

A considerable number of other progenies of both Trice and Acala seem to breed true and perpetuate their individual characteristics to a marked degree, but space forbids the inclusion of further data similar to the two above, which are the out-standing instances.

The evidence in hand would seem to indicate that in the period when variation is stimulated after introduction from a foreign country not only great numbers of undesirable forms are thrown out but also numbers of new individuals with exceptional characteristics appear which may even exceed any previous performance in the history of the race. The breeding true of such individuals would lead us to infer that they were mutations.

CORRELATIONS

Correlation of Lint Index and Seed Weight. In the studies of samples of average plants taken from different groups certain observations were possible on the correlation of various characters. Most interesting of these perhaps was the record of seed weight as correlated with lint index.

TABLE V.

		WEIGHT OF 100 SEEDS IN GRAMS											
Class		6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	Freq.
Weight of Lint from 100 Seeds in Grams	2.0-2.5	2	...	...	...	...	...	...	...	...	...	...	2
	2.5-3.0	2	...	1	...	...	...	...	...	...	...	...	3
	3.0-3.5	4	1	6	...	1	...	...	...	...	...	...	12
	3.5-4.0	...	2	5	6	6	3	...	1	...	...	...	23
	4.0-4.5	...	1	1	5	2	6	3	1	1	...	...	20
	4.5-5.0	...	...	...	3	3	4	4	2	1	...	...	17
	5.0-5.5	...	...	...	...	...	3	3	3	1	...	1	11
	5.5-6.0	...	...	...	...	...	...	...	1	2	...	...	3
6.0-6.5	...	...	...	...	...	...	1	...	1	...	...	2	
Freq.		8	4	13	14	12	16	11	8	6	0	1	93

In Table V the distribution of the ninety-three individuals in the correlation table is represented. The classes of weight of seed are indicated in the horizontal line at the top of the table and range from 6.0-7.0 to 16.0-17.0. Lint index is indicated in the vertical column at the left, the classes ranging from 2.0-2.5 to 6.0-6.5. The narrowness and inclination of the ellipse of distribution indicate a very positive correlation between these two factors. Computed in detail by the formula

$$R_{xy} = \left(\frac{\sum (dx \cdot dy)}{n} \right) \left(\frac{1}{s_x \cdot s_y} \right) \text{ for correlation, together with}$$

$$E = \pm \frac{.6745 (1-r^2)}{\sqrt{n}} \text{ for estimating probable error, we find}$$

$$R_{xy} = .801 \pm .0257.(i)$$

A similar study of College No. 1 specimens shows $R_{xy} = .7695 \pm .028$ while with the Miller $R_{xy} = .762 \pm .029$. As .5 is considered quite a positive correlation we may conclude that lint index is quite dependent on size of seed.

Now if boll count, boll size, and number of seeds per locule are constant, the lint index is very closely correlated with

actual yield. On a series of 103 plants the correlation between boll count and lint index was $R_{xy} = .038 \pm .066$ or practically 0. With boll size however on a series of ninety-five plants a positive correlation of $R_{xy} = .337 \pm .0613$ resulted. This was undoubtedly due to the tendency of larger bolls to have larger seed upon which high index is so dependent. The number of seeds per locule has been found to be practically constant within the variety. Yield therefore is closely linked with and depends in a great measure upon size of seed.

Correlation of Lint Percentage with Other Factors.—Mr. O. F. Cook and others have repeatedly pointed out the desirability of emphasizing lint index in selection rather than lint percentage. It is therefore interesting to note the correlations of lint percentage with other factors.^(k)

TABLE VI.

Class	PERCENTAGE OF LINT													Freq.	
	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31	31-32	32-33	33-34	34-35		35-36
6-7	...	...	...	...	1	...	...	1	2	2	1	1	...	...	8
7-8	...	...	...	...	...	...	...	1	1	...	...	...	1	1	4
8-9	...	...	...	...	1	3	...	5	1	2	...	1	...	...	13
9-10	...	...	...	...	...	1	5	2	2	2	2	...	...	...	14
10-11	...	...	1	...	2	3	2	1	2	1	...	...	...	...	12
11-12	...	1	1	3	...	4	3	1	2	1	...	...	...	...	16
12-13	...	...	...	1	2	2	2	3	...	...	1	...	...	...	11
13-14	1	...	...	2	1	2	1	...	1	...	...	...	...	...	8
14-15	1	...	...	1	...	2	...	...	1	...	...	...	...	...	5
15-16	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
16-17	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
Frequency	2	1	3	7	8	17	13	14	12	8	4	2	1	1	93

Table VI gives the correlation chart for percentage and size of seed of the ninety-three specimens from the Tai Ping Men farm. It is interesting to note that in this table the ellipse of distribution inclines to the right, showing a negative correlation. The breadth of the ellipse and its lack of definiteness in outline indicate a less decided correlation between these factors than was evident in Table IV with lint index and size

of seed. A computation of the coefficient from the above figures— $.523 \pm .0508$. In like manner Progeny 141 gives a coefficient of $-.598 \pm .52$, and College No. 1, $.327 \pm .055$. This would indicate that high percentage is dependent to a considerable degree upon small size of seed.^(l)

