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Special Report No. 1.

March, 1934.

FINAL REPORT OF THE PLANT IMPROVEMENT  
PROJECT CONDUCTED BY THE UNIVERSITY  
OF NANKING, CORNELL UNIVERSITY  
AND THE INTERNATIONAL  
EDUCATION BOARD

C. H. Myers

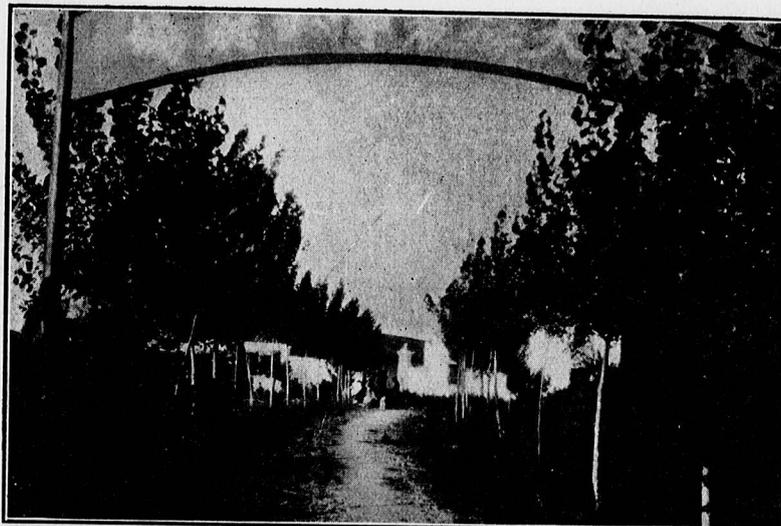


COLLEGE OF AGRICULTURE AND FORESTRY  
University of Nanking  
Nanking, China

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*Gateway to Tai Ping Men Farm, Nanking.*

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The University of Nanking is indebted to Dr. C. H. Myers for an exceedingly fine report on the valuable crop improvement work done under the direction of the visiting professors from Cornell University during the years 1926 to 1931. This work was made possible through an agreement between Cornell University, the International Education Board, and the University of Nanking, and, in addition to Dr. Myers, the University is indebted to Dr. H. H. Love and Dr. R. G. Wiggans for the success of this cooperative undertaking. The report is being published because of a desire to share its contents with others interested in agricultural development in China and of a sincere hope that a study of it will inspire other organizations to attempt projects of a similar nature.

Y. G. Chen, President,  
University of Nanking.

Nanking, China,  
February 13, 1934.

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On behalf of the College of Agriculture and Forestry of the University of Nanking, I accept with sincere appreciation this report written by Dr. C. H. Myers of the Department of Plant Breeding of Cornell University. Dr. H. H. Love, Dr. R. G. Wiggans and Dr. Myers are the three Cornell representatives who came to China to take part in the Cornell University—University of Nanking—International Education Board Plant Improvement Cooperation. This summary report is written by Dr. Myers who spent the final year of the five-year cooperative period in China.

As a result of this project in crop improvement, the growing interest in this phase of rural improvement work in China has been greatly accelerated. It is hoped that the success of this project will stimulate similar cooperative projects between organizations in China and abroad and that the results will be mutually beneficial. There is no question of the benefit which the University of Nanking has derived from cooperation with Cornell University and I sincerely hope that the Cornell representatives feel that their experience in China has been of value to their work in the United States.

K. S. Sie, Dean,  
College of Agriculture and  
Forestry,  
University of Nanking,  
Nanking, China.

February, 1934.

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## INTRODUCTION

The Plant Improvement Project organized and conducted by the University of Nanking, Cornell University and the International Education Board had its inception in the mind of Dean John H. Reisner of the College of Agriculture and Forestry at Nanking. His first work at this College had been in the field of plant breeding and had convinced him of the tremendous possibilities of agricultural improvement by the use of improved varieties of crops. His experience had also convinced him of the necessity of organizing such work on a comprehensive scale and in accordance with scientific methods.

Although trained in the field of plant breeding, Dean Reisner's own time and energy were being devoted more and more to the administrative work essential to the proper conduct of the College. Although there were men on the Chinese staff at Nanking who had some training in plant breeding, there were none who had enjoyed broad experience or advanced training in the underlying science of genetics and to whom he could turn for the further development of the crop improvement program he had begun, and of which he had visions for the future. He conceived the idea of asking for cooperation from experienced plant breeders to aid in the organization of such a project.

### Formulation of Project

The matter was presented to members of the staff of the Department of Plant Breeding at Cornell University with the suggestion that one or two sabbatic leaves might be utilized for this purpose. It was early recognized that such a program could not be completely organized and placed on a permanent basis in one or two years. After careful consideration a project was finally drawn which involved a period of from five to ten years for its completion. This project was presented to the three co-operating agencies, the University of Nanking, the International Education Board and Cornell University, and was formally approved by them in 1924.

Briefly summarized, the project involved the following points:—

1. The purpose of the project was two-fold, first to organize and conduct a comprehensive crop improvement program, involving the principal food crops of the famine areas of Central and Northern China, and second, to train workers in the principles, methods, application and organization of plant improvement.
2. Each year for a minimum period of five years, beginning with 1925, a professor from the Department of Plant Breeding at Cornell University, was to go to Nanking, there to be associated

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with the Department of Agronomy at the College of Agriculture, and to have complete supervision of the plant improvement program of that department. When the project was being drawn, consideration was given to a plan which might make it possible to depend upon other institutions in addition to Cornell University, to provide the men to supervise the work in China. It was finally decided to use men from the one institution and one department for the sake of better continuity of work and program. Each representative returned to Ithaca from three to four months before it was necessary for his successor to leave for China. Thus there was ample opportunity for conferences relative to the work, which aided materially in sustaining the continuity. At the close of the project, those who have been most closely connected with it, feel that this plan was well justified. After the fifth year it was thought that it would be desirable to have the Cornell representative go only every other year until the project was completely and firmly established.

3. The University of Nanking assumed financial responsibility for the traveling expense to and from Ithaca, and the maintenance and traveling expenses in China of the Cornell representative, the maintenance of all the laboratory and field work at Nanking and a share of the expense of maintaining the work at such cooperative stations as might be established.

4. Cornell University agreed to grant sabbatic leaves when possible to members of the staff of the Department of Plant Breeding, for work in China, and to grant such other special leaves without pay as might be found feasible and necessary in connection with the development of the program.

5. The International Education Board assumed the responsibility of providing salaries for the Cornell representatives when on leave without pay from the University, and also to aid financially in certain other ways as might be agreed upon during the progress of the work.

#### Progress of the Project

Since the field work is such an essential part of any plant breeding program, it was arranged that the Cornell representative be in Nanking from early spring until October or November, that is, throughout the main growing season for crops. Actual work on the project was begun April 11, 1925, with the arrival in Nanking of Dr. H. H. Love, who was followed in the spring of 1926 by the writer.

On March 24, 1927, Dr. R. G. Wiggans landed at Shanghai on his way to Nanking as the third representative. It was just at that time that all the foreigners had evacuated Nanking on account

of the political disturbance coincident with the taking over of that city by the Nationalist forces from the South, who had come down the river from Hankow. While the laboratories, experimental gardens and fields at Nanking were not disturbed in the least, and the Chinese staff of the University was able to maintain the work, it was not feasible for Dr. Wiggans to proceed. So, after a series of conferences in Shanghai with members of the staff of the Department of Agronomy from Nanking and with Dean Reisner, he returned to his post at Cornell.

In the spring of 1928, the political situation was somewhat improved, but it was not deemed advisable to resume the cooperation at that time. But early in 1929, the staff at the University of Nanking urged the resumption of the cooperation.

The three men mentioned above had made their first trip to China on sabbatic leave, combined with the regular vacation period. It had been the original plan that other members of the Cornell Plant Breeding staff should participate in this program. Certain readjustments and changes of plan and personnel made it impossible to carry out this arrangement and so each of the three individuals mentioned above, eventually made a second trip to Nanking under the terms of the project.

Dr. Love made his second trip in 1929. He was followed by Dr. Wiggans in 1930. The close of Dr. Wiggans' second term marked the five year point and the minimum period in the formal cooperation. It should be recalled, however, that on his first trip Dr. Wiggans was unable, on account of disturbed political conditions, to do more than hold a number of conferences with members of the Nanking staff who came to Shanghai for that purpose, after which he returned as soon as possible to Ithaca. And so his second term marked, in reality, only the fourth year of active and complete cooperation, with a lapse of time of six years since the beginning of the work.

It was then decided that the formal cooperation should come to a close after one more period of work by a representative from Cornell. It fell to the lot of the writer to be this last representative on duty in China from late February to October 2, 1931. For those most actively associated with the project, there was some feeling of disappointment to have the formal cooperation discontinued at the close of the 1931 season, with only five years of actual, formal cooperation, when from five to ten years were originally contemplated and planned for. But they fully realize that changed conditions influenced the change in plan, and they have a feeling of confidence that the work has been placed on a permanent basis and that it will come to its full development in due season. In anticipation of fuller discussion later it may be

briefly stated here that the project has attained its purposes as completely as could be expected. A comprehensive program of crop improvement for Central and North China is well established; first distributions of new varieties are being made and an organization of well trained workers has been perfected to insure the independence and continuation of the program.

This accomplishment has been achieved in the face of what to many would seem to be insurmountable obstacles. The period of 1925-31 in China has seen civil war with all its attendant evils and hardships; an invasion by a foreign power which resulted in the loss of thousands of lives and millions of dollars in property damage; and one of the most disastrous floods in the history of the country. That the project succeeded in spite of these serious disturbances is an enduring tribute to the loyalty and devotion of the Chinese, whose names appear elsewhere and upon whose shoulders was placed the burden of carrying on the work through all of this discouraging time.

#### Previous Reports

Annual reports of progress of the work have been made by each of the Cornell representatives at the close of each of his periods of work. These reports have not been published but copies have been furnished to the administrative officers of each of the three cooperating agencies and to other interested parties. Frequent and free reference has been made to these annual reports in compiling this final report. The list of the annual reports follows:—

- 1925—H. H. Love
- 1926—C. H. Myers
- 1927—R. G. Wiggans
- 1929—H. H. Love
- 1930—R. G. Wiggans.

#### Final Report

The separate annual reports served in fact as reports of progress. The final report serves two purposes. First it records the special activities for the year 1931, the last year of the formal cooperation, during which considerable emphasis was placed upon the organization of various phases of the program. Second, it is the purpose, herewith, to give a summarized and condensed statement of the development of the project during the period 1925-1931, to place an evaluation upon its accomplishments and contributions, and to make certain recommendations for consideration in the future. Many persons have contributed to the prosecution of the Nanking Crop Improvement Program. In making the final report, it seemed highly desirable to have one person serve as the

author. The circumstances which place this task and opportunity as well as responsibility on the last Cornell representative are keenly appreciated. He is fully aware that the success of the project has resulted from the efforts of others quite as much or more than from his own.

#### REPORT FOR THE YEAR, 1931

In connection with the final trip, the writer spent the period from February 20 to October 2, 1931 in China. This was the longest period spent by any of the representatives. The purpose of the additional time was to permit a special study leading to the reorganization of the Agricultural Program of Yenching University at Peiping. The request for this study and reorganization was made by Yenching University through the China Famine Committee. Cornell University granted the writer additional leave of absence in order to enable him to comply with this request. A summary of this study and recommendations comes later in the present report.

#### Conditions at Nanking and at the Cooperative Stations in 1931

The writer's first contact with the field work of this project was in 1926, the second year of the cooperation. While a real beginning had been made at this time, there was much yet to be desired in organization, equipment and trained personnel. Five years later, at the time of his second visit, he found a much better organized Department of Agronomy in the College of Agriculture and Forestry. A staff of some eighteen men was functioning efficiently in conducting the projects in crop improvement; a larger area of land was being devoted to the work; additional laboratory and office space had been provided; the work at the twelve cooperating stations was in good condition and political conditions were relatively stable. In short, the whole project was in a healthful condition, having made surprising progress for the period of its organization.

In July and August came the disastrous flood of 1931, one of the major calamities of China, which disrupted a rural population estimated at 25,000,000 in the Yangtse and Yellow River basins, and which caused an enormous loss of life and property. Nanking and its environs did not escape the ravages of this flood. Many parts of the city were under water to a depth of three feet and thousands of acres of fertile land outside the city were completely submerged for months. Not only were growing crops destroyed but it was impossible to make the usual fall seeding of wheat which is one of the important food crops of that region. The lower

lying parts of the University of Nanking's experimental farm were also submerged. Fortunately, however, no serious losses of experimental material occurred. Some of the rice experiments for that year were lost but reserve supplies of seed were available for renewing the work as soon as conditions permitted. The experiments with other crops were not seriously damaged. Wuchang, near Hankow, was the only one of the cooperative stations which suffered material injury from the flood. Here the damage was very severe and plant breeding projects were entirely disrupted for the growing season of 1931. The reserve supplies of seed, however, were not lost and the work was fully renewed in 1932. The fact that the crop improvement program was relatively so little permanently affected by the flood is evidence of its stability and the loyalty and efficiency of the trained Chinese workers responsible for its execution.

#### Special Problems in 1931

As mentioned above, in 1931 the technical phases of the work were in good condition. As leaders of the various crop breeding projects, were to be found Chinese who had been associated with the program since 1925. They had worked constantly with the Cornell representatives in carrying on the work; they had participated in the three special Institutes of Crop Improvement held at Nanking in 1926 and 1929 and at Yenching University in 1930 and were well qualified to do the work for which they were responsible. For the most part, methods of technique were well established and the major plant breeding projects were progressing normally.

It seemed desirable, therefore, in this last year of the formal cooperation for the Cornell representative to study the general organization of the program to the end that it might be made even stronger and placed upon a more permanent basis. In furtherance of this purpose, particular attention was directed to three problems, (1) the reorganization of Yenching University's Agricultural Department, (2) the location, organization and work of the cooperative stations and (3) the organization of personnel and projects of the Department of Agronomy of the University of Nanking. Attention was also given to other matters of lesser importance, which will be mentioned under the proper heading.

#### Reorganization of the Yenching University Agricultural Department

In 1922, Yenching University received a grant of the income of \$250,000 from the China Famine Fund, for the purpose of establishing an agricultural experiment station. Work was undertaken in the fields of Dairying, Animal Husbandry, Poultry, Horticulture and Plant Breeding. Early in 1930 the authorities of

Yenching University and the China Famine Fund Committee became convinced that a larger contribution to the agricultural interests in China would be made if the College of Agriculture and Forestry of the University of Nanking were made responsible for the direction of the agricultural program at Yenching.

In furtherance of this scheme the President of Yenching University, in the autumn of 1930, visited Shanghai and Nanking for conferences with the officials of the University of Nanking and with the China Famine Fund Committee. The President of Yenching took the initiative in this proposal and prepared an outline of procedure for consideration. After full discussion by all parties concerned the following agreement was drawn up and approved:—

#### *Agreement between University of Nanking, College of Agriculture and Forestry and Yenching University*

1. The University of Nanking, College of Agriculture and Forestry, undertakes to conduct on behalf of and in the name of Yenching University the Agricultural Experiment Station belonging to the latter, with complete control of its Agricultural Experiment Station land, financial resources and other assets. Budgets and reports covering the fiscal year ending June 30 shall be rendered annually to the Board of Managers of Yenching University.

2. The operations will be limited, at least for the immediate future, to crop improvement.

3. The University of Nanking, College of Agriculture and Forestry, will secure the approval of the President of Yenching University before making any final decisions that affect the general administrative and property interests of Yenching University.

4. Yenching University is not to be financially obligated except in the use of funds designated for agricultural work or receipts therefrom.

5. All staff appointments shall be made by the University of Nanking, College of Agriculture and Forestry, for temporary or permanent residence at Yenching University, and shall be treated by the latter as visiting staff members of the rank held in each case at the University of Nanking.