Now the correlation of percentage with lint index is by no means as marked. For example with Progeny 141 we have a coefficient of $.29 \pm .07$ and for College No. 1, of $.2672 \pm .064$. Yield therefore as represented by lint index depends upon size of seed to a marked degree, but on percentage scarcely at all. The comparatively strong correlation between percentage and small size of seed demonstrates the fact that mass selection of cotton plants on the basis of percentage would reduce the average size of seed, reduce the lint index, and hence the yield. Moreover small seed is one of the certain characteristics of degenerate cotton. In a number of degenerate specimens studied seed index ranged from 5.0 to 7.0. By emphasis on percentage of lint, therefore, in cotton selection we should have the strange anomaly of merely hastening degeneration as a result. On the other hand the laws of correlation demonstrate that improvement, at least in respect to yield, would result from selection based on larger seed. In practice this observation is further demonstrated by the fact that all the improved strains of both foreign and Chinese progenies that have seemed worth saving in multiplication plots have a larger seed than the average of their variety.

With reference to the length of lint and size of seed, studies in the several varieties mentioned failed to disclose any correlation whatever.

CONCLUSIONS

1. The efficacy of roguing and selection in overcoming the degenerative tendencies resulting from change of climate have been demonstrated by sample measurements.
2. The quality of product as judged by lint length, size of seed, and lint index, at the end of three years of acclimatization work, is superior to that of the first year.

3. Fixing of type in superior progenies is demonstrated by the low coefficient of variability of the above characters in selected progenies.

4. The phenomenon of break-up of variety type into diverse forms has been universally true of all imported stocks, even including pure strains such as College No. 1.

5. The effect of change of environment seems to throw the cotton plant into a mutating condition or at least permits the throwing out of new forms breeding true, in some rare instances markedly different from and superior to any individual of the parent stock.

6. A strong positive correlation exists between lint index and size of seed with a moderate negative correlation between per cent and size of seed. No correlation exists between lint length and size of seed.

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UNIVERSITY OF NANKING
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THE CHURCH AND RURAL CIVILIZATION

"All the great leaders in the Rural Life movement to-day are practically agreed that the country church is the most important factor in the adequate solution of the problem of the betterment of rural civilization. Theodore Roosevelt, Liberty H. Bailey, Kenyon L. Butterfield, Sir Horace Plunkett, Gifford Pinchot, and Albert E. Roberts, as well as many other writers and lecturers upon the subject, are all in accord on this point of emphasis in the modern rural situation." (Introductory paragraph, Chapter II. The Rural-mindedness of the Prophets and of Jesus, in "The Rural Church Movement," by Edwin L. Earp.

* * * * *

SAVED AGAIN

by

J. B. GRIFFING, M.A.

DEPARTMENT OF RURAL EDUCATION.

The door bell rang. I hastily put down my suitcase and removed my overcoat before opening the door. The smiling face of my dapper young friend Wang Tsung-ming greeted me. It was always a pleasure to meet and talk with Wang, if one had the time. His snappy foreign clothes, his sophisticated ways and his free use of English made him a favorite of all his teachers. This afternoon he seemed to have just stepped from a fashion plate and the delicate aroma of Florida water wafted through the door with him as he breezed in.

Seeing my suitcase, he suspected the truth and began apologizing for interrupting my journey. "Never mind, Mr. Wang. If I don't leave for an hour I can still catch the ferry. Come in and try a new kind of Chekiang tea I received to-day." This I suggested knowing Wang to be a rare connoisseur of fancy teas.

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After the customary exchange of polite nothings over the teacups Wang drew from his leather folder a bulky manuscript.

"I have here a plan for saving China. This plan, if adopted, will bring about reunification, a strong central government, eliminate political corruption and lay the foundation of industrial and commercial prosperity."

"This is most interesting, if true," I suggested.

"You see," he continued, "there is a \$5,000 prize given by the Monthly Review for the best plan for saving China. I have mine all finished and would like very much for you to look over it."

"Really, you flatter me, Mr. Wang, in your estimate of my ability to comprehend profound economic problems. I fear that my lack of background will seriously impair my judgment on matters of the solution of China's difficulties."

"You won't need to worry about that," Mr. Wang assured me. "It is just corrections in English that I need.—This is the table of contents. You see there is an introduction and eight chapters. Each chapter has eight divisions. The first chapter is entitled Political Reforms; the second, Financial Reforms; the third, Social Reforms; the fourth, Educational Reforms; the fifth, Industrial Reforms; the sixth, Reforms of Press and Publicity; the seventh, Religious Reforms; and the eighth, Aesthetic Reforms."

"You, doubtless, have been greatly helped by John Stuart Mill." I ventured, as he passed from the index to the introduction.

"No, really," he replied, "you are the very first person that I have asked for any assistance."

"Haven't you found Plato's 'Republic' quite an inspiration in preparing your document?" I asked.

"Well, no—Plato, you see, is pretty well behind the times. but I was able to get a lot of good ideas out of Bertrand Russell's 'The New Day in China,' and then there is another book just off the press, Mussolini's 'The One Man State.' His ideas seem to be quite different from Bertrand Russell's, so by taking the suggestions of both you can find the golden mean as it were."

The hour passed.

"You have evidently done a lot of work on this manuscript, Mr. Wang, and I hope you win the prize," said I.

"Well, it isn't so much the prize, you know, but I feel that I should be giving my best for my country's good," replied Wang.

"Yes, very true," I said while buttoning my overcoat.

Four hours late and arriving at two A. M. at a village so small that the train stopped only for water, was not a pleasant prospect. "I do hope that my letter arrived and that a servant will be sent to meet me," thought I as the train pulled in at San Pu. Imagine my surprise, therefore, when upon stepping to the platform, there was the big ungainly form of Chang himself running about with his lantern and peering into every face as Diogenes might have done. Suddenly he saw me and rushing up seized my suitcase and expressed his deepest regrets that the lateness of the train had given me a very tiring journey, as though he himself had been responsible.

In a few minutes more we were sound asleep in a near-by inn to put in what remained of the night. It seemed but five minutes later when I was awakened by the donkey bells at the door and saw Chang, fully dressed, arranging for our trip to his school twenty li farther into the country.

"You came just at the appropriate time," he remarked, as I hastily dressed. "The boys are looking forward to your being here as a judge of their cotton projects, and the ribbons are to be awarded at our special Sunday program to-morrow."

"What projects are these?" I asked.

"Well, you see," Chang replied, "each of eleven boys is growing at home one *mow* of cotton from improved seed. It is now almost the end of the season and the last picking is still on the plants to aid in the judging. Then each one has to prepare an exhibit of a best plant, best ten bolls of cotton and a basket of ten cattles of seed cotton for the exhibit at the Agricultural Fair, which is part of to-morrow's program."

We took some *shao ping* in our hand and hurried along as rapidly as the donkeys would take us in order not to be late for the opening of school. Twenty li we rode over the plain, unbroken save by the countless villages,—mud villages with grass for the roofs. What a contrast from our beautiful hills and scenes about Nanking they seemed.

About eight thirty we came to a larger village which seemed a relic of better days. Once a market town dignified by a mud wall and gate, it had now through vicissitudes of flood and famine degenerated to a most forsaken looking place. The mud wall was everywhere tumbled about and just the gate was still standing. Only one day in five was now a market day.

We pulled up before the remains of an old brick temple with the typical country theatre in the open space before it. As we entered the gate of the temple courtyard there was a sudden blast of bugles and thirty boys all dressed in black work

uniforms drew up at attention and at a command from their leader bowed low before us.

"We have promised them that they will be excused from lessons this morning and go with us to judge the home cotton projects," Chang explained. "But first let us have some tea."

The teacherage of the establishment was a dilapidated mud addition to the temple,—a tiny little room with dirt floor and a grass roof. The furnishings were as coarse and crude as Chang's own homespun clothing, but everything was clean and one was not in a mood to criticise the quality of the tea after a dusty ride of twenty li.

As soon as we had refreshed ourselves we struck out over one of the paths leading to a nearby village, with the whole student body trailing after us. There Chang brought us to a little rectangular patch of cotton presided over by a proud little twelve year old urchin. All the aunts and uncles, brothers and cousins gathered round, while we were supposed to form our scientific estimate of the merits of the work. Surely no cotton of the yield and quality of that grown by the boy had ever been seen in that village before.

An old gentleman's beaming face in the foreground attracted my attention. "Who is he?" I whispered to Chang.

"Oh, he is the boy's father," Chang replied, "and is even more proud than the boy himself."

"Do the parents object to having their student sons dig in the ground in their school gardens and in these home projects?" I asked.

"They did at first, but now they have made the remarkable discovery that a boy can still be useful around home after he begins to study, and the fact that they are learning about better crops pleases the people immensely."

From village to village we passed, inspecting each boy's work and finally by noon time we were back at the market town well tired out with our long tramp and inspection.

"On to-morrow we have market day, and Sunday happens to fall on the same day," Chang explained, "so we are holding a special Sunday service which combines Sunday School, Church and an Agricultural Fair."

That afternoon everything was a bustle of preparation. The old temple room where the idols were now screened off and which was used as a class room was now decorated with the exhibits of the students. Some of the exhibits were from the cotton projects, others were from the school gardens, still others from the school work, such as mounted specimens and drawings.

Besides the competitive feature and display of work there were demonstration exhibits showing advantages of better varieties of wheat and cotton, better methods of culture, and better methods of marketing.