6. The above Agreement may be terminated by either of the two institutions upon previous notice of twelve months, and a mutually satisfactory adjustment of property and other issues involved, provided that additions to property and equipment necessitating the expenditure of funds beyond the regular income and resources of the Agricultural Experiment Station involving later adjustments shall not be made without the action of the Board of Managers of Yenching University or its Executive Committee.

7. This Agreement is to become effective immediately upon the approval of the Board of Managers of Yenching University, the Board of Directors of the University of Nanking, and the China Famine Fund Committee.

8. In view of the decision to limit the experimental work at Yenching University to crop improvement, it is expected that the Animal Husbandry and Horticulture already developed be provided for elsewhere so as to conserve the original objectives.

9. It is expected that in affecting the transfer of responsibility described above, the University of Nanking will as soon as possible place a properly qualified person in residence with authority to assist in the reorganization of the Experiment Station on the proposed new basis.

Approved in Principle—China Famine Fund Committee,  
October 3, 1930.

Approved—Board of Managers, Yenching University,  
October 20, 1930.

Approved—Board of Directors, University of Nanking,  
November 21, 1930.

In accordance with the terms of this agreement, the writer arrived at Yenching University, March 18, 1931, for the purpose of making a study of the Agricultural Department and recommendations for its reorganization and future direction by the College of Agriculture and Forestry of the University of Nanking. Inasmuch as this reorganization was one of the important accomplishments in the program for the year 1931, it seems desirable to present herewith a summary of the report made by the writer under date of May 26, 1931, copies of which were filed at Yenching University, the University of Nanking and at the office of the China Famine Committee in Shanghai.

*Basis for the study and recommendations*

In addition to the memorandum of agreement referred to above, the study at Yenching was based upon the following important points: (1) A report made by Dr. T. H. Shen of the University of Nanking following a series of conferences with President Stuart and members of the agricultural staff at Yenching; (2) A series of conversations with Acting President Galt and various members of the faculty and administrative officers at Yenching and with other persons interested in the development of agricultural education in North China, particularly Mr. James A. Hunter of Tungshien, and Dr. Willard Simpson of Changli; (3) A first hand study of the facilities and agricultural work in progress at Tungshien; (4) Brief surveys of all the land owned or rented by the Yenching Agricultural Experiment Station; (5) A detailed study of current projects at Yenching Agricultural Experiment Station and at Tungshien and (6) a careful and complete study of the annual reports of the Yenching Agricultural Experiment Station and the separate reports and recommendations made by J. L. Buck and R. G. Wiggans concerning the work of this department.

In addition to the above specific considerations, certain general principles were kept in mind as being fundamental. A statement of these from the above report is quoted here.

"First, an agricultural experiment station cannot successfully promote purely commercial enterprises, such as the dairy business, a general seed or nursery business and the production of peppermint, without considerable danger of vitiating its real function, viz., that of conducting scientific experimentation and teaching. Any use of land and facilities for such purposes should be purely incidental and only to such an extent as is consistent with good farm practice.

Secondly, with a limited budget and personnel, extreme care should be exercised not to initiate more projects than it is possible to carry through to a successful conclusion.

Third, an agricultural experiment station should have close relationships with other science departments and with a good library."

*Results of the study.*

The study of the situation based on the above considerations, led to the inevitable conclusion that the Agricultural Department of Yenching had failed to make contributions to the agriculture of North China, commensurate with the time and money expended upon it from 1922 to 1930, and strongly confirmed the wisdom of the decision of the authorities of that institution in asking for a reorganization and refocusing of the program. It is not pertinent here to discuss in detail the reasons why the program as carried on failed to function properly. These are set forth in the report mentioned previously. In general, however, it may be safely affirmed that the program failed of fruition because it was conceived on a much more extensive scale than could be possibly carried out with the funds and facilities available. Also lack of continuity in the supervision of the program, with the resulting fluctuating policy was a deterring factor.

*Recommendations.*

In formulating recommendations for reorganization, it was a recognized fact that the scope of the work must be narrowed considerably. After careful consideration it was recommended, that for the immediate future, at least, the station limit its endeavors to crop improvement work. It was obvious, of course, that other phases, such as poultry, animal husbandry, horticulture, vegetable crops and even dairying, were deserving of attention. But there was little foundation for these at Yenching. It is true that there was a dairy herd consisting of 9 Guernsey cows, 3 Guernsey bulls, 2 Ayreshire cows and 1 cow each of Holstein, Shorthorn and Mongolian; buildings consisting of a barn, milkhouse, silo, shed, isolation ward and residence and a small amount of equipment, such as separators, bottles, refrigerators, pails, scales and silo cutter. Of swine there was a total of 43 animals, consisting of

19 pure breeds and 24 cross-breeds with 16 small pig-houses. In the Poultry Department there were 78 cocks and 143 hens representing three breeds and native stock. In the Horticultural Department there were some 6000 fruit trees, 1—5 years old, of apricots, peaches, apples and pears, and a small amount of spray materials and a few hand sprayers of uncertain value. All the above data are taken from inventories dated December, 1930, and furnished by the officials of Yenching Agricultural Experiment Station. The inventory and appraisal of the Dairy was made by Messrs. Hunter and Eubank, independent appraisers. No experimental records or data were disclosed in the study of these various projects, except crop breeding, other than a listing of the number of animals, chickens or trees that had been distributed from time to time. The crop improvement work, under the leadership of Mr. S. T. Shen, consisted of six well established projects having to do with the improvement by breeding of wheat, kaoliang and millet. The experimental data and records for these projects were in good order and the experiments were being conducted in a scientific manner. It was therefore recommended, for the immediate future, at least, that the station at Yenching limit its work to the field of crop improvement, that this phase of the work be strengthened and that all work in Dairying, Animal Husbandry, Poultry and Horticulture be discontinued.

The Dairy Department with all the stock and equipment was taken over by Yenching University to be conducted as a commercial project. Most of the swine were turned over to the Mass Education Movement at Tinghsien, and the poultry and equipment to Jefferson Academy at Tungchow. The fruit trees were presented to the Horticultural Experiment Station at Changli.

A plan for the organization of the Yenching University Crop Improvement Station was drawn up. According to this plan, the members of the staff were to be appointed as members of the staff of the Department of Agronomy of the College of Agriculture and Forestry at the University of Nanking and assigned to duty at Yenching University, and to be treated by the latter institution as visiting staff members of the rank held in each case at the University of Nanking. They were to have the usual ranking with respect to titles, periods of service and salaries as established by the department of Agronomy and to be directly responsible to the head of that department. For the sake of efficiency and promptness in administering the affairs at Yenching, members of the staff were to be delegated to act for the Head of the Department of Agronomy at Nanking. A scheme was provided for the regular approval and reporting of projects. Two additional projects were drawn up and added to the six referred to above. A budget for the remainder of

the current fiscal year (April—June, 1931) with tentative adjustment to the old budget of the Yenching Agricultural Experiment Station was prepared, as was also a budget for the year July 1, 1931—June 30, 1932. Recommendations for appointment to the staff were also made.

The above is a summary of the main features of the study and recommendations concerning the Yenching Agricultural work. Many other matters of lesser importance were included. A typed copy of the report, including the complete recommendations was submitted to Acting President Galt of Yenching University and President Y. G. Chen of the University of Nanking. The report and recommendations were approved without change by each of them and subsequently by the China Famine Committee of Shanghai.

#### Cooperative Stations

##### *Organization in 1925.*

Early in the organization of the Nanking Cooperative Crop Improvement Program, the desirability of extending the scope of the work through cooperative stations was recognized. Distributed throughout Central and Northern China were a considerable number of mission stations. Some of these had trained agriculturists on their staff who were carrying on various phases of agricultural improvement, in some cases, plant breeding. Other mission stations, which had no trained agriculturists on the staff recognized the desirability of developing agricultural experimentation but felt the need of expert technical supervision.

In the autumn of 1925<sup>2</sup>, a conference was held at Nanking between representatives of mission stations and representatives of the University of Nanking. Among those who attended this conference were the following:—

##### Kaifeng Baptist College—

Mr. Gordon K. Middleton, Kaifeng, Honan.

##### Presbyterian (North) Mission—

Mr. H. H. White, Nanhsuchow, Anhwei.

Mr. A. L. Carson, Weihsien, Shantung.

##### University of Nanking—

Dean T. S. Kuo

Dean John H. Reisner

Mr. G. E. Ritchey, Head of Dept. of Agronomy

Dr. H. H. Love, Cornell Representative.

No representatives were present from the missions at Kweiteh, Honan, Wuchang, Hupeh or Yihsien, Shantung, but previous correspondence and conferences with the officials of these stations had

2. Report—1925—H. H. Love (unpublished).

assured their desire and willingness to enter into the cooperation should it be developed.

This conference indicated clearly that it would be much more satisfactory if all the interested agencies would join together in one comprehensive program of crop improvement, under expert, centralized supervision. In order that there might be a clear understanding of what was involved and to point the plan towards certain definite objectives, a memorandum of agreement was formulated for those stations entering into the cooperation. This memorandum was very specific with respect to the following points:

(a) The crops to be handled by each station, in order to cover a wide range of climatic conditions, at the same time avoiding unnecessary duplication and too large a number of projects at any one station.

(b) The methods of breeding and testing to be employed.

(c) The system of records to be kept and the type of annual reports to be made.

(d) The selection of a properly trained personnel and the arrangement of furloughs so as to avoid unnecessary interruption to the experimental projects.

(e) The cooperative purchasing, through the Department of Agronomy of the University of Nanking, of supplies, seeds, equipment and the like.

(f) Annual conferences of the workers for the purpose of discussing results obtained and plans for improving the program.

(g) Some financial assistance from the University of Nanking to promote the plant breeding projects of the different cooperating stations, when a consideration of all the circumstances indicated the desirability of such assistance.

(h) A simple plan of procedure for terminating the cooperation, either by the University of Nanking or by any of the cooperating stations.

In formulating the memorandum of agreement with respect to the points enumerated above, complete responsibility, for direction of all the plant breeding work covered by the memorandum, was placed with the Department of Agronomy of the University of Nanking, of whose staff each Cornell Representative was a member, during the time he was in residence in China. Such centralization of responsibility was desirable and a wise provision for the program at that time. Subsequent events have repeatedly justified this statement. In the beginning of the cooperation, in 1925 only a relatively few trained plant breeders were available to the staff, either at Nanking or at the cooperating stations. In order to avoid



*Carrying rod-row bundles of wheat from the field to the storage shed, Tai Ping Men Farm, Nanking.*



*Rod rows of wheat hanging in storage shed, Tai Ping Men Farm, Nanking.*

costly mistakes, needless expenditure of time and energy, and to provide reasonable assurance of worth while contributions, it was necessary and proper to have such close supervision and direction as was arranged for in the memorandum of agreement. In no other way could the program have been made so effective.

Soon after the conference referred to above and the formulation of the memorandum of agreement in 1925, five mission stations entered into the plan. The names of these stations and that of the Nanking station, together with the crops to be handled by each, are given in Table 1.

TABLE 1. *List of stations cooperating in the Nanking Crop Improvement Program, with the names of the crops to be handled by each, 1925.*<sup>3</sup>

Station	Winter Crop	Major Summer Crop	Minor Summer Crop
Kaifeng	Wheat	Kaoliang	Soybeans—Millet
Nanhsuchow	Wheat	Soybeans	Kaoliang
Yih sien	Wheat	Kaoliang	Soybeans
Weih sien	Wheat	Kaoliang	Soybeans
Wuchang	Wheat	—	—
Kweiteh	Wheat	Kaoliang	Soybeans
Nanking	Wheat Barley	Cotton Corn	Rice-Soybeans

*Condition of cooperative stations in 1931.*

By 1931, the number of cooperative stations had increased to eleven, listed as follows:—

- 1—Kiangsu Wheat Experiment Station, Provincial, Hsuechowfu, Kiangsu.
- 2—Kaifeng Baptist School, Kaifeng, Honan.
- 3—North Presbyterian Mission, Nanhsuchow, Anhwei.
- 4—North Presbyterian Mission, Weih sien, Shantung.
- 5—Central China Teacher's College, Wuchang, Hupeh.
- 6—Shantung Industrial School, Yih sien, Shantung.
- 7—Jefferson Academy, Tungh sien, Hopeh.
- 8—Shanghai Rural Middle School, Hwangtu, Kiangsu.
- 9—Canadian Church Mission, Kweiteh, Honan.
- 10—Oberlin Shansi Memorial School, Taiku, Shansi.
- 11—Tsangchow London Mission, Tsangchow, Hopei.

At the beginning of the crop season of 1931, the Yenching Crop Improvement Station came under the direction of the University of Nanking, as outlined in preceding pages. The Yenching Station is

3. From Report by H. H. Love—1925 (unpublished).

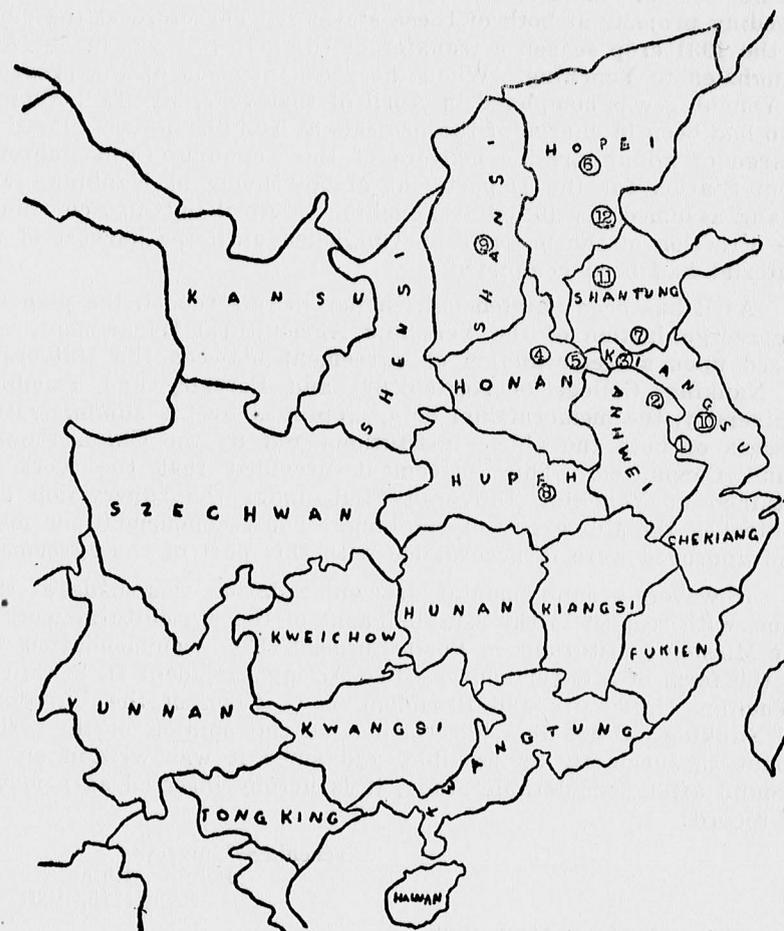
in reality a sub-station, but from the standpoint of distribution of effort it may very well be grouped with the cooperative stations.

The station at Taiku is listed above as being one of the cooperating stations in 1931. In the summer of 1930, Dr. R. G. Wiggans<sup>1</sup> visited Taiku and made a study of the location, equipment, staff and needs of the station and recommended that formal cooperation with the University of Nanking be established beginning with January 1, 1931. The formal memorandum of agreement was not concluded until nearly the end of the crop season of 1931. However, the writer of the present report made a trip to Taiku in June, 1931, at which time the projects of crop improvement were carefully reviewed, and plans made for the expansion of the work to a much more comprehensive scale. This expansion was within crop projects. The actual number of crops to be worked with was reduced. The formal memorandum of agreement was signed a short time later.