When the day's work was done, Chang insisted on giving up his good bed to me while he arranged a series of benches to sleep on himself.

The next morning I awaited the oncoming events with considerable anticipation. Such a peculiar mixture of ceremonies and functions it had never been my pleasure to attend. By eight o'clock the students had arrived and for an hour there was quiet and serious study of Sunday School lessons, in which Chang was aided by one of his village church members. By nine the paths radiating from the town were filled with villagers flocking to the market. The school and its exhibit were the center of attraction. Many were the exclamations of wonder and admiration, especially on the part of those examining the product of their own sons or nephews.

As the hour of eleven o'clock arrived the old temple bell struck. The crowd gathered in the open lot in front of the country theatre. I was quite astonished to see more than a thousand of the country folk and nearly as many women as men. Chang, who served as pastor as well as teacher, mounted the stage. Calling to attract the attention of his audience he announced a hymn. Aided by his Christian members grouped with the school boys he led them lustily through the song "Bringing in the Sheaves." Then he read from the book of Matthew the parable of the sower. Calling for a reverent silence, he then gave a short simple prayer, thanking God for the harvest, for his love and care, and petitioning for more of the spirit of love in our own hearts. Then came the most peculiar sermon that it has ever been my privilege to hear.

He began quite without a text and talked about wheat planting. As the time for sowing was approaching, he urged the farmer to plant seed of improved varieties that they might receive a better harvest. He held up before his audience the bundles of superior wheats grown by his pupils on their school farm and explained that a supply of improved seed was now available.

Next he explained that the yield of wheat the year before would have been far greater if it had not been for the nematode disease. This was not due, he said, to the evil spirits but to a tiny worm which would get into the seed. Then taking a tub

of water which he had prepared on the stage, he said, "Now I will show you how we can do something to check this disease."

Every eye was upon him and there was breathless interest as he weighed out a certain amount of salt, mixed it with the water and then poured in a bag of wheat.

"Now you see," he explained, as he stirred the mass, "many of the grains come to the top. The others go the bottom. The ones on top all have the disease and will bring it again if we plant them." The floating grains he dipped out and placed to one side. The grain at the bottom he dipped out and spread on a corner of the platform in the sun.

Without changing his style of address, he continued, "Now this disease in the heart of the wheat is just like sin in the heart of man." With the same open-mouthed interest, his audience listened while for twenty minutes he drove home in a telling manner the teaching of the Jesus way as the method of cleansing from sin.

Another song and the pastor announced: "Now we will have the awarding of prizes for the best homework in growing cotton."

Then as their names were read the boys winning first, second and third honors shyly mounted the stage and received their badges of honor.

The pastor then announced a drama and immediately a smile of approval lighted up the faces of the audience. Then from the side rooms of the stage came the little actors, a group of the older pupils yet made up with all the whiskers and other adornment of grown-ups. Their play set forth in a stirring manner the evil consequences of gambling as contrasted with the virtue of thrift.

A brief summing up of their message by Chang himself, followed by words of friendly cheer and a benediction completed the program, and the audience dispersed to barter for their knick-knacks on the village street before returning home.

"This village is a different place since Chang Sien Seng came here," remarked an old village elder standing at my elbow. "Two years ago there was scarcely a family that was not entangled in some quarrel or lawsuit, and gambling was the only thing for which the town was noted. Now the magistrate hardly ever has a case from this section and he calls this the model village of his *hsien*. Everyone is talking improved crops and learning to read nowdays."

"Learning to read?" I asked.

"Oh, yes," replied the elder, "every Sunday he holds a class in learning to read."

And sure enough that afternoon more than two hundred villagers sat on benches brought from village stores and homes, while Chang laboriously taught them characters from the stage by writing them on his big blackboard.

The next day I tarried long enough to hear the pupils say their lessons and to watch them in their improved wheat field, preparing the plots. Their enthusiastic projects in the field seemed to stimulate their alertness in the class room. The spirit of the old fashioned pupil droning over his book and too dainty to touch outside manual labor was missing entirely.

"What do you expect to make out of these boys,—farmers?" I asked Chang.

"Citizens!" he replied as quick as a wink. "When we start them right with the learning-by-doing method we don't put on limitations as to what they can do, we take the limitations off. A few of these boys will be farmers and good farmers. Some, I hope, will be teachers, some preachers, some engineers, and so on. The main thing is they will have developed the habit of doing things and the grit that goes with it while they are still in the formative period.

"Just one thing more before I go," I asked. "Don't you get tired of this work so far away from the cities and among this ignorant country peoples?"

Chang's face betrayed absolute astonishment. "Tired of it!" he exclaimed, "Why I would rather be doing this than be President of China. Think of the interest and the response of all these farmer folk,—the very best people of China. Think of the opportunity of leading them from famine to prosperity. Think of the future of these school boys and what they will mean to their country. Think of this rapidly growing church and its influence on the lives of these people. No, I am not tired of it. I only hope that I may be given the years and strength to make the most of such a wonderful opportunity."