During the summer of 1931 a critical situation arose with respect to the cooperative station at Kaifeng. This was one of the first group of stations to be established. It is located at an advantageous point in Western Honan. The experimental projects had been carried continuously since 1925 and were reaching the stage where distribution of new varieties could soon be made. The authorities of the Baptist Mission at Kaifeng, reported in July, 1931, that on account of very serious curtailment of funds it would be physically impossible for the Mission to continue the financial support of the agricultural projects that had been furnished in the past. They also expressed a high degree of satisfaction and confidence in the work that had been conducted under the cooperative arrangement and urged that the University of Nanking continue the program if possible. Representatives of the Mission came to Nanking and after conferences with Dean K. S. Sie of the College of Agriculture, members of the staff of the Department of Agronomy and the Cornell Representative, a satisfactory solution of the problem was reached. It was agreed that the Mission would continue to permit the use of the land, owned by them, for the work in crop improvement and would also furnish necessary office and laboratory space in some of the Mission buildings. The salaries of the staff, however, and all other expenses of maintenance were taken over by the Department of Agronomy of Nanking. Mr. Pih, the plant breeder in charge of the projects at Kaifeng, was made directly responsible to the Department of Agronomy. By this arrangement the crop improvement program at this station was greatly strengthened, although some of the other lines, particularly animal husbandry, had to be abandoned.

1. Report for the year 1930—R. G. Wiggans (unpublished).

MAP SHOWING LOCATION OF STATIONS ASSOCIATED IN THE NANKING CROP IMPROVEMENT PROGRAM



- |              |              |
|--------------|--------------|
| 1—Nanking    | 7—Yih sien   |
| 2—Nanhsuchow | 8—Wuchang    |
| 3—Hsuechowfu | 9—Taiku      |
| 4—Kaifeng    | 10—Hwangtu   |
| 5—Kweiteh    | 11—Tsinan    |
| 6—Yenching   | 12—Tsangchow |

In connection with the reorganization of the agricultural department at Yenching, it was decided to transfer the plant breeding projects from Jefferson Academy at Tunghsien to Yenching. These two locations are not very far apart and climatic and soil conditions are not very dissimilar. It did not seem desirable to maintain plant breeding projects at both of these stations. Therefore at the close of the 1931 crop season a transfer of the material was made from Tunghsien to Yenching. When the reorganization of the program at Yenching was completed in April of that year, Mr. T. R. Chang, who had been in charge of the projects at Tunghsien, was placed in charge of administrative matters of the Yenching Crop Improvement Station for the Department of Agronomy at Nanking. Mr. Chang assumed his duties at Yenching in April but also continued his direction of the projects at Tunghsien until the harvest of all material had been completed.

As it has been pointed out, earlier in this report, the plan for the reorganization of the Yenching Agricultural Department, was based upon a memorandum of agreement between the University of Nanking, College of Agriculture and Forestry and Yenching University, the memorandum being approved by the administrative officers of both the above institutions and by the China Famine Fund Committee. This agreement provided that the work be retained at Yenching University but under the supervision and control of the University of Nanking. The recommendations made and approved were in accordance with this part of the agreement.

However, a supplementary recommendation was made at that time, with respect to the establishment of the agricultural work of the Mission Institutions in North China. This recommendation was in the form of a letter addressed to Acting President H. S. Galt of Yenching University and President Y. G. Chen of the University of Nanking. Since this letter sums up the opinion of the writer about as succinctly as possible, and since it was written on the ground after considerable study, it is hereby inserted as a matter of record:

Yenching University,  
Peiping, China,  
April 15, 1931.

Acting President H. S. Galt,  
Yenching University, Peiping.

President Y. G. Chen,  
University of Nanking, Nanking.

Gentlemen:

I recently submitted to you a series of recommendations for the reorganization of the Agricultural Program at Yenching University in accordance with the mutual agreement to place that program under

the direction of the University of Nanking. Both the agreement and also my recommendations were based on the promise that the funds allocated to Yenching by the Famine Fund Committee were to be used at Yenching.

My study of the situation at Yenching, however, has convinced me that the agricultural interests of the Christian agencies in North China would be better served by transferring all the agricultural work from Yenching to another institution. The main reason for this is that Yenching is not and cannot become an agricultural center. This university functions in an entirely different capacity in the Christian program of education. It has no agricultural course. It serves in no way as a center for farmers of the community. As a matter of fact, a farmer would feel decidedly out of place on the Yenching campus.

The only land suitable for experimental purposes owned by the University is the Korean Garden consisting of 260 mow of which about one-third is taken up in waste land and buildings. The tillable part of the garden is well adapted to experimental uses and the buildings, which are those belonging to an old garden, are only reasonably well adapted to the use of the agricultural work. Since the tillable land in the Korean Garden is inadequate, other land must be obtained. The land now being used is rented from a wealthy landowner. It is good land but there is little probability of purchasing it and rented land always introduces an uncertain factor in experimental work. It is also some three miles from the Korean Garden and the poor road makes transportation of material between the two places difficult.

In my judgment, a much better location for this agricultural work is at the Jefferson Academy at Tunghsien. This is decidedly a rural center. Its importance as a rural training center will increase in the future. Through the excellent work of Mr. Hunter and his associates during recent years, farmers are already looking toward Tunghsien for assistance in these problems. Land very near and easily accessible to the Academy can be purchased. Buildings very much better adapted to the work than those now in the Korean Garden at Yenching can be erected at a cost not to exceed that at which the present Yenching buildings are carried on the inventory.

The recommendations which I have already submitted to you for the reorganization of the Yenching agricultural program, would in no material way be altered by the transfer of the work to Tunghsien. The reorganization that I have suggested, in my opinion, will function equally well at Yenching or at Tunghsien. I presume that the matter of the transfer of the program from Yenching to Tunghsien might require a little time for decision. In the meanwhile the work at Yenching can proceed in accordance with the reorganization plans. If the transfer is to be made, it should be accomplished if possible before the planting season of 1932 begins.

From the standpoint of the most efficient development of the Agricultural Program of the Christian agencies in North China, I strongly recommend that the program now in operation at Yenching University be transferred to Jefferson Academy at Tunghsien.

Yours respectfully,  
(Signed) C. H. MYERS.

No action has yet been taken with respect to this matter but it has been discussed by interested parties at various times. Since the above letter was written, action has been taken by the China Famine Fund Committee, allocating to the University of Nanking for another ten year period beginning with 1933, the Famine Funds previously allocated to Nanking, and in addition the funds previously allotted to Yenching University, the latter to be used in North China. The continued financial support for the work in North China is therefore assured. No permanent arrangement with respect to an adequate area of land for experimental purposes at Yenching has been made. Since the program is reasonably assured for another ten year period at least, it seems expedient that this matter and the permanent location of the station in North China be settled. Whether it remains at Yenching, is transferred to Tunghsien or elsewhere, land must be made available for experimental purposes. It is possible that changed conditions at Yenching and at Tunghsien may shed new light on the situation and may invalidate the recommendation as to location made by the writer in 1931.

The Nanhsuchow Station is also one of the important cooperative stations, having been established in 1925 and having an unbroken and continuous record so far as the experiments in plant breeding are concerned. Special study was made of the work of this Station in 1931. It was found that the number of projects under way was greater than could be efficiently handled and supervised by the two Chinese in charge of crop improvement. One of these men is a graduate of Nanking, the other a graduate of the Short Course. Both took special work in Plant Breeding and have also attended the Special Summer Institutes of Crop Improvement conducted in connection with the Nanking Program. They are well trained in plant breeding methods and were doing good work at Nanhsuchow, considering the number of projects for which they are responsible. Since the departure of Mr. H. H. White from the Mission at Nanhsuchow, no trained agriculturist has been on the administrative staff. The present officials of the Mission were fully aware of the need and value for agricultural work, but not being trained in the technique of scientific agriculture, did not have a clear understanding of objectives and the method of reaching these. Also, curtailment of funds for the Mission made it impossible to finance the agricultural program as fully as seemed desirable considering the nature and importance of the work at Nanhsuchow. A thorough study of the projects was made, after which there was a full discussion with the plant breeding staff and the officials of the mission. Plans were made for eliminating or curtailing some of the projects of lesser importance and for concentrating effort on those of major importance. Another result

of the discussion was a better understanding on the part of those responsible for the administration of the Mission of the purpose and aims of the crop improvement program.

Another important accomplishment affecting the cooperative stations in 1931 was the culmination of an agreement with Cheeloo University at Tsinan. This agreement had been recommended by Dr. Wiggans, the Cornell Representative, in 1930 but like the one with Taiku, had not been completed. In the early summer of 1931, the writer spent three days at Cheeloo University with Dr. Charles M. Stanley and with Mr. H. W. Li, in charge of plant breeding. A survey of land and buildings available and also a review of the plant breeding projects in progress was made. Detailed suggestions were made for procuring more land for experimental purposes, for expanding the projects with wheat and millet, for additional storage and work rooms, for additions to the staff as the work developed and with respect to other matters of lesser importance, but having to do with more efficient handling of the projects.

The writer did not find it possible in 1931 to visit the stations at Hsuchowfu, Weihsien, Wuchang, Yihsien, Hwangtu, Kweiteh and Tsangchow. But during the Summer Institute of that year, special conferences were held by him with the representatives of these stations as well as with the representatives of all the other stations. Members of the Department of Agronomy at Nanking took an important part in these conferences. All projects were reviewed and special problems both of administrative and technical nature were discussed. Detailed reports of the conferences were typed, copies of which were furnished to the representatives of the station concerned, while bound copies of all the reports were made a part of the permanent records in the office of the Department of Agronomy.

On account of continued unsatisfactory conditions at Weihsien and due to the fact that the better located station at Tsinan could serve the region effectively, it was recommended to discontinue the experimental work at the former. It was suggested that in the future, Weihsien could function effectively as a seed center for that region in a program of seed distribution.

*Revised Memorandum of Agreement*

The memorandum of agreement formulated in 1925 was designed to meet a different set of conditions than that which prevailed in 1931. In 1925 very few well trained plant breeders were available for the stations. It was necessary, therefore, for the memorandum to be very specific and exacting with respect to many points of procedure and all the work had to be very closely checked and supervised by the Department of Agronomy at Nanking. As an illustration, all plans of planting had to be submitted in advance of

planting time; duplicate sets of all plans, records and notes had to be sent to Nanking; from a study of the records at Nanking, all selections for propagation had to be made and sent to the stations; in some instances, even the weighing of harvests and weighing and preparation of seed for planting had to be made at Nanking; in short, all details of the work were centered very closely in the Department of Agronomy at Nanking. As mentioned before, the wisdom of this strong centralization of responsibility has been established beyond a doubt.

In 1931 conditions were different. The training of men, one of the two important aims of the Crop Improvement Program, had progressed to the point where its effect was noticeable. No longer was it necessary to exercise such close supervision of the work. By their contact with the program and by their study in the Summer Institutes, the men originally on the staffs of the cooperative stations in 1925 had become capable of working more independently. Also more recent graduates in Agriculture from the University of Nanking had emerged much better trained in genetics and plant breeding as a direct effect of the Nanking Program than were the earlier graduates. Some of these later graduates had become connected with the work at the cooperative stations. In view of these changed conditions it seemed desirable to revise the memorandum of agreement with cooperative stations so as to provide more flexibility and freedom of action without losing the advantage to be derived from correlated effort, a very important advantage in Crop Improvement. A new memorandum was, therefore, drawn up, which provided for a careful scrutiny and consideration of all projects, particularly with respect to their number, the scope of work and the general methods to be employed in their prosecution, but permitting much more freedom and individual responsibility on the part of the project leader. The new memorandum was submitted to each of the cooperative stations and was formally approved by them, and by the Department of Agronomy at Nanking. The group of cooperating stations functioning under this agreement is a very strong one. The work started in 1925 is beginning to produce results. A recital of significant results will not be made at this point but in the discussion of the work with the separate crops mention will be made of important points.

#### Organization of Department of Agronomy at Nanking

During the years 1925-31, the Department of Agronomy experienced a decided growth, not only in staff and facilities but also in responsibilities. One outside the field seldom appreciates the normal, expected growth of a plant breeding project. In the first year or two, when the preliminary work is being done, a relatively small amount of time, space, energy and equipment is needed to

get the project under way. But as it continues in its development, it seems to increase almost geometrically at times. With its own projects under way at Nanking and with the responsibility of the close supervision of the related projects of the cooperative stations and of training workers, by 1931 the Department at Nanking found itself almost entirely engrossed in the Crop Improvement Project, to the detriment of other phases of agronomic work, particularly in Soils and Crops. The revised memorandum of agreement for the cooperative stations, placing more responsibility upon the project leaders of those stations, relieved the members of the staff of Agronomy from a great amount of monotonous and time consuming routine. In addition to this there was a real need for a revision of the program of the Department, and at the request of Dean K. S. Sie of the College and Mr. C. M. Heh, Acting Head of the Department of Agronomy, a study was made with this aim in view.

#### Revision of projects.

At the time when the projects of the department were drawn up, it seemed desirable to have a project for each phase of work, no matter how closely related these different phases were, in order to definitely limit and focus upon the specific problems involved. Thus some thirty odd projects were approved. As the standard of achievement developed and the leaders of the various projects obtained more experience and training, it seemed no longer necessary to sub-divide a general project into all of its different phases. A grouping of related problems under a general heading, simplified the administration of the projects in the Dean's Office particularly with respect to the allocation of funds and the record of expenditures in the Department. This grouping in no way interfered with the proper prosecution of the project. As a matter of fact, it gave a little more freedom and responsibility to the individual leader without weakening in any way the research program. Provision was made for the approval of all projects by a Project Committee of the College, with the Dean as *ex officio* member. This committee can function more efficiently when the projects are grouped under general headings. A standard, simplified project form sheet was drawn up and adopted for use, not alone in the Department of Agronomy but throughout the College of Agriculture and by the Cooperative Stations.

The following list of revised projects for the Department of Agronomy was submitted and duly approved after review by the Project Committee:—

- Project No. 1—Improvement of wheat by selection.
- „ „ 2—Improvement of wheat by hybridization.
- „ „ 3—Genetic study of wheat.

- Project No. 4*—Improvement of rice by selection.  
" " *5*—Improvement of barley by selection.  
" " *6*—Genetic study of barley.  
" " *7*—Improvement of soybeans by selection.  
" " *8*—Improvement of corn by selection.  
" " *9*—Improvement of kaoliang by selection.  
" " *10*—Studies of experimental methods.  
" " *11*—Production and distribution of new strains of seed.  
" " *12*—Improvement of corn by inbreeding and the subsequent recombination of inbred lines in crosses and double-crosses.

The above list covers all the experiments in progress in the Department of Agronomy at Nanking. None of them involved new problems but covered ones which had been under way for some time. Some of them, as for example, Number 11, was made up of a combination of six of the original ones. This new line up of projects should prove to be of decided benefit to the Department and to the College.