On the afternoon of the following day I was drawing near home. Never had Purple Mountain looked so beautiful as upon my return from those dusty plains. As I drew up in front of the gate I saw Wang Tsung Ming's private rickshaw standing in front of the door.

"Oh, how are you?" he beamed, as I entered where he was sipping the Chekiang tea. "I have just learned that you were about to arrive, and I am very anxious to show you my new plan as it is now revised," and he proceeded to draw a bulky

bundle from his leather case. "I found it necessary to add five new chapters and each chapter has been expanded to thirteen divisions."

"Really, Mr. Wang," I said, "I fear you are too late."

His jaw fell. "Why, how is that? There are still two weeks before the contest is closed."

"Well, you see it's this way, Mr. Wang. Another fellow has beaten you to it. He didn't know about the contest, but he worked up a better plan than yours, and it works. The country is already being saved."

Extra copies in English will gladly be sent on request. Copies in Chinese (simple Gwan Hwa) are also available on request. They should be used to good advantage with teachers, preachers and older students.

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CHINA UNION UNIVERSITIES
CENTRAL OFFICE

UNIVERSITY OF NANKING
COLLEGE OF AGRICULTURE AND FORESTRY
NANKING, CHINA

December 1924

Miscellaneous Series

Number 3

A CHRISTIAN SCHOOL
WITH
A RURAL MESSAGE.

JOHN B. GRIFFING

THOSE in charge of schools that relate closely to country life often desire to modify the work of the school in order to better the conditions of those they are trying to serve. They are often perplexed, however, by such questions as the following: What kinds of agricultural work can be successfully introduced into the country school? How much specialized training is needed by the teacher to enable him to introduce agricultural work? What can a teacher do in the way of improving the agriculture of the community? And especially what increased financial burden is involved in maintaining a school with agricultural work as opposed to the academic type?

It was with the specific idea of securing more evidence on these and other points that a rural school experiment was launched by the department of rural education of the University of Nanking, College of Agriculture and Forestry at Wukiang, Anhwei, in February of this year. The results of the experiment are subject to the criticism that generalizations can not be drawn from a single isolated example and again because in working out latent possibilities in rural service beaten paths were not followed and the school that developed followed lines quite divergent from the conventional type of rural school. Nevertheless many phases of the experiment relate closely to problems confronting any rural worker and even the new approaches to these problems should not be without interest.

Field of Work. The site that was chosen for the experiment was a market town on the Yangtze River serving as an outlet for a fertile belt of land noted particularly for the growing of cotton but also producing considerable quantities of wheat, beans, rape, and other crops. The moral tone of the community seemed unusually degenerate. Officials

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and landlords were for the most part opium smokers with exploitation of their constituents as a dominant interest. The fact that the farmers themselves universally adopt the unusual practice of removing the bolls from the cotton plants before they are fully open and pick the cotton out of them laboriously in their door yards to save it from being stolen by the neighbors, indicates that a delinquent moral standard is not limited to the upper classes. The Christian uplift of the area, for which a certain mission assumed responsibility, rested upon the shoulders of a Chinese pastor who had evidently been found incompetent for larger fields of service and had been temporarily shunted to this station pending an early release. His time, other than that used in intermittent preaching, seemed to be spent largely in serving as intermediary between the quarrels of the sheep of the flock and the wolves of the world. This quasi-pastor and a semi-modern government lower primary school were the only ameliorative agencies for a considerable area and the impact of these upon the life of the actual farmers was quite negligible.

Previous Extension Work. For two years previous to the opening of the school attempts had been made to introduce improved cotton seed into this area. In no place, however, had the problem seemed more difficult. The extension workers from the College of Agriculture and Forestry were looked upon with suspicion. Farmers looked askance at tickets entitling them to free supplies of improved cotton seed saying that the last ticket distribution in their community had developed into an increase in taxes. The more aggressive method of carrying packages of good seed directly to the farmers met with scarcely greater success. The refusal of such philanthropy was explained on the grounds that the local magistrate had made a free distribution of mulberry trees in a program of agricultural improvement and later collected for them at treble value.

Equipment for the New Work. Opening negotiations in the fall of 1923, a tract of 18 mow of good land was rented. This tract stretched along the main highway where a great portion of the farming population must pass on their way to market. Nearby this property an old ancestral temple was secured for use as a school building. These properties were located more than a *li* from the edge of the town and were thus distinctly a part of the farm life.

Personnel of the Station. The person selected for the pioneer task was a young man who had been admitted to the one year course in agriculture at the University of Nanking on his personal qualifications rather than on his record of previous preparation. His academic study

had gone but little further than the higher primary grade, but a trip to France with the labor corps had given him an aggressive viewpoint of life and an appreciation of the dignity of labor that more than compensated for his lack of classical knowledge. He finished the short course creditably during the previous year and was retained as field assistant in agricultural work until the school was established. The other members of the staff were a laborer and a yellow cow.