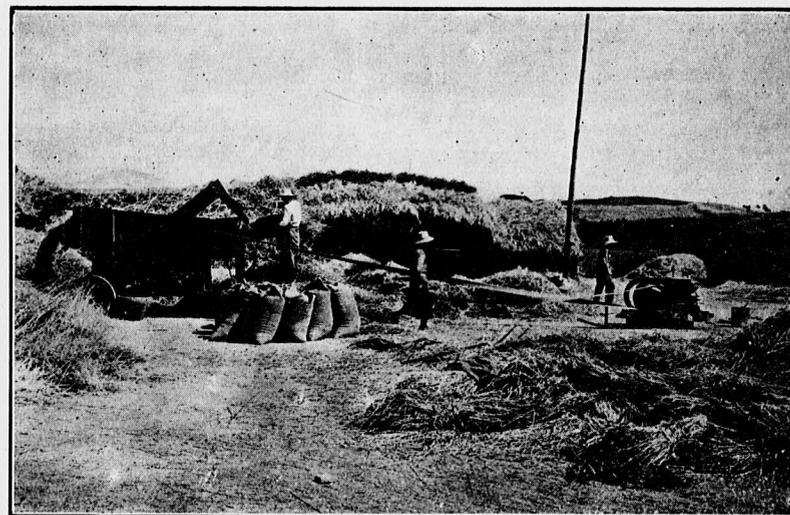
*New lines of work.*

As mentioned above, the activity of the Department of Agronomy became somewhat one-sided, due to the emphasis placed upon and the interest aroused in the cooperative crop improvement program. This result was not an unnatural one. It is difficult to maintain an even keel in such situations. It is usually necessary in pioneer work to focus effort on particular objectives, each in turn. It is seldom possible to emphasize all objectives at one and the same time. This condition applied in this instance. While the plant breeding projects were being developed to such an extensive scale, other phases of the agronomic field more or less marked time.

This was particularly true of those fields of Agronomy, commonly referred to as "Soils" and "Farm Crops." While regular courses of instruction in Soils and Farm Crops were included in the curriculum of the College by the Department of Agronomy, these courses were for the most part given by men, who were depended upon largely for the work in plant breeding and genetics. In July, 1931, Mr. N. F. Chang (M. S. Wisconsin) was placed in charge of Soils, with the responsibility of strengthening the instructional work and developing experiments to determine the relative values of different fertilizers, factors affecting the rate of decomposition of composted materials and other similar problems. This addition to the staff should strengthen the work of the Department considerably both in research and instruction.



*Picking cotton from the increase field, Nanking.*



*Threshing increase plots of wheat, Tai Ping Men Farm, Nanking.*

The departmental staff was further augmented in the autumn by the arrival of Mr. Goodsell, a new Mission appointee stationed at Nanking. Mr. Goodsell came direct from the University of Missouri where he took graduate work for 3 years, with interests in Genetics, Plant Breeding and Farm Crops. His first year in China was necessarily spent in language school. Since then he has been on duty in Nanking and has stimulated the instructional program in Farm Crops very materially.

Cotton breeding at the University of Nanking was initiated in 1919 by Dr. J. B. Griffing of the Department of Rural Education and Extension and conducted by him until 1927, when he returned to the United States. During the following two years this project was more or less inactive, except for the maintenance of seed sources of some of the selected strains. In 1929 it was decided to place the cotton breeding program in the Department of Agronomy which had been responsible for the breeding of all crops except cotton, up to that time. This transfer was made and Mr. Y. S. Chen, formerly associated with Dr. Griffing in Extension, was also transferred to the staff of the Department of Agronomy in charge of cotton breeding. In 1931 Mr. Chen resigned his position to become Secretary to Dr. H. H. Love, newly appointed as Agricultural Adviser to the Ministry of Industries of the National Government. This resignation left the cotton breeding project in the Department of Agronomy without a leader. No properly trained person was available to be appointed as successor to Mr. Chen and the remaining members of the staff of the department were so heavily burdened with other responsibilities, that it was impractical to further load them with the cotton breeding.

In this emergency the plan was evolved to place the responsibility for the general direction and supervision of the cotton breeding program with Dr. Love. In arranging for his services as Agricultural Adviser to the Ministry of Industries, it had been agreed that the University of Nanking should furnish him living and office quarters in return for which the University was permitted to use Dr. Love in an advisory capacity and particularly with respect to advanced training in Genetics and Plant Breeding. One of the younger Associates of the Department of Agronomy, Mr. S. P. Peng, was delegated for the actual execution of the details of the cotton projects in the laboratory and field. Mr. Peng was a recent graduate of the College and was serving his apprenticeship as a plant breeder in the Department. It is hoped that with further training and experience he will be fully qualified to accept complete responsibility for the work with cotton. Until that time, a proper handling of the project is assured by Dr. Love's supervision.

Already progress has been made in the purification of seed stocks of the varieties Trice, Acala and Million Dollar and in making new selections from Chinese cottons.

*Program of seed distribution.*

The distribution of superior strains of wheat, cotton and corn began at Nanking about 1925. The strains distributed were Nanking No. 26 wheat, produced by Dean Reisner; selected strains of Trice and Acala cotton and a selected strain of Chinese cotton, named Million Dollar produced by Dr. Griffing, and a selected strain of native corn named Nanking Yellow also produced by Dean Reisner. These were the results of the earlier plant breeding at the institution prior to 1925. By 1930 the total quantity of seed of these strains distributed had amounted to about 60 tons. In Table 2\* is a summary of seed distribution for the years 1925 to 1930.

No definitely formulated program for the distribution of this seed had been followed. The strains were distributed as the result of the efforts of extension representatives of the College and other interested parties such as agricultural missionaries. As would normally be expected, the bulk of the distribution was in the province of Kiangsu, of which Nanking is the capital with the neighboring provinces of Anhwei, Shantung and Chekiang receiving a goodly amount while the remainder was distributed in other provinces of Central and North China. This relatively restricted range of distribution is not surprising. Indeed it is in accordance with good agronomic practice. All of these improved strains had been obtained in the experimental breeding plots at Nanking. It was to be expected that they would be adapted to the surrounding region and to neighboring provinces with similar conditions but not necessarily to the whole of Central and North China. As a matter of fact it has since been proven in the work at Nanking and at the cooperative stations that the matter of regional adaptation is of extreme importance with wheat, cotton, corn and soybeans. It is altogether likely that it will be of importance also with the other crops under investigation, rice, kaoliang, barley and millet. The performance record of the above mentioned strains was not uniformly satisfactory. In some places a given strain was quite as good as its record in Nanking promised, while in other localities it gave an unsatisfactory result. This reaction to differing regional conditions must be taken into consideration in any well-balanced seed distribution program.

\*From Report of Department of Agronomy, 1930, C. M. Heh (unpublished).

TABLE 2. Summary of distribution of improved strains of wheat, cotton and corn—1925-1930, University of Nanking (from C. M. Heh).

Year	Number of Provinces	Amount cattles*
<i>Wheat</i>		
1926	9	14063
1927	4	4125
1928	11	18054
1929	6	16876
1930	9	19528
Total for wheat		72646
<i>Cotton</i>		
1927-28	13	12696
1929	11	12410
1930	9	6300
Total for cotton		31406
<i>Corn</i>		
1925	14	2421
1926	17	5770
1927	10	3262
1928	11	779
1929	9	990
1930	6	3664
Total for corn		16886

By 1931, some of the projects which were started in 1925 when the Nanking-Cornell cooperation was established, began to yield results, particularly those having to do with wheat. Out of the many thousands of individual head selections carried in the test at Nanking, several were beginning to show up remarkably well in comparison with Nanking No. 26 which was superior to the farmers' varieties. For example, the five year average yield of the five leading strains in 1931 was 45 per cent better than Nanking No. 26. Also there were noted very promising strains in the wheat tests at Nanhsuchow, Yih sien, Yen ching and Kaifeng; in the kaoliang tests at Nanhsuchow, and Yih sien, and in the soybean tests at Nanking. It was obvious that very soon a well thought out program for seed distribution would have to be established. Such a program was formulated by the Cornell representative during the Summer Institute of 1931 and

\*One catty is equivalent to 1.33 pounds.

presented, for discussion and approval, to a conference, consisting of representatives of the Nanking Department of Agronomy, and also representatives of all of the cooperative stations. This program dealt with four important factors involved in seed distribution: (1) the number of strains to be distributed; (2) the system of nomenclature to be employed; (3) the method of distribution, and (4) the registration of new varieties.

As a general policy it was agreed that the number of new strains put out should be limited, because it is expensive and time consuming to change varieties in agricultural practice. A new strain ought not to be distributed unless it is definitely and significantly superior to the varieties in general use. The number of strains disseminated should be as few as possible and should be determined by the climatic requirements of the different regions.

It is almost obvious that a systematic distribution, beginning with favorable centers and spreading out from these, is much superior to a hit or miss random method. By focusing on definite centers, more rapid progress can be made, especially in the beginning when the supply of pure seed is more or less limited. Cooperation with millers, merchants, bankers and the like is also desirable, since these have wider contacts and a greater sphere of influence than do individual farmers. The maintaining of a constant supply of pure stock seed is very important. This was recognized as a necessary function of the central station at Nanking and of the cooperative stations.

The naming of new varieties is of relatively small importance, but nevertheless it requires consideration in order to prevent the confusion that arises from multiplicity of names. It was agreed, that for the Nanking Crop Improvement Program, the use of a number, preceded by the name of the station would be followed.

Registration of new varieties is important in preventing the introduction of untried or unworthy sorts. Systems of registration are now followed in many countries. Inasmuch as there was no national or provincial agency organized for that purpose in China, it was agreed that temporarily at least, the Department of Agronomy of the University of Nanking should serve as the registration bureau for all new strains introduced by the stations cooperating in the Nanking Program. No variety is to be distributed without the approval of the registration committee of the Department of Agronomy. For the consideration of this committee, the following information must be submitted with the application for registration:—

(a) Name of the variety.

(b) Detailed description of the plant, flower, seed, special characters, season of maturity, adaptability and the like. This description may vary in details with different crops, but it should be adequate for easy and positive identification of the new variety.

(c) A tabulated summary of the performance record during the entire experimental testing period, which usually should involve from 5—7 years. This performance record is very important, since it is largely on the basis of this that the variety will either be accepted or rejected.

If, in the future, some other agency, national, provincial, or otherwise, should be organized to provide for the registration of varieties in China, then the Department of Agronomy may find it desirable to relinquish this responsibility. But until that time it seems necessary for this Department to continue to function in that capacity.

With the program at Nanking and at the cooperative stations covering such a wide range of territory and such a large number of crops it seemed desirable in 1931, to more definitely fix the responsibility for conducting the seed distribution phase of the Crop Improvement Program. This part of the work is of the greatest importance. In fact it might be rightly considered as the most important link in the chain, for, unless the new varieties produced at Nanking and the cooperative stations reach the individual farmer and come into general use, over large areas of the region to which they are adapted, a successful conclusion of the program has not been achieved.

As mentioned previously, a number of the stations, in addition to Nanking, have varieties of wheat, kaoliang, corn and soybeans which have definitely proved, over a series of years of testing, to be superior to the varieties commonly grown by farmers. Other stations have promising strains which should be ready for distribution within the next few years. The next problem is to determine the range of adaptation of these various strains. This can best be done by regional tests, so located as to include all the different important areas and also the different strains of the crops. Such regional tests are a necessary preliminary to an intelligent and efficient distribution of seed.

Also as the program develops it is desirable to fix the responsibility for maintaining foundation stocks of seed. This can probably best be done by the person in charge of regional testing, who should also cooperate very closely with the committee in charge of registration of new varieties. As a matter of fact he might well be an *ex officio* member of this committee.

Also some system of inspection, adapted to Chinese conditions must be worked out in order to insure a constant supply of pure seed of recommended varieties to farmers. It is also possible and not improbable, with the growth of cooperative agencies which is in evidence in recent years in China, that some sort of a certification process will be devised, similar to that used in other countries.

Considered in its entirety, the seed distribution program of the Nanking Crop Improvement Project is of great importance, involves many phases of work and all in all is a challenging task. In order to focus this part of the work more definitely, it was placed under the direction of Mr. C. M. Heh, who from 1926-31 had served most efficiently as Acting Head of the Department of Agronomy. A leave of absence and a scholarship for one year was recommended to permit him to pursue graduate study in genetics and plant breeding at Cornell University and to make a first hand study of seed distribution and certification in the United States and Canada. In the meantime a number of regional tests were established in 1931 to get this part of the work under way. When he returns to China, Mr. Heh will assume full responsibility for and will devote his entire time and energy to the seed distribution work in all its phases. With this addition the plant breeding work seems now to be organized on an efficient, permanent basis.

*Cooperation with other departments.*

From the very beginning of the Nanking Crop Improvement Program by the Department of Agronomy, there has been the closest cooperation with the Department of Plant Pathology, in the earlier stages under the direction of Dr. R. H. Porter, and since 1927, under the direction of the Chinese members of the staff. In his earlier survey work, Dr. Porter had shown the tremendous losses to crops from diseases and the importance of breeding for disease resistance. When the plant breeding projects of the Department of Agronomy were drawn in 1925, provision was made, whereby the disease reaction of all strains under test at Nanking and at some of the cooperative stations, would be made by the Department of Plant Pathology. This arrangement is an outstanding example of inter-departmental cooperation on a general project, and is still in effect. While disease resistant strains of all crops studied have not yet been obtained for distribution, real progress has been made in locating certain strains valuable for crossing and in developing technique for testing disease reaction.\* It is highly desirable that the cooperation between the two departments be maintained in the future as it has been in the past.

\*See the following references:—

Porter, R. H.—Seed disinfectants for the control of kernel smut of foxtail millet. Proc. 3d Pan-Pacific Sci. Cong., pp. 2108-2107 (1926).

—, Yu, T. F. and Chen, H. K.—The effect of seed disinfectants on smut and on yield of millet. Phytopath. XVIII, 911-919 (1928).

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There is a great field in China for the economic entomologist. Unfortunately at the present time there are only a few entomologists who are engaged in studying insect pests and methods for their control. In North China the mole cricket does a great deal of damage each year to kaoliang and millet. In the Yangtse Valley, wheat nematode is rapidly assuming importance as a limiting factor in wheat production. Also the stem borer causes considerable loss to the rice and millet crop in many sections. The above are three examples of many that might be cited. Of recent years, plant breeders are attacking this problem of insect control through the breeding of insect resistant strains. This is a relatively new lead in plant breeding but is already yielding promising results. A project for producing nematode-resistant or tolerant strains of wheat and also one for borer-resistant strains of rice is in progress at Nanking. But to properly prosecute these projects and similar ones with other crops, it is almost necessary to have the active cooperation of a trained entomologist. It is to be hoped that in the future this phase of the work may be developed much more fully and in cooperation with the newly established Department of Entomology.

At the University of Nanking, the Department of Agricultural Economics is conducting a very elaborate series of economic and social surveys. The schedules for these have been very carefully drawn with the result that valuable data are accumulating, which are primarily of interest to the sociologist, the economist and the student of farm management. These schedules contain blanks for general information on crop production and distribution. If to this could be added information concerning varieties, it would be of considerable value to the plant breeder. It is possible that a slight revision of the schedules, which might be suggested by the Department of Agronomy, would in time make available information of value to those in charge of the plant breeding projects. This phase of cooperation would be beneficial.

*Building equipment and land.*

During the year 1931, some valuable additions were made to buildings and equipment of the Department of Agronomy. The most notable of these were the two new green-houses, completed in September, 1931, made entirely of iron, cement and glass and including a floor area of 3750 square feet. There is a head-house attached to these, providing space for two offices and two small fumigation rooms, in the basement of which there is located the heating plant for the green-house. These green-houses fill a long felt want of the Departments of Plant Pathology and Agronomy to whose use they have been assigned and will be of great value in promoting the work of both departments.

Also in the summer of 1931, arrangements were completed for the building of a wire cage in which experimental plants, particularly cereals, could be grown under outdoor conditions and yet be thoroughly protected from damage by birds, which is often very serious when protection is not given. This cage is solidly constructed with concrete posts and woven-wire and covers an area of 117 feet by 90 feet, a total of 10530 square feet. The cage was completed in December, 1931, and has already proven to be a valuable addition to the departmental equipment.

The removal of the Department of Agricultural Economics from Bailie Hall, the main agricultural building of the University of Nanking, to the building formerly devoted to the Language School, made it possible to add to the office and laboratory space allocated to the Department of Agronomy. The rearrangement of the office and laboratory space, made possible by the addition, provided much more desirable quarters and laboratory space for the 18 members of the staff, including the additional quarters needed for the expansion of instruction and research in Soils and Crops.

Since 1925 a considerable area of land has been provided for the experiments of the Department of Agronomy. This land was purchased by the College and allocated to the Department. The three main farms, Tai Ping Men, Shen Tsi Men and Heh Ma Ying, are located some three to four miles from the campus but a good road makes them easily accessible by cart, rickshaw, bicycle or auto. The total area of these three farms, suitable for experiments and for increase plots, excluding area devoted to buildings, is 732 mow.\* At the Tai Ping Men Farm, the main experiment field, there was completed in 1926 a threshing and storage shed and a large concrete sunning and drying platform. There are also adequate buildings for housing the caretaker and the necessary animals and implements. As the program has expanded, there is now need for an addition to the storage and threshing shed, particularly for taking care of foundation stocks of pure seed, which are now beginning to increase rapidly. Another item of equipment very much needed, is a light auto-truck for transporting material between the experimental farms and the laboratory on the campus. This item has been recommended in each annual report for several years past. It should be provided as soon as possible.

The research garden of the Department of Agronomy located immediately adjacent to the campus, includes a usable area of about 33 mow. This garden provides an excellent place for the growing of materials for crossing and also the growing of the hybrids in the earlier stages of work before they are taken to the

\*One mow is equivalent to one-sixth acre.

final tests at the experimental farm. The combination of this garden with the new green-houses now provides the department with up to date facilities for plant breeding and genetic work. These facilities should be maintained and provision should be made for enlarging them in the future as the expansion of the projects demands.

*Special scholarships for staff members.*

The great demand upon the Department of Agronomy at Nanking to train plant breeders, in the regular College course, in special courses such as the summer institutes and by actual contact with active projects in the laboratory and in the field, emphasizes the need for maintaining and strengthening the staff of that department. In the summer of 1931 the Board of Directors recognized this fact and approved the recommendation of the Dean of the College for one year's leave of absence and \$2,000 scholarship each for Messrs. C. M. Heh and S. Wang, who had been efficient members of the staff of the Department since 1924. Also in connection with the reorganization of the Yenching program, provision was made for similar scholarships for Messrs. S. T. Shen and T. R. Chang. Each of these four men were granted these scholarships to enable them to spend a year in graduate study in America.\* This system of granting scholarships to outstanding men of the staff to enable them to make special advanced study, should be continued in the future. Naturally, in picking men for such scholarships, attention should be paid to their qualifications so as to choose men whose records justify the expenditure of money and whose qualifications are such as to insure their getting full benefit from graduate study.

**Instruction**

Previous to 1931 each of the Cornell Representatives participated in specially scheduled courses in the Department of Agronomy, during their period of residence at Nanking. That is, beginning with their arrival, usually in March, they gave formal lectures and conducted laboratory practice from then until the end of the spring term, and also from the opening of the fall term in September until the time of their leaving, usually in October. These courses were special courses arranged in advance and open to a selected group of students. The subject matter covered was in the fields of Genetics, Plant Breeding, Biometry and Taxonomy of Farm Crops. Complete details of the instruction offered in these courses were given in the annual reports made by the representatives

\*In June, 1933, three of these four men completed the work and received the degree of M.S. at Cornell University. The fourth received his degree the preceding year, June, 1932.

from Cornell. It does not seem necessary to repeat these here. It should suffice to say that in every case the instruction offered was of the same grade and covered the same field as that offered by the three professors concerned in their teaching at Cornell and that the class of students was always a selected group, who were able to profit to the fullest possible extent from these irregularly and specially scheduled courses.

In 1931 the writer did not offer any such courses during the regular session of the College. As mentioned previously in this report, he was requested to devote a major portion of his time to various problems of organization. A few formal lectures on subjects of a more general interest to students of the College were given. In addition many individual conferences were held with the junior members of the staff at Nanking and at the cooperative stations visited, with respect to special research problems and graduate training in general. All of these men were graduates of Nanking or other Colleges and were qualified to undertake post-graduate work. Each of them was also working on one or more of the regularly scheduled projects and was desirous of adding to his training and experience. This was obtained in part by the personal and individual conferences which were in the nature of graduate instruction by actual contact. This is probably the best method of graduate teaching. It is difficult to estimate in terms of hours or credits the amount of such work but a tremendous amount of time and energy was devoted to this during the entire period of residence at Nanking and the cooperative stations in 1931, and indeed throughout the entire period of the cooperative project.

*Summer Institute of Crop Improvement.*

The purpose back of the organization of the special institutes of crop improvement, in connection with the Nanking Program, was to provide intensive courses of instruction in Genetics, Plant Breeding and related subjects, for workers who had not had the opportunity to receive such training in connection with their college or short-course work. It was not the intention to furnish instruction for undergraduate students at Nanking but rather for those who had graduated there or elsewhere and were connected with various institutions where plant breeding was in progress or was contemplated. In the beginning it was believed that the institutes would prove to be of service mainly to the members of the staffs of the cooperative stations. Later it was found that workers from other institutions found the institutes well worth while, and the attendance consisted of representatives from many outside institutions, both mission and governmental.

A secondary but not unimportant purpose was to bring the Nanking cooperators together at least once a year to discuss

problems arising in connection with the work at their stations and to check upon methods of technique employed and results obtained. By doing this it was hoped to maintain unity, continuity and coordination of the work at Nanking and the cooperative stations.

The First Summer Institute was under the direction of the writer at Nanking, July 12 to August 4, 1926, and the second one was conducted by Dr. Love, also at Nanking, during the summer of 1929. The third was held at Yenching University, July 18 to August 5, 1930 and was directed by Dr. Wiggans. In each of these three institutes, lectures and laboratory practice were given in Genetics, Plant Breeding and Plant Pathology. Also numerous individual conferences dealing with specific problems were held. The interest in and the results from these Summer Institutes was very encouraging to those responsible for them. They assumed a very important place in the program so far as the training of workers was concerned.

Considerable emphasis, therefore, was laid upon the Fourth Institute, to be held during the summer of 1931, the last year of the formal cooperation between Nanking, Cornell and the International Education Board. It was scheduled from July 6—24. The preliminary organization was well set up and functioned smoothly under the direction of Mr. C. M. Heh of the Department of Agronomy. Announcements were sent out early in May to various institutions, both governmental and mission. The following quotation is from this announcement:—

“The purpose of the Fourth Summer Institute of Crop Improvement is to offer instruction and training in the methods and technique of plant breeding and the methods of controlling diseases, as a part of the plant improvement program of the Agronomy Department of the University of Nanking, for those primarily interested in the improvement of crops for China:

- (1) As cooperators with the department in its plant improvement program.
- (2) As staff members of other institutions or organizations who are making efforts along the same line.
- (3) As individuals without institutional connections who may be sufficiently interested.

It is hoped that as a result of the summer conferences and other efforts, uniform methods of plant improvement will be adopted by all those making efforts along this line, to the end that results secured at one place by one individual or more are not only reliable but also can be fairly comparable with results secured by another and independent worker at another time or place. We hope also that some of the problems in plant breeding work as to method and technique, can be solved through discussions in conference.”

The response to this announcement was wholly gratifying. There were 91 persons regularly registered for the Institute, with

20 regular visitors from the staff of the College of Agriculture at Nanking, mostly from plant science departments. There were 32 institutions represented of which 17 were governmental and 15 private, representing 9 provinces, as follows:—

Province	No institutions represented
Kiangsu .. .. .	9
Anhwei .. .. .	1
Hopei .. .. .	4
Kwantung .. .. .	1
Shantung .. .. .	4
Chekiang .. .. .	3
Honan .. .. .	6
Hupei .. .. .	2
Shansi .. .. .	2

This distribution of attendance shows clearly the appeal made by this opportunity for special training. Those coming to Nanking in July did not come on a summer vacation. The weather there at that time is not conducive to vacation activities. They came to do intensive work and they found the full program which was mapped out in advance in the preliminary announcement. Following is a description of the courses given, together with a record of the registration:—

Elementary Plant Breeding—Dr. T. H. Shen. This course consisted of 5 one-hour lecture periods and 3 two-and-one-half-hour laboratory periods per week. It dealt with elementary principles of genetics and practical methods of crop improvement. It was intended for those who had no previous training in Plant Breeding and did not understand English. There were 51 regularly registered with 6 visitors.

The course in Plant Pathology was given by Professor F. L. Tai. It consisted of 5 lecture periods of one hour each and 2 laboratory periods of two and a half hours each week. Diseases of crop plants, methods of control and their relation to crop improvement were covered. There were 91 who registered for the entire course with 6 visitors who attended all the lectures.

A course in Advanced Plant Breeding was given by the writer of this report. It consisted of 5 lecture and 2 laboratory periods each week. This course was designed for those who had previous training in Genetics and Plant Breeding and who could also use English. It dealt with the principles of Genetics as applied to Plant Breeding, the development of methods of breeding, and the analysis and interpretation of data. There were 40 regularly registered for this course with 14 visitors, who took the lectures only.

A course in Biometry was given by Dr. H. H. Love. As mentioned earlier, Dr. Love came to Nanking in March, 1931, at the invitation of the National Government at Nanking and the Provincial Governments of Kiangsu and Chekiang, as Agricultural Adviser. By cooperative arrangement, the College of Agriculture and Forestry of the University of Nanking was permitted to use Dr. Love's services in the training of advanced students in plant breeding. Thus it was possible to have a course in Biometry offered by him in the Fourth Summer Institute. This course was also limited to those students who could use English. It consisted of 3 two-hour periods each week and dealt with the methods of calculation and application of the more important statistics and with the experimental error concept. There were 40 students regularly registered for this course with 6 visitors attending the lectures.

In addition to the regular courses, there were four special lectures given, one in English, the rest in Chinese. The subjects of these lectures and the name of the speaker follow:—

- (1) Agricultural Research and Demonstration—Dr. H. H. Love, Agricultural Adviser to the Ministry of Industry.
- (2) The Relation of Rural Organization to Crop Improvement—Mr. C. M. Chiao, Department of Agricultural Economics, University of Nanking.
- (3) The Work of the Shanghai Bureau of Inspection and Testing Commercial Commodities—Mr. P. W. Tsou, Director.
- (4) The Way to Success—Mr. T. H. Chien, Director, Museum of Natural History, Nanking.

During the Institute the following field trips were made:—

- (1) To the experiment fields and laboratories of the College of Agriculture of National Central University, to see something of the genetic and cytological research and the plant breeding and cultural experiments with cotton, rice and wheat.
- (2) To the experimental farms of the Department of Agronomy of the University of Nanking, to see the experiments with wheat, barley, soybeans, millet, kaoliang, rice and corn.
- (3) To the National Meteorological Station at Pei-chi-ko, Nanking, a modern station located on the identical site that has been used for that purpose for 1500 years.
- (4) To the Botanical Garden in the Sun-Yat-Sen Memorial Park, just outside the walls of Nanking.

The individual conferences held during the Institute have already been referred to as well as the general conference of the representatives of all the stations cooperating with Nanking. These constituted an important part of the work of the institute, so far as the writer is concerned, and consumed all of his spare time between lectures and laboratories.

Of perhaps lesser importance, but nevertheless of considerable value, were the three social functions at which the entire Institute including the faculty were present. To those who are familiar with Chinese courtesy and hospitality, no explanation is necessary. To others, there is not time or space here for adequate description.

The Fourth Summer Institute was one of the outstanding features of the program for 1931. There was a larger attendance than at any of the previous ones, a better balanced series of lectures, laboratory practices and field meetings was possible, and the interest and zeal manifested by those registered for the different phases of work could not have been better. That the Nanking Project with the Summer Institutes is performing a real service in agricultural education in China, outside the mission and private institutions, was evidenced in the Fourth Institute by the large representation from provincial and other governmental institutions. The following list is evidence of the fact:—

- 1—National Mass Education Movement, Tingsien, Hopei.
- 2—Kao-yu District, Experiment Station, Kiangsu.
- 3—Chekiang University, Hangchow.
- 4—Kiangsu Provincial Wheat Experiment Station, Hsuehchowfu, Kiangsu.
- 5—Wukiang Agricultural Extension Department, Wukiang, Anhwei.
- 6—Second Provincial Vocational School, Runan, Honan.
- 7—Kiangsu Board of Agriculture and Mines, Chinkiang, Kiangsu.
- 8—Kiangsu Provincial School, Wusih, Kiangsu.
- 9—Honan Water Conservation School, Kaifeng, Honan.
- 10—Hupeh Provincial Rural Normal School, Wuchang, Hupeh.
- 11—Lingnan University, Canton, Kwantung.
- 12—New Citizen School, Pingting, Shansi.
- 13—Chiating Agricultural Experiment Station, Chiating, Kiangsu.
- 14—International Famine Relief Commission, Tsinan, Shantung.
- 15—Changshu Agricultural Experiment Station, Changshu, Kiangsu.
- 16—National Bureau of Inspection and Testing, Tsingtao, Shantung.
- 17—Kiangsu Provincial Rice Experiment Station, Soochow, Kiangsu.
- 18—Honan Provincial Horticultural Experiment Station, Kaifeng, Honan.
- 19—Chekiang Provincial Agricultural Experiment Station, Hangchow, Chekiang.
- 20—Chekiang Provincial Cotton Experiment Station, Siao-shan, Chekiang.
- 21—Honan University, Kaifeng, Honan.

Another significant fact has to do with the academic rank of those who attended the Fourth Institute. Out of the list of 91

regularly registered students and 20 visitors to the lectures, 66 were graduates of recognized Colleges, 24 were upper-classmen from the University of Nanking and 21 were graduates of the Nanking Short Course in Agriculture. All of these, except the 24 upper-classmen of Nanking, had been out from one to several years and were engaged in teaching or experimental work at their respective institutions. The Institute was in fact a Graduate School of Agriculture, dealing with a limited field of work. The value of these institutes in connection with the Nanking Program is beyond question. They have not yet reached the limit of accomplishment. Although the formal triangular cooperation has been concluded, the staff of the Department of Agronomy is fully competent to continue this special phase of instruction along with the rest of the program. It is highly desirable that special schools of instruction, similar to the Summer Institutes, be continued as an established part of the Departmental Program.

#### Experimental Work in 1931

The five annual reports of the Cornell Representatives have dealt in considerable detail with the experimental work of the program as it has developed year by year at Nanking and at the cooperative stations. Beginning in 1925 with the so-called small grain crops such as wheat, rice, barley and also with soybeans, the number of projects increased until in 1931 there were active projects in progress with all of the crops of major importance in Central and North China. This list included, wheat, rice, barley, millet, kaoliang, soybeans, corn, cotton and cabbage.

In the earlier years considerable attention had to be paid to the establishment of proper methods. In some cases these could be adapted directly from the experience of others. In other cases, new methods adapted to the crop and to the conditions under which the work was done had to be devised. Also in the beginning, not so many well trained and experienced men were available to the staff but as the program developed this lack was overcome. Through actual contact with the projects under the direction of the Cornell representative and through intensive study in the Summer institutes, the men originally connected with the staff gained experience and training and also younger men became available for appointment and were added to the staff either at Nanking or at the cooperative stations.

Thus in 1931, the writer found upon his arrival at Nanking a well organized, well trained staff of plant breeders working upon well established projects. There was not, therefore, the need for devoting as much time to the details of the various projects as there had been in the earlier period of work. Already some

data had been published by those responsible for projects. Other experiments had progressed to the point where publication of results will be possible in a relatively short time. These will speak for themselves. In the present report, this section dealing with the experimental work for 1931 will deal only with the high points and will indicate some additions or changes in the methods of procedure of some of the projects. For convenience each crop is treated under a separate heading.