Organization of the Work. Shortly after China New Year a school was opened in the ancestral temple. No students were received except children of bonafide farmers. These were given instruction for four hours per day and *only in the forenoon*. In addition to the ordinary academic branches instruction in agriculture was given particularly through the development of a school garden and nursery. Much adverse criticism developed against this program by the farmer parents. "How could a school be a regular school that sent the pupils home to help their parents in the afternoon?" and did not the gardening work mean that the foreigners who established this school wished to work their land with free labor? Some of the first students enrolled were withdrawn leaving only eight who continued through the spring semester.

During the afternoons the teacher proceeded to make a careful survey of his community, thus better acquainting himself with the farmers and the farmers with the ideas of the new rural school and improved cotton. Incidentally he directed the preparation and planting of selected cotton seed on the 18 mow of land.

As soon as the work with the small pupils and the school farm were well under way, a class in popular education which met at night was organized. This phase of the work proved popular from the start. The illiterates began work on the thousand character course while those who could read somewhat were provided a reading table of simple literature.

By cotton planting time the good intentions at least of the school seemed quite well established and five thousand cattles of improved cotton-seed were distributed to the farmers.

During the summer the cotton crop of the school farm began to stand out more and more in marked contrast to the degenerate plants in the local fields. And in the fall when the great bolls opened with their big fluffy white masses, the roadside field became a feature of unusual interest.

The farmers too that had planted the improved seed were reaping harvests that filled them with pride and astonishment. But where

would the superior product be sold? War conditions made buyers cautious and prices low. Good American cotton also was hard to gin. But the little rural school started a hand saw gin and proceeded to offer a dollar per picul above the market price for the improved seed cotton as the value justified it.

Exhibition Day. As the close of the cotton picking season drew near an exhibition was prepared not only of the improved cotton, the ginning process, but also of the work of the school which had now grown to eighteen pupils. Evergreens, paper flowers, and a sign of welcome bedecked the doorway of the old temple, while the national colors floated overhead. Displays of all kinds covered tables and walls and big cotton plants with their snowy masses restored stood about like Christmas trees. The wonderful machine that ginned the cotton was put in operation. Bags from eight of the different farmers who came in on that day with their product for sale were labeled with the name of the farmer and a statement of his yield and income.

By two o'clock the old temple was crowded with the farmer visitors. From an improvised platform the teacher Mr. Li extended his greetings! Then as he recounted the difficulties he had first met in breaking down the suspicions of the community there were hearty good-natured laughs from those among whom he had become a friendly and popular figure. To illustrate what the good cotton could do for them Mr. Li then called in succession four different farmers to the platform to testify as to their success in growing the new product and to name their own yields and income.

Finally the visiting extension workers presented their program of charts and lectures, and, as the afternoon sun sank in the west, by stereopticon slides and moving pictures. These extension workers, twice foiled in their efforts to make any impact on the community, now had a resident middle man through the popular teacher and through whom their transient message can be daily and painstakingly made a part of the life of the community.

So great was the interest of all in securing the improved cotton seed that the fact became evident that even the large supply available to supplement the locally grown seed will be inadequate to meet the demand at planting time next spring. Many of the farmers realize this and are carefully ginning their own improved crop in order to make sure of having enough seed for themselves.

Financial Phase of the Experiment. The rent of the land for the seed farm amounted to M. \$90 per year; of the ancestral temple \$6.00

per year. The labor in producing the cotton and for other purposes has amounted to about \$100.00. The salary of the teacher has been \$20.00 per month. The school fees though low have covered school supplies and incidentals apart from certain articles of permanent equipment. A harvest of 25 piculs of improved seed cotton from the farm demonstration will provide within seventy five dollars of the total expenses for the year.

SUMMARY:

1. The school is located in the country and serves actual farm life.
2. The teacher is of low academic standing with a little agricultural training and a love for country work.
3. A small amount of land is used for a school garden and school nursery and a larger amount for a demonstration farm upon which improved cotton seed is grown for distribution.
4. The highway location lends effectiveness to the object lesson.
5. A half day school made possible a greater total impact on the community through extension and popular education in night school.
6. The breaking away from classical traditions resulted as was expected in temporary misunderstanding and disapproval by the school constituency, and even a falling off in school enrollment eventually followed by a period of growth and increasing popularity.
7. Gardening was popular with the students from the start as they had not yet developed the classical aversion to labor.
8. In Sunday work the teacher not only conducted a Sunday school but sometimes preached.
9. An actual and considerable impact was made on the improvement of crops of the community through improved cotton seed. The beginning already made and the interest established indicates the possibility of a wide spread change in the agriculture of the area through the agency of this school.
10. The total cost of the varied operations including the salary of the teacher has been met within seventy-five dollars by income from the operations themselves.
11. The location of the school was more than 90 li from Nanking thus throwing responsibility for the development of the details of the work upon the teacher in charge with a minimum of foreign supervision.