*Wheat.*

Full responsibility for the work at Nanking with wheat was placed with Dr. T. H. Shen, when he assumed his duties at Nanking in 1927 at the conclusion of his graduate study at Cornell University. In 1926, Dr. Shen had his first contact with the Nanking program, when he was granted a special Fellowship by the International Education Board and a leave of absence from his graduate study at Cornell, to enable him to join the writer at Nanking and to assist in carrying on the work of that year. It was at this time that the arrangement was made for Dr. Shen to join the staff of the Department of Agronomy as soon as he had completed his graduate study. This active contact with the project in 1926 was valuable preparation for Dr. Shen because it made it possible for him to adjust himself very promptly to the work when he assumed his new position. The plan was also an excellent one from the standpoint of the Department of Agronomy there, for it made it possible to add a well trained and experienced man to the staff and also one who was not unfamiliar with the work of the Department. Also his appointment was made at a critical time in the program, immediately following the temporary break in the cooperation caused by the political disturbances of the spring of 1927. Dr. Shen's services to the institution at that time and during the succeeding years, have been of great value in maintaining the continuity and stability of the research and teaching program.

Under his able direction the wheat projects have developed rapidly at Nanking and at the cooperative stations. Two lines of work are in progress: (1) the production by selection and hybridization of new strains superior in yield, disease resistance or in other important characteristics, (2) genetic studies, in which the mode of inheritance of various factors is being determined. Real progress has been made in both of these lines.

Beginning in 1925 thousands of individual selections have been made and run through the routine row-testing program. It is not desirable or necessary here to describe this process. The methods used were well established and for the most part may be found in publications from various sources. In fact, in 1925, the methods were briefly outlined by Dr. Love and were translated

into Chinese and published for the benefit of those who were not versed in English. Evidence of the success of the selection program may be seen in Table 3, where are given the yields from 1927 to 1931, of eight of the outstanding selections at Nanking, judged by their performance record for that period of time. The yields of these line selections are remarkably good as compared with the check or standard variety but it must be remembered that all of these selections were made in a practically pioneer field where no such work had been previously done. If another large series of selections were made throughout the same region, it is hardly to be expected that such outstanding results would be obtained. Within one or two years more, final decision can be made as to which one or two of these eight strains will be recommended for distribution. They were placed in regional tests in 1931 in order to get information as to the range of their adaptation.

Similar results have been obtained at the Kaifeng cooperative station, where the yields of four new selections for the six year period, 1926-31, showed gains of from 12 to 23 per cent over the standard variety, which in turn like Nanking No. 26 was a selection and superior to the farmers' varieties. Milling tests of the Kaifeng selections, made at the Shanghai Research Association in 1931, showed these wheats also to be of very good quality.

At the Nansuchow cooperative station a strain designated as No. 6 has been under distribution for several years. It had proven to be superior to the local farmers' varieties and the local demand for it far exceeded the supply. A new strain, No. 61, which was among the selections made in 1926, has proven to be about 30 per cent better than No. 6. Multiplication of No. 61 was made in 1931 and it is now ready for distribution in the region of Nansuchow. This strain also was placed in the regional tests in 1931.

A study of the data from the wheat experiments at Yenching in 1931 did not reveal strains of sufficient superiority to be deemed worthy of distribution. In the light of results at other stations it seemed probable that the original number and range of selections had not been adequate. Therefore in the summer of 1931, over 11,000 new individual selections from Hopei and Tsai-har were made by Mr. S. T. Shen, who is in charge of wheat at Yenching. These were placed in head-rows in the fall of 1931 and will be continued on through the testing process in the usual manner. From these it may be reasonably expected that outstanding strains will be obtained.

The work with wheat at the other cooperative stations has not yet reached the point where new strains are ready for distribution, but is proceeding normally and may be expected to yield results

TABLE 3. Yields in bushels per acre of 8 new strains of wheat, compared with a standard variety, Nanking, 1927-1931.

(from T. H. Shen)

Strain	Source	1927		1928		1929		1930		1931		Average		
		Yield	Gain over Standard	Yield	Gain over Standard									
2902	Selected from Chinese wheat	27.5	9.9	23.2	3.9	41.9	19.7	31.5	5.0	21.9	-0.2	29.2	7.7	35.8
2903	"	25.4	7.8	25.7	7.3	39.5	17.4	33.9	7.4	20.6	0.5	29.0	8.1	38.7
2905	"	35.8	16.6	24.6	7.3	44.6	22.5	34.1	8.1	19.6	-0.5	31.7	10.8	51.7
2915	"	26.8	7.0	22.4	6.2	42.9	20.6	31.8	5.8	20.0	1.8	28.8	8.3	40.5
2941	"	33.9	10.0	25.4	5.1	46.2	23.4	34.4	5.9	20.5	1.6	32.1	9.2	40.2
516	Red Rock	23.2	11.6	26.8	9.6	35.8	15.4	33.4	8.0	24.9	5.4	28.8	10.0	53.2
2869	Selected from Chinese wheat	29.7	8.8	27.1	7.0	44.1	22.3	33.6	8.1	21.7	-0.4	31.2	9.2	41.8
2919	"	32.7	7.0	26.0	8.6	39.3	16.7	37.1	8.6	20.7	1.8	31.2	8.5	37.4

Standard variety is No. 26 which yields 7 per cent better than the farmers' variety.

in due time. The instances given above where success has been attained are drawn from those stations where more intensive work has been possible in the earlier years.

The selection program with wheat was started first as experience indicated that it would produce results in a minimum amount of time. But it was also recognized that the method of hybridization must be applied if fullest success was to be attained, because a selection program, if intensively conducted, sooner or later reaches a stage where no further progress can be made. That is, when all the good things have been sorted out of the general population, there is nothing more left, except what might occur as the result of chance crosses or mutations and these occurrences in wheat are rare. Therefore a program of crossing of wheat was inaugurated in 1926 at Nanking. The first crosses made were between Japan Bearded, Early Arcadian and Honor, varieties readily recognized by those familiar with wheat. By 1931, strains from these crosses were in the comparative yield tests and were giving results most promising, indicating that some of them may prove superior to the line selections referred to above. Another series of hybrids made for the purpose of obtaining strains of good yield and quality and also resistant to flag smut, had been carried to the third generation. The value of these remains to be determined. All of the hybridization work is carried on at Nanking but promising strains obtained are sent at once to the cooperative stations to be placed in the tests.

The genetic studies with wheat are conducted by Dr. Shen at Nanking. The following characters are being studied: shape of head, height of plant, double spikelet, compound spikelet, reaction to flag smut, reaction to nematode, hairy leaf, awn characters. Good progress has been made in these studies. No attempt is made here to report upon them in detail. This has already been partly done in some of Dr. Shen's publications and further reports undoubtedly will be made by him in the future. Here it will suffice merely to stress the importance of such studies, not only from the standpoint of their possible application to breeding work but also from the standpoint of their value as providing illustrative material for teaching.

*Barley.*

In the Nanking program, barley in importance comes after wheat, kaoliang, soybeans, millet and rice. Improvement work is being conducted at three places, Nanking, Nansuchow and Kaifeng. At Nanking, under the direction of Mr. S. Wang, selection and hybridization are both employed. At the other two stations the selection method only, is being applied.

At Nanking the first selections of barley were made in 1925. Further selections were made in 1928. In addition foreign varieties were introduced into the tests beginning with 1927. At the close of the harvest in 1931 an analysis of the data by Mr. Wang showed that none of the selections obtained were enough superior to the farmers' varieties to justify putting them into distribution. Of the foreign introductions, Texas Winter and Wisconsin Winter were slightly better in yield than the standard. But each of these strains was too late in maturity to fit in with the cropping system practiced in the Yangtze Valley. Here again it seemed probable that selections had not been made in sufficient number and over a wide enough range to get outstanding strains. Work at Cornell by Dr. Love has shown that in selection experiments with small grains, only one or two outstanding strains may be expected from 12,000 selections. Therefore in the summer of 1931 at Nanking additional selections were made in the province of Kiangsu, consisting of 10,000 heads of hulless and 1017 heads of hulled barley. These were planted in the test in the fall. When these have gone through the test, a period involving about five years, it will be definitely demonstrated whether or not superior strains of barley for that region may be obtained by selection.

In 1929 a series of 180 crosses of different strains of barley were made for the purpose of combining into one variety the desirable characteristics of resistance to covered smut, stiff straw, early maturity and high productivity. Weak straw and susceptibility to covered smut appear to be the most important defects of Chinese barleys. The work with these hybrids has not been carried far enough yet to know what strains of value may come out of it. However, the varieties used in making the crosses carried the desirable characters. It seems highly probable that a happy combination will eventually be obtained.

In addition to the plant breeding work with barley, Mr. Wang is also conducting genetic studies, involving particularly awn characters, one of which is a new character of awn not yet reported in barley. Publication of the results of some phases of this study will be made within one or two years.

At the Kaifeng station, three selections of barley, judged by the five year average yield, were worthy to be considered for distribution. At the Nansuchow station, one other strain appeared outstanding. All of these are to be placed in regional tests. When this regional test has been completed, decision can be made as to distribution of barley. It is possible that distribution will have to be delayed until some of the later selections or hybrids are available.

*Soybeans.*

The soybean work at Nanking was started in 1923, when Professor G. E. Ritchey, who was then head of the Department of Agronomy, collected some 60 varieties from different parts of Honan, Hopeh and Shansi, and planted them in a variety test at Nanking. In 1924 Mr. S. Wang was placed in charge of the soybean project. Individual plant selections were made as follows:—

	No. selections	Province
1924	407	Kiangsu
1925	600	Honan
"	1080	Kiangsu
"	100	Anhwei
"	909	Shantung
"	61	Shantung
"	52	Nanking
1929	500	Kiangsu
1930	2500	Kiangsu
Total	6209	

All of these individual plant selections were placed in the comparative tests where their performance record was accurately recorded. One very superior strain has been obtained which in the tests at Nanking yields about 50 per cent more than the best farmer's strain. In 1931 plantings of this strain were made for increase purposes. Distribution of seed to farmers will be made as rapidly as possible.

In his experiments, Mr. Wang has established the fact that the soybean is more sensitive to environmental changes than some of the other crops as, for example, wheat and kaoliang. That is, the range of adaptation is not so wide. This means that strains of soybeans will have to be developed for different regions, and free use must be made of regional tests before distribution of seed. He also has made a study of the correlations existing between such characters as height of plant, size of seed, number of seed, date of maturity, and yield. Another study was on the effect of length of row and number of replications upon the accuracy of field tests. Both of the above studies were completed in 1931 and the results prepared for publication.

The work with soybeans at Nanking has made excellent progress. Studies which are important from the standpoint of method have been completed. One striking new strain is ready for distribution in the surrounding region, while several even more promising strains from some of the later selections are showing up in the tests.

Soybean selections are also being tested by the cooperative stations at Nanhuchow, Kaifeng, Yihsien and Weihsien. The number of selections under test is not so great as at Nanking, but many of the strains are those which have been obtained from the Nanking station because of their possible adaptation due to some observed characteristics as, for example, time of maturity. Several promising strains are emerging in the tests at Kaifeng, Nanhuchow and Yihsien. As mentioned in an earlier section, the cooperation with Weihsien was discontinued at the close of the 1931 crop season.

*Rice.*

Rice projects are in progress at Nanking and at the cooperative station at Wuchang. Since 1927 those at Nanking have been under the direction of Dr. T. H. Shen. The experimental land controlled by the University does not include a very large area suitable to rice growing. For this reason the work with this crop has been limited.

One important study in method is being conducted. It involves a comparison of the direct planting with the transplanting method and was suggested by Dr. H. H. Love in 1925. Without going into details, suffice it to say that the direct planting method involves very much less labor\* than the transplanting method. If the results obtained prove to be comparable as between the two methods, the direct method would be of great value to the plant breeder. It is not presumed that it would be used in the general culture of rice. The results for the three years 1928-30, were promising but not conclusive. The experiments in 1931 were so seriously damaged by the severe flood that no data were obtained. This experiment will be continued until definite conclusions can be drawn.

Another project at Nanking involves a study of the reaction of different strains of rice to the stem borer. Preliminary observations have indicated that strains may differ with respect to the amount of infestation by this pest. Whether or not this is an inherited characteristic is not known, but the object is to determine this point. If such resistance is discovered it will be of inestimable value to the rice-breeder as well as to the grower, because the damage by the stem borer is often serious.

A study in method involves a comparison of the accuracy obtained by using rows of different length and with different numbers of replication. Both the direct and transplanting method are also involved in this experiment. Here again the damage by flood prevented the recording of data in 1931, but reserve supplies of

\*Dr. Shen estimates that the direct planting requires only 5 per cent as much labor as the transplanting method.

seed made possible the continuation of this project, the final results of which will be of immediate value to those interested in rice breeding in China, as well as elsewhere.

A considerable number of individual selections of rice have also been made and tested in the attempt to obtain superior strains. A preliminary summary of the performance of five of these is given in Table 4. While it is too early to reach positive conclusions concerning any of these, the results so far indicate that the selection method with rice may be as successful as it has been with wheat and soybeans.

At Wuchang, individual rice selections have been under test since 1926, but not in such numbers as should be desired. The experiments were also entirely spoiled by the disastrous flood of 1931. This station is very near Hankow where the flood damage was at a maximum. Reserve supplies of seed, however, made it possible to continue the work with both rice and wheat, with the loss only of one year's time. In 1931 the number of rice selections was increased by some 3000 which were made that year.

*Kaoliang.*

Kaoliang is well adapted to the drought conditions of north central China, where it is one of the very important crops. The grain furnishes food for human as well as animal consumption. The stalks, are used in making dwellings, windbreaks, fences and the like, and the roots are used as fuel. It is hard to conceive of existence in some parts of North China without kaoliang. Naturally, therefore, the main breeding projects are located at the cooperative stations in these regions. Nanking is located just beyond the area in which the crop is usually grown. It was desirable, however, to have some work with kaoliang at Nanking for the purpose of training students. For this, different general types were used and the work focused on a study of methods, applicable to breeding.

One of the problems had to do with the effect of selfing and was begun in 1929 under the direction of Dr. Shen. Thirty eight strains, representing different types of kaoliang were used. To determine the effect of selfing, notes were taken each year on (a) the yield, (b) the number of heads per plant, (c) the per cent of grain in the head, and (d) the average weight of kernels. In 1931 no data were obtained on account of damage by floods. The data for 1929-30, however, indicated strongly that selfing for two generations did not result in any appreciable loss of vigor. These results, together with those obtained from selection experiments at the cooperative stations, show that selfing of kaoliang results in the isolation of strains which may be either superior or inferior to the original variety from which they were obtained and confirm



the use of the individual method of selection by selfing as a means of improving kaoliang.

Another study of value from the standpoint of method is the experiment made to determine the length of row and number of replications necessary to obtain a reasonable degree of accuracy in comparative tests of kaoliang. This is also under the direction of Dr. Shen and duplicate experiments are being run at the cooperative stations of Hsuchow and Nanhsuchow. Data for publication will be available within one or two years more.

Also in 1931 a study was made of the method of threshing kaoliang and the relation of the total weight of head to the weight of grain from that head. A new and simple form of threshing box was designed by Dr. Shen which greatly reduces the labor of threshing in connection with the breeding experiments. Incidentally, this box was also found to be equally useful for threshing rice, wheat, barley, soybeans and millet. All of these studies of method are of use in the breeding program as well as in the giving of instruction.

Selection experiments to obtain superior strains of kaoliang are under way at Nanhsuchow, Kaifeng, Yihsien, Yenching, Hsuchow, and Taiku. The success of selection of new strains is indicated by data from the experiments at Nanhsuchow, where the kaoliang project is of major importance. A summary of yields of six selections is given in Table 5. At the Kaifeng station four strains have been obtained which average about 20 per cent better than the farmers' variety. Very promising strains have also been obtained at Yihsien. In 1931 plans were made to place all of these new strains in regional tests at Kaifeng, Yenching, Nanhsuchow and Yihsien. Within two or three years, it will be possible to begin general distribution of one or more of these strains, depending upon their performance in the regional tests and at the station of their origin.

*Millet.*

Millet is also a crop which is adapted to the drought conditions of North China and is one of the most important food crops in the region where it is grown. It is not commonly grown in the region where Nanking is located. But here again, as in the case of kaoliang, two studies on methods of breeding millet are being conducted at Nanking. These are under the direction of Mr. C. M. Heh. One of these is for the purpose of determining the effect of selfing. This was begun in 1929. The results to date do not show any loss of vigor whatever due to selfing. The experiment is to be continued and additional data will be available later. A second study is being made to determine the proper length of row and number of replications for a comparative test of millet, a

TABLE 5. Comparison of new strains of kaoliang with farmers' variety at Nansuchow  
(from T. H. SHEN)

(Yields are in bushels per acre)

Strain	Source	1927		1928		1929		1930		Average		
		Yield	Gain over Standard	Yield	Gain over Standard	Gain over Standard in %						
1A7-9c-2d-4	Selection from Native variety	32.6	7.8	33.8	5.7	52.1	26.9	47.3	4.3	41.5	11.2	37
1A7-9c-2a-3	"	32.6	7.8	33.8	5.7	42.1	22.5	36.3	6.1	36.2	10.5	41
1A7-9c-2b-4	"	32.6	7.8	33.8	5.7	46.7	25.2	37.2	1.5	37.6	10.1	37
1A7-47c-3b-4	"	38.2	4.3	28.7	5.5	49.6	16.6	50.2	10.4	41.7	9.2	28
101-11b-1a-4	"	44.9	12.2	38.1	16.5	41.0	7.5	47.1	19.1	42.8	13.8	48
101-11b-1b-2	"	44.9	12.2	38.1	16.5	45.7	10.8	49.2	17.3	44.5	14.2	47

so-called "blank" test. A duplicate of this experiment is also being run at Nansuchow. Data are available for two years. As a result of this experiment, in the millet tests at the cooperative stations it is recommended that a fifteen foot row replicated from 4 to 9 times, depending upon conditions, be used. This recommendation may be slightly modified when the blank test is complete.

Selection to obtain new strains of millet is in progress at Kaifeng, Yenching, Cheeloo, Taiku and Nansuchow. In the work at Kaifeng four strains have already proven to be outstanding. One of these should be ready for distribution within one or two years. The most elaborate tests with millet are those conducted at the Yenching station where 5849 selections were under test in 1931. Three of these strains in 1931 gave a gain over the standard variety of from 28 to 34 per cent. Additional selections were made at Yenching in 1931. It seems certain that a superior strain will soon be available from the work of this station. No significant results are yet available from the work with millet at Cheeloo, Taiku, and Nansuchow but with the experiments that are in progress, new strains should be obtained at each of these stations within the next few years.

#### Corn.

The corn breeding program at Nanking was started by Dean Reisner when he first went there in 1914. The method of selection was practiced and as a result the strain known as Nanking Yellow was obtained and distributed, as mentioned earlier in this report. During the following years this strain was maintained but no further efforts at corn breeding were attempted until 1930. At that time Dr. Wiggans\* prepared a corn-breeding project for central and northern China, based upon the newer method of corn breeding that is now universally used in the United States, to be conducted at Nanking and at Tungchow. To quote from Dr. Wiggans' report:—

"The work for 1930 included (1) the establishing of a large number of lines of corn by the inbreeding method from 868 individual ears of corn collected from many localities in China and from many varieties and strains introduced from the United States, (2) the testing of 35 varieties, 30 double crosses, 11 single crosses, and 6 varietal crosses from the United States for their adaptation to Chinese conditions, (3) the continuation of previously established inbred strains of doubtful purity, and (4) the testing of F<sub>1</sub>'s of native strains."

The work done under Dr. Wiggans' direction in 1930, indicated strongly that native inbred lines would have to be obtained since none of the introduced combinations proved definitely superior to the Nanking Yellow which was used as the check.

\*See—Wiggans, R. G.—Report for 1926 (unpublished).

Therefore in 1931 the selfing of 750 inbred lines of Chinese corn was continued at Nanking, while the work which was started at Tungchow in 1930 was transferred to Yenching in 1931. In the experiment at Yenching, 277 lines were selfed. This method of improving corn will undoubtedly be successful in China. It has already proven so in the United States. But it will require some years of continued selfing, followed by further years of testing of the various combinations of single, double crosses and the like, before the results can be applied and seed furnished to farmers. Possibly it will require from 10 to 12 years. Inasmuch as corn is one of the crops of minor importance, coming after wheat, kaoliang, millet, soybeans and rice, it seems that the corn breeding projects should be maintained at not more than one or two stations. The station at Yenching is admirably suited to this project, as is the main station at Nanking, and it seems reasonable to maintain this project at these two places only. Later when different combinations are ready for testing, they may be sent to some of the other stations for this purpose.

*Cotton.*

Earlier in this report, reference was made to the reorganization of the cotton project in the Department of Agronomy, made necessary by the resignation of Mr. Y. S. Chen. By special temporary arrangement the work was placed under the direct supervision of Dr. H. H. Love, with Mr. S. P. Peng in active charge of the field work.

In 1931 efforts were centered along four lines: (1) The purification of seed stocks of the three varieties, Trice, Acala and Million Dollar; (2) A collection of additional varieties for breeding purposes, consisting of 27 American varieties obtained from Arkansas, Georgia and Oklahoma and 32 varieties of Chinese cottons from the provinces of Hopei, Shantung, Kiangsu, Anhwei, Kiangsi, Chekiang, Hunan and Hupeh; (3) The increase and distribution of seed of Trice, Acala and Million Dollar; (4) Making a large number of individual selections from the stocks on hand, for the purpose of obtaining superior strains. A summary of the work for the year shows that 2834 individual selections were tested; that 300 mow of land were planted to increase seed which was distributed as soon as available without satisfying the demand; that studies were made on quality as evidenced by staple length and lint index; and that a study of correlation of characters in Acala and Trice was begun. It was also decided, since they are better adapted to these regions, to move the selection experiments with Trice to the cooperative station at Hsuehchow, and those with Million Dollar were temporarily moved to the Provincial Cotton Experiment Station

at Yuyao, Chekiang. With these changes in organization and with the new experiments in progress, the cotton work should soon regain its proper place in the Nanking Crop Improvement Program.

*Cabbage.*

In 1926 projects for the improvement of cabbage were formulated by the writer of this report and placed in charge of Mr. C. C. Kwan, an assistant in the Department of Horticulture. These projects were carried on by Mr. Kwan until he left in 1929 to take graduate work at Cornell. Since that time the cabbage projects have been inactive. However, the stock of seed of Succession, which has been used for distribution for several years, has been maintained by mass selection.

The use of the heading type of cabbage as contrasted to the Chinese form, is increasing in China. This fact was confirmed by observations from many sources in 1931. It is recommended that as soon as possible a trained plant breeder be appointed to do breeding work with cabbage and other vegetable crops. While it is preferable that this man be a member of the staff of the Department of Horticulture and that his work be maintained by that department, it is highly desirable that he work in close cooperation with the Department of Agronomy where so many other plant breeding projects are active, and where all the instruction in genetics and plant breeding is given.

**Cooperation in 1931**

Mention was made in an earlier section of this report of the cooperation between the Departments of Agronomy and Pathology at the University of Nanking and possibilities of further cooperation with other departments of the College were suggested. There are certain other special instances of cooperation, which should be recorded here, as evidence of the manner in which the Nanking Crop Improvement Program is extending its influence.

In his report for the year 1930, Dr. R. G. Wiggins referred to an agreement under which the "China Foundation for the Promotion of Education and Culture," made a grant of \$10,000 a year for a period of three years, to aid in projects on breeding and disease work by the Department of Agronomy and Pathology. This was the first aid granted by the China Foundation to the Crop Improvement Program and was evidence of the place which the program had won, in the minds of those interested in improving Chinese agriculture. In 1931, as in the previous year, the funds from this special grant were used in connection with some of the fundamental research projects, and thus made possible certain of these studies, which otherwise would have been inactive. It is to be hoped that the work accomplished will be such as to continue to merit recognition from the Foundation in this material way.

In 1931, Dean K. S. Sie of the College of Agriculture, University of Nanking, Dr. T. H. Shen of the Department of Agronomy, and the Cornell Representative served for several months on the Organization Committee appointed by the Minister of Industry of the National Government, to formulate plans for the organization of a National Bureau of Agricultural Research. A considerable amount of time and energy was devoted to service on this committee and in a survey and study of land available for a central experimental farm. The formation of such a national bureau was part of the program contemplated, when the National Government and the Provincial Governments of Kiangsu and Chekiang engaged Dr. Love for a period of three years as Agricultural Adviser. The fact that men from the staff of the College of Agriculture of the University of Nanking, a private institution, were requested to perform this important service, is evidence of the high regard for the accomplishments of the institution. It is also an excellent example of the spirit of cooperation which has always been in evidence in the development of the Nanking Program.

There was also during the last year of the formal triangular cooperation at Nanking, very close relationships with the Department of Agronomy of the College of Agriculture of National Central University, also located at Nanking. There were frequent conferences between the members of the staff of the two departments as well as the exchange of material for use in experiments. Such harmonious conditions can not be other than helpful to the full development of work.

In addition to the above, there were many other examples of cooperation, in which members of the staff at Nanking advised with representatives of National and Provincial organizations concerning problems of various kinds. In many cases, materials, particularly seeds of many kinds, were furnished by the Nanking Department of Agronomy to various institutions. A list of such materials would be of considerable length. It is not necessary to furnish it here.

To sum up in a few words, it may be said that the Nanking Crop Improvement Program has reached the stage where it commands general respect in China, and is functioning in an effective way towards improvement of agriculture not alone through its own projects but also through the influence which it has throughout the whole country.

#### GENERAL SUMMARY AND EVALUATION OF THE ACCOMPLISHMENTS OF THE COMPLETED PROJECT

The cooperative crop improvement project entered into by the University of Nanking, Cornell University and the International

Education Board, was a unique venture in the field of international education and good will, involving as it did close cooperation between two well established educational institutions, far removed from each other in time and conditions, and a large philanthropic organization. The ultimate object in view was to promote the general program of famine prevention in China, a country that has experienced 2000 famines within the last 2200 years.

Each of the three cooperating agencies has made its contribution to the project, financial or otherwise. The largest expenditure of funds was made by the University of Nanking, from the funds allocated to it for famine prevention work by the China Famine Fund Committee. All the necessary traveling expenses and the entire maintenance of the project, including the major portion of salaries paid to the staff in China have been supplied by the University of Nanking. The International Education Board contributed financially by paying the salaries of the Cornell Representatives, when special leaves of absence without pay were necessary, and by the grant of a scholarship to Dr. Shen. Cornell University made a direct contribution in the salaries of its representatives when on sabbatic leave, and an indirect but nevertheless noteworthy contribution in granting special leaves of absence, when sabbatic leaves were not due.

The project had two direct objectives (1) to reorganize and develop crop improvement work at the University of Nanking, and (2) to provide special training for men engaged in plant breeding in China. A brief summary of the accomplishments along the lines of these two objectives is in order.

#### In the Field of Plant Breeding

As a result of the undertaking there is now established on a permanent basis at the University of Nanking and at the cooperative stations, a program of crop improvement, which in organization and scope ranks among the largest of such programs anywhere to be found. The territory covered includes most of the northeastern provinces of China. Effective work is now in progress with all the more important crops of this region and as time goes on other crops will be added. A splendid spirit and policy of cooperation between departments and between institutions adds to the efficiency with which work is being done. Established methods of plant breeding have been adopted wherever possible and, where it was necessary, new methods have been devised. Significant contributions have been made in methodology. Already superior strains of wheat, soybeans, kaoliang, millet and rice have been obtained and are ready for distribution. A comprehensive plan of seed

distribution for the whole project has been outlined and a specially trained man placed in charge of this phase of the program. In short, the progress made in the attainment toward the first objective has been remarkable considering the relatively short period of time involved and is most gratifying to all who have been engaged in the work.

#### Training of Specialists

The success attained in the training of Chinese workers in the field of genetics and plant breeding has also been outstanding. This was accomplished by (1) instruction in regularly scheduled courses at the University of Nanking, given by each of the Cornell Representatives; (2) in the four special Summer Institutes of Crop Improvement; (3) by numerous conferences with individuals on specific problems and (4) by actual contact with the work involved in the prosecution of the projects at Nanking, the cooperative stations and at other institutions. As a result of all of these endeavors, rapid and significant advance was made in the training of men, not only those who were connected with the Nanking Program but also many others from governmental and private institutions. This has had a strong and favorable influence upon plant breeding throughout the whole of China. Indeed, there has been a world wide interest in the project. One of the significant results has been the stimulation of Chinese students to the recognition of need for further graduate training and as a result a considerable number of these have gone abroad to study for advanced degrees.

#### Development of Projects by Governmental Agencies

The success and accomplishments of the Nanking Project have challenged the interest of various governmental agencies in China. One significant result was a plan for the development of a project along similar lines by the National Ministry of Agriculture and the provincial governments of Kiangsu and Chekiang. Dr. H. H. Love was invited to be the technical leader of this project. He was granted a leave of absence for three years by Cornell University to enable him to assume this duty. In the development of this scheme, the University of Nanking is being used as a training center for experts. Under Dr. Love's direction the work of National and Provincial experiment stations in these provinces is being reorganized, coordinated and placed upon a more efficient basis.

Another significant fact is the demand made by governmental institutions upon the University of Nanking to furnish graduates, specially trained in Plant Breeding. Many Nanking graduates now

hold important positions in other institutions. But the demand is not yet met, for each year the University receives more requests than can be supplied.

Members of the staff of the Department of Agronomy at Nanking are also frequently called upon for important committee or other advisory service by governmental institutions. Following the disastrous flood of 1931, Mr. C. M. Heh, was drafted by the National Flood Relief Commission to make a study and report on the problem of supplying seed to farmers in the devastated areas, a task of considerable magnitude, since it was reliably estimated that a rural population of twenty-five million was affected.

The breadth of view of the administrative officials of the University of Nanking is evidenced by their willingness to permit members of the staff to perform these important services for so many different institutions. No reasonable request has been refused.

#### CONCLUSION

Recommendations with respect to specific points have been made in the preceding pages of this report under the different headings. Making recommendations in this way should be more effective than to collect them and present them in a separate section, entirely removed from the subject matter to which they apply.

However, a general recommendation or suggestion seems entirely in place at this point. In the face of the evidence, it must be granted that the Nanking Cooperative Crop Improvement Program has been a very successful accomplishment. But it applies to a relatively limited field in the scheme of agricultural improvement in China, considered as a whole. Other similar projects with the same or kindred institutions should be developed in such fields as Soil Science, Plant Pathology, Entomology, Poultry, Horticulture, Nutrition and the like, not only in China but in other countries where improved agriculture is unknown or only poorly developed. The promotion of such projects should be of interest to philanthropic and welfare organizations whose resources and contacts point them out as the logical agencies for the initiation, organization and support of such programs. But regardless of whether or not the Nanking Cooperative Crop Improvement Program may serve as a pioneer example for other similar enterprises, its accomplishments have already fully justified all the time, effort and money that have gone into it.