12. The suspicion directed toward temporary extension workers gave way to confidence showing that a local man may become an effective middle man between scientists who improve crops and the farmer who grows them.

13. The impression made in the community by the teacher contrasted in a marked manner to the apathy toward former pastoral service suggesting the efficient use of the agricultural approach in an evangelistic program.

14. In general the conditions involved in the whole experiment are such as could be duplicated in many other places.

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UNIVERSITY OF NANKING
COLLEGE OF AGRICULTURE AND FORESTRY
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Miscellaneous Series

Number 5

ONE OF THE LEAST

J. B. GRIFFING, M.A.

And Jesus answering said, A certain man went down from Jerusalem to Jericho, and fell among thieves, which stripped him of his raiment, and wounded him, and departed, leaving him half dead. And by chance there came down a certain priest that way; and when he saw him, he passed by on the other side. And likewise a Levite, when he was at the place, came and looked on him, and passed by on the other side. But a certain Samaritan, as he journeyed, came where he was; and when he saw him, he had compassion on him, and went to him, and bound up his wounds, pouring in oil and wine, and set him on his own beast, and brought him to an inn, and took care of him. And on the morrow when he departed, he took out two pence, and gave them to the host, and said unto him, Take care of him; and whatsoever thou spendest more, when I come again I will repay thee. (Parable of Jesus).

He knows politeness and righteousness whose barn is filled.

If clothing and food are not enough, then it is hard to know right from wrong. (Proverb of Kuan Tz.)

Once upon a time there was a farmer. He toiled from before daylight until after dark. His wife and children labored in the fields with him. But the days passed without rain and the crops which gave his family their only living were dried up by the burning sun and yielded only shriveled heads. He sold his cow and pawned his tools for food, but still there was not enough. Then soldiers came and robbed his poor house of all things that could be carried away and of the winter clothing and bedding, and the furniture they smashed in pieces.

The farmer knew not whether to go away or to stay. For there was no place where he might find work and if he remained there seemed naught but to starve.

Then it happened that one passed his door. That he was a superior man could be easily told by the cloth of his gown and the delicacy of his hands. His face was of one who had found peace and who was much given to meditation and prayer. He looked in upon the home of sorrow. "Peace be unto your house," he said.

"Good teacher, we are in dire need. Our food is nearly gone and our clothing is not enough for the cold weather," said the farmer.

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"Ah, your plight is, indeed, sad," replied the one with the beautiful face. "The world here below is a life of tribulation, but in heaven we shall find happiness. Come to our place of worship in the market town and we will tell you how to find this happy future."

"But we are not anxious to die and live with the devils," said the farmer, "neither have we clothing enough to wear to your house of worship in the market town. We must remain here and sit in the sun or stay in bed."

"At least I can pray to the Heavenly Father to bless your household more abundantly," said the superior one.

"We beg of you do not mention our name in your prayers," said the farmer, "The Old Man of the Heavens is very angry with us and treats us cruelly. We fear him."

Then the one with the peaceful countenance shook his head sadly and passed on down the road.

"Father," said the farmer's son, "who was that man?"

"Oh! he is a crazy teacher. He goes about telling of some foreigner who died and lived again. Heed him not."

Several days later another looked in upon the scene of desolation. His gown too was clean and finely woven. His hands were delicate and his brow was high, giving him the air of one much given to thought on deep problems.

"I shall write a report on rural conditions as soon as I return to the city," said the stranger, half to himself as he gazed upon the ragged, hungry family.

"If you are the tax collector, you can get nothing here," said the farmer, "We haven't even food to eat."

"I am not the tax collector, I am the new teacher," said the individual with the high brow. "We are opening a new school in the market town and would like to have your son attend. It is only five dollars a semester."

"But that is more than the old teacher needed, and if we wished to send the son we could not, for we haven't even money to buy food."

"Very true," replied the teacher, "your plight is indeed sad. Many other farmers are in the same fix. It is all because you have no education. You older people may never expect anything better, but if you give your son a chance, he may become a higher class man and rich, and some day may help you."

"That is a fine thing for those who can do so, but we have no money and my son has to spend all his time gathering fuel."

"What stupid pigs these farmers are," muttered the teacher, as he walked on down the road."

Somehow the winter days passed. The farmer did not die. Neither did his wife nor son. A well-to-do friend in the market town who was a carpenter gave them a portion of his sawdust which they mixed with their scanty portion of meal and made it go farther. Moreover, they were quite expert in getting along with almost no food.

Then one day a third man called at the door. His gown was blue and coarse. His body was large and his hands were rough. His face was dark as though he had spent much time in the sun and wind.

"How is your food holding out, neighbor?" asked the farmer, thinking the stranger one like unto himself.

"Quite well," the stranger replied, "how are you faring?"

"Were it not for the fact that green things grow soon we would surely perish" said the farmer, "Do you know of any money lender who could help us till next harvest?"

"That is truly a hard matter," said the other. "Silver or gold have I none, but such as I have, I will be glad to give you. You have some mulberry trees in your yard, and so of course you raise silk worms."

"We did raise silk worms, but no longer; the evil spirits make the worms to die after they have eaten the leaves and then we lose all. Last year we thought to sell the leaves, but the spirits were against others too, and so many worms died that we could not even sell our leaves."

"But, my friend," said the stranger, "it was not the evil spirits that killed your silk worms, it was a dangerous disease that lived in the eggs and then went into the worms. I have here some eggs that do not have this disease and the worms from them will not die. This I know, because some experts have examined them carefully. Please accept a few to try," and he drew from a little bag that he carried a little paper with the disease-free silk worm eggs.

"Well, it will do no harm to try them for the result can scarcely be worse than before. But even the dying of the silk worms does not cause so great a loss as that which we have even when rain is enough, from the black heads of the wheat which the ghosts plant in our fields and that grow instead of good grain."

"But the black heads are not really planted by the ghosts. They too are caused by a disease, and I have a medicine that can prevent it. When planting time comes again we can wash your

seed with this medicine and there will be no more black heads. I have also an improved kind of cotton seed that may help. It does not fear the dry weather as does the grain. This new kind yields much more than common cotton and brings a higher price. See how large the bolls of this kind of cotton grow," and the stranger drew from his little bag an open boll of beautiful cotton.

"Ah!" exclaimed the farmer, "If I only had money to buy seed of this wonderful cotton."

"You may get the seed now and pay when you harvest the crop," said the visitor. "Come to the market town to-morrow and you may get these things at the tea house where I am meeting many other farmers."

Then as though he had much important business, the guest hurried on, the farmer meanwhile showering upon him his expressions of gratitude as he passed out of the door and down the road.

A few months later, the visitor, now no longer a stranger, appeared at the farmer's door.

"Pour tea! our good friend has come," called the farmer to his wife.

"I came to tell you about the school which opens next week; we would like to have your son come," said the guest. "Your silk worms paid you well this year. Your cotton crop will give you a good return and the grain looks well. With so much prosperity, you should begin educating your son.

"Ah! thanks to your good seeds and pointing us to the right way, we are no longer so poor. Would that I could send my son. Where is the new teacher who came last year?"

"We may not hope to keep so learned a man in the country for long," responded the visitor. "He has been called to a better position in the city. There is none other to teach than I, your unworthy younger brother."

"So you are to be the teacher!" exclaimed the father. "Very good. How fine it would be if I could send my son. But there is no one else to tend the cow."

"But," said the visitor, "the cow needs to feed only part of a day. This year we have the pupils come early in the morning and go home at noon to help their fathers. We do not want our pupils to become useless at home when they begin to study books. So, your son may both study at school and help at home. Then he will become a strong and useful man as well as an educated one."

"That is indeed a splendid plan. My son shall be there on the opening day."

"One thing more, old friend," said the guest. "At night we have a class where the farmers may come and learn to read. Now that your hardest work of the season is over, come and join our Thousand Characters People's School."

"What! I! I learn to read!" exclaimed the farmer. "Really am I not too old to learn now?"

"By no means, you can learn far more rapidly than the small students and in six months you will be able to read some simple newspapers which we have."

"Good teacher, you are, indeed, too kind. We are unworthy of such noble efforts that you are making to help us. Tell me, why is it that you do this? For whom are you working?"

A pleasant smile beamed forth on the teacher's face. "I work for a Master," he said, "who has commanded me to minister to those who are in need of clothing, or of food, or are sick, or whose spirits are imprisoned, whose hearts are sad, or whose lives are tormented by spirit devils."

"Such a one is a great and good Master," said the farmer, "And has done much for us by your hand, we would like to know more about him."

"He is indeed great and good. Come on Sunday to the school house and there we will talk about Him and perhaps we may even meet Him, for I would like to have you work for Him, too."

"We will certainly be there," said the farmer, "My wife, my son and I."

This article has been translated into Chinese and any number of copies up to 100 can be secured free of charge for distribution.

The following publications have been issued in this series and can be had free, upon request to the College of Agriculture and Forestry, University of Nanking, Nanking, China.

MISCELLANEOUS SERIES

- No. 1. SAVED AGAIN, (In Chinese also), by J. B. Griffing.
- No. 2. ANNUAL REPORT DEPARTMENT OF SERICULTURE, 1923-1924.
- No. 3. A CHRISTIAN SCHOOL WITH A RURAL MESSAGE, by J. B. Griffing.
- No. 4. MAPPING THE RURAL COMMUNITY, by Chiao Chi-ming.
- No. 5. ONE OF THE LEAST, (In Chinese also), by J. B. Griffing.