#### ACKNOWLEDGMENTS

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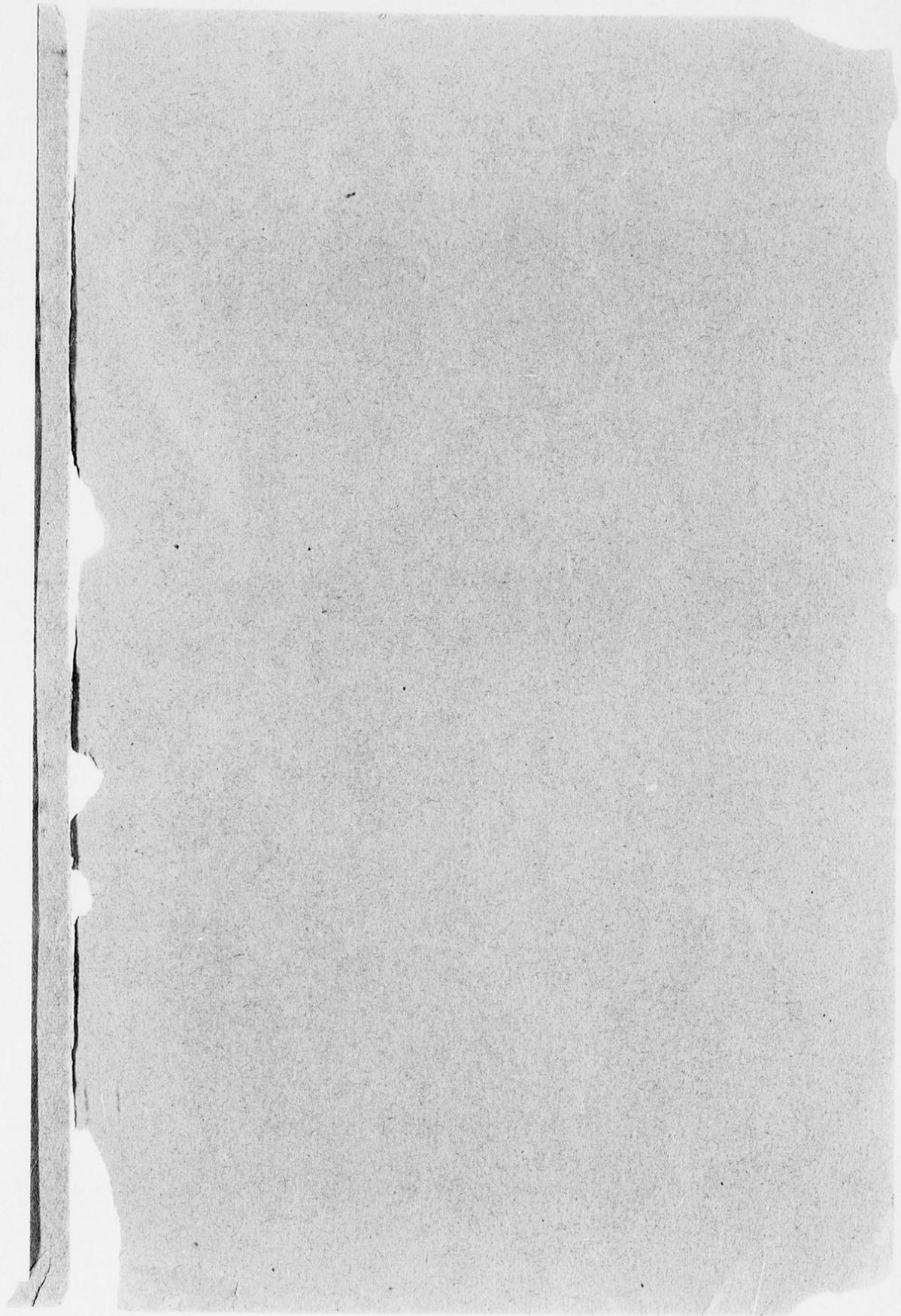
- The International Educational Board and its successor, the General Education Board, New York City.
- The University of Nanking, Nanking, China.
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- Dr. Y. G. Chen, President, University of Nanking.
- Dr. Livingston Farrand, President, Cornell University.
- Dr. A. R. Mann, Provost, Cornell University.
- Mr. J. H. Reisner, former Dean, College of Agriculture and Forestry, University of Nanking.
- Mr. T. S. Kuo, former Dean, College of Agriculture and Forestry, University of Nanking.
- Dean K. S. Sie, College of Agriculture and Forestry, University of Nanking.
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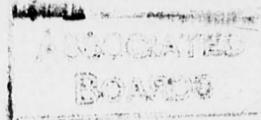
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IMPROVED VARIETIES DEVELOPED  
through the  
COOPERATIVE CROP IMPROVEMENT PROJECT  
of the  
UNIVERSITY OF NANKING

Agronomy Department  
and  
Cooperative Stations



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

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**IMPROVED VARIETIES DEVELOPED**  
through the  
**COOPERATIVE CROP IMPROVEMENT PROJECT**  
of the  
**UNIVERSITY OF NANKING**

**INTRODUCTION**

H. H. LOVE

One of the first projects in agricultural improvement undertaken by the College of Agriculture of the University of Nanking was that of crop improvement, or plant breeding, which has as its aim the development of better varieties of crops for the farmers' use. When Dean John H. Reisner first came to the College of Agriculture, he was interested in crop improvement work and started investigations. From the experiments started in those early years by Dean Reisner, Nanking No. 26 wheat and Nanking yellow corn have developed. His administrative duties, however, soon demanded most of his time and he was not able, personally, to superintend the investigations, but they were continued by Mr. George E. Ritchey, Head of the Department of Agronomy. As Dean Reisner was interested in seeing this work develop, he encouraged the Department of Agronomy to make it one of its major projects.

In 1924 it was decided to enlarge this project, and Dean Reisner took up the problem of how to develop the crop improvement work on a more extensive scale. As a result of his deliberations and correspondence with Cornell University, a cooperative project in crop improvement was developed. The International Education Board, then one of the Rockefeller Boards, was asked to cooperate and accepted the invitation to aid in a five year program. The program that finally developed was a cooperative program with the University of Nanking, the International Education Board, and Cornell University. Cornell University was to release for service in China members of its staff to direct the work, and the International Education Board and University of Nanking were to give financial support.

Beginning with 1925, the work in crop improvement was much enlarged and, in addition to the work that was already being conducted on the land of the University of Nanking, cooperation was sought with a number of agencies. In the beginning this cooperation was limited to certain of the mission institutions where agricultural missionaries were stationed. Later, however, the cooperation extended to Government and other agencies so that at the present time, there are eight cooperative stations for breeding work situated in seven provinces and six stations in two provinces for regional testing only.

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The reason for enlarging this project is that crops must be developed for particular regions or environments. That is, it is not possible to develop a wheat variety at Nanking and expect this variety to perform well in all other wheat-growing regions of China. Soil and climatic factors are such that varieties must be adapted to them, and, in order to secure the most effective results, it was planned to have a large number of cooperative stations, each station concentrating its efforts on the crops most important in its region. In this way it is possible to accomplish more than by concentrating at one station and a wide area of China can be reached in a short time.

The methods for crop improvement work were standardized, and each station was requested to follow the most approved methods for breeding and testing the various crops. The result of this large project is that thousands of individual selections of different crops have been made from farmers' fields and these have been compared under uniform conditions.

In addition to these selections, seeds of some foreign varieties have also been obtained and compared under Chinese conditions. The results of testing these foreign types indicate that, for most crops, it seems best to concentrate on improving the Chinese varieties. One exception to this is cotton, since it is possible to obtain foreign varieties of cotton that are more promising for certain regions than Chinese varieties. In the case of wheat, one foreign variety has been found which gives a satisfactory yield but which is too late to fit into the cropping system followed by the Chinese farmer.

The comparison of these different selections and varieties must be done in a very careful manner. It is not sufficient to have one small plot of one variety and one of another and make comparisons this way, but it is necessary to have several plots of each variety all tested under as uniform conditions as possible so that every strain may have an opportunity to develop to its fullest capacity. Since one begins this work with hundreds or even thousands of selections, it means that each year the poorer ones are discarded and only the better ones kept. By gradually eliminating the poorer ones, a few strains have been obtained which give better results than the farmers' varieties.

The process of crop improvement through the methods of plant breeding is a slow one. There are no short cuts, and the work cannot be hurried. It takes several years to develop and test a new variety, because it is important that recommendations be based on fact rather than on opinion. The work has now been under way for a long enough period so that a number of improved strains of crops have already been obtained and other promising strains are under test. Crop improvement work is a continuous process in that, while new strains may be developed that are an improvement over the farmers' varieties, it is possible to develop even better strains either from the standpoint of yield or other characters. In this work of crop improvement, yield has been of special

importance but attention has also been given to other factors, such as disease resistance, insect resistance, stiffness of straw, the problem of the shattering of grain due to storm, and other characters that make for a good plant.

A number of men have been associated with these investigations and have worked very faithfully to bring about these results. It is not possible here to name all these men, but their services have made possible the development of new varieties. The improvement work that is under way at the present time is confined to wheat, rice, barley, cotton, corn, soybean, kaoliang, and millet. As already stated, a number of improved strains have resulted from the experiments.

It will be seen that the new varieties of crops described here have given such satisfactory performance that it is important that seed be multiplied and distributed to the farmers as rapidly as possible. This is a very important phase in any crop improvement program, and the University of Nanking is organizing this work on a sound basis so that the seed will not be wasted but will be distributed in such a way that the most good may result.

Mr. C. M. Heh, who has given special study of this phase of crop improvement work, is in charge of the seed multiplication program and has already made considerable progress in connection with the methods to be used for multiplying and distributing these seeds to the farmers.

From the standpoint of the farmer, the improvement that may come about as the result of crop improvement offer him the cheapest means of obtaining larger yields, since he is not required to buy large amounts of fertilizer. There is the initial cost of purchasing the improved seed and then a small additional cost for the fertilizer that is necessary to make up for the fertility taken out of the soil due to the larger yield. For this economic advantage it is very important that the program of crop improvement be continued and expanded until all the important crops of China are receiving attention, and then organizations of farmers' cooperatives must be developed so that in time large areas will be sown to improved varieties.

These improved strains have been described, and a record of their performance has been given by the project leader in charge of the particular crop or station. These descriptions may be found in the following pages.

#### AN IMPROVED VARIETY OF WHEAT—NANKING 2905

T. H. SHEN

*Head of the Agronomy Department*

**History.** Since 1925, the program of wheat breeding at the University of Nanking has consisted of head selections from farmers' fields, the introduction of varieties from different provinces and from foreign countries, and the development of new varieties by hybridization.

Special emphasis was first placed upon selection and introduction in order to study the material already in use. During the last few years, our attention has been chiefly directed to hybridization with the hope of synthesizing the desirable characters in different varieties into a new strain.

Nanking 2905, a new improved variety, originated from a single head selection in 1925 and has been under test since that year. The selection made in 1925 consisted of 4529 heads from the fields in the vicinity of Nanking, Wuchang, Nanhsuchow, Yihsien and Weihsien. Although the source of the head number 2905 is unknown, it probably came from the vicinity of Nanking. It matures a week earlier than the common varieties at Nanking. Conservatively speaking, this variety yields 25 percent more than Nanking 26 and about 32 percent more than the farmers' varieties. The actual yields in the rod-row tests at the Taipingmen farm for 1927-1933 are shown in Table 1.

**Table 1. The yield comparison of Nanking 2905 wheat with Nanking 26 in catties per mow.**

(1 catty=500 grams and 1 mow=666.67 square meters)

Year	Actual yield†	Gain over No. 26
1927*	(322)	(140)
1928	221	65
1929*	(401)	(202)
1930	307	73
1931	176	-4
1932	211	58
1933	213	32
<b>Average</b>	<b>226</b>	<b>45 = 24.9%</b>

Mr. C. M. Heh is in charge of the regional tests of wheat. He conducted advanced tests with a number of improved strains, using as checks the best local varieties at Kaifeng, Hsuechow, Tsinan, Yihsien, Nanhsuchow,—north of the Yangtze River—and Hwangsu, Changchow, Wusih, Hwangtu, Hangchow,—south of the Yangtze—in 1932 and 1933.

\*The average yield for Nanking 2905 is based on the data of 1928, 1930, 1931, 1932 and 1933. The yield data in 1927 and 1929 are excluded because that from 1927 was based on the two-rod-row test which is only preliminary, and in 1929 the yield of Nanking 26 was unusually low, owing to a poor stand and should not be compared with Nanking 2905 for that year. Excluding these two highest yields, the average yield of Nanking 2905 is 226 catties per mow which is a gain of 45 catties or 24.9 percent over Nanking 26.

†The reader may question why the actual yield of the variety is not very high. This is because the soil of the experimental field is typical of the Nanking region and its fertility is slightly lower than that of the normal field.

In addition, regional tests were also conducted at Sian and Wuchang in 1934. A complete report of these tests will be published in the Journal of the Agricultural Society of China. In general, Nanking 2905 yielded less than Nanhsuchow 61 at Nanhsuchow, less than Kaifeng 124 at Kaifeng, and less than Red Awn at Hsuechow, but considerably more than the best local varieties at the stations in the Yangtze Valley. This means that Nanking 2905 is the best variety known at present for use in the Yangtze Valley from Wuchang to Hangchow.

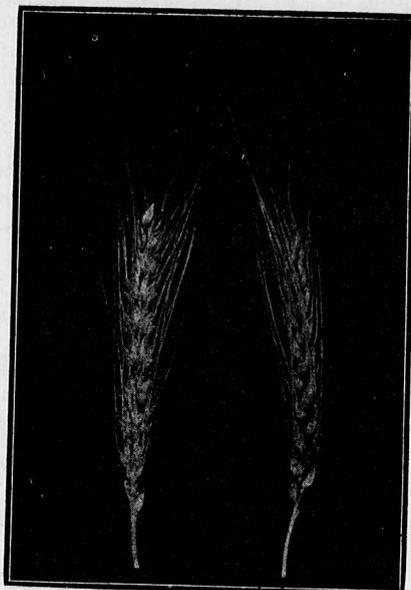
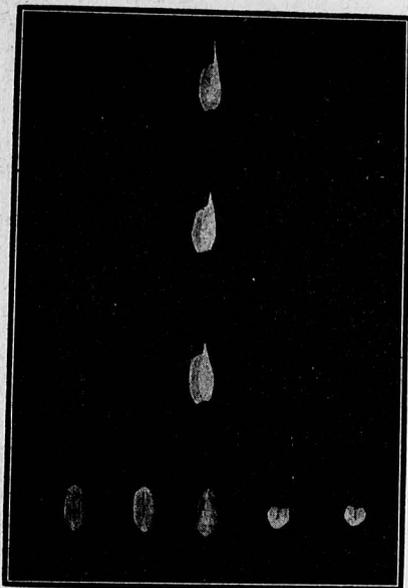
**Characteristics.** Besides being a heavy yielder, Nanking 2905 matures from five to seven days earlier than Nanking 26 and the local varieties at Nanking, and shows only a trace of loose smut under field conditions. In 1934, when loose smut was abundant at Nanking, this variety showed less than one percent of smut. The Plant Pathology Division of the College of Agriculture of the University of Nanking conducted the flag smut test with Nanking 2905 and a few other promising varieties in 1931 and 1932. Nanking 2905 showed only 0.3 percent smut in 1931 and 0.7 percent in 1932. Another desirable characteristic is its stiff straw which stands the wind very well.

**Germination tests.** As the rainy season usually starts at the beginning of June in the Yangtze Valley which is the harvesting and threshing season, the wheat grains of the local varieties are often damaged because the moisture causes rapid germination either before or after threshing. A germination test was conducted with the mature heads of thirteen leading varieties during the middle of June, 1934, and with their threshed grains in the middle of July. After the heads were exposed to moist conditions for twenty four days, only 5 percent of the kernels of Nanking 2905 germinated, while 93 percent of Nanking 26 germinated. In the case of germination of the threshed grains, no single kernel of Nanking 2905 germinated after two days under moist conditions, whereas Nanking 26 showed 78 percent of the kernels germinating. After ten days under moist conditions, 81 percent of the kernels of Nanking 2905 germinated while 99 percent if the kernels of Nanking 26 germinated.

Although these are the results of only one year's test and a further test is needed before drawing final conclusions, the agreement of the results from the two tests on germination indicates strongly that Nanking 2905 has a much slower rate of germination and is less damaged by rain during harvesting and storage. The difference in the rate of germination of the two varieties seems to be due partly at least to the fact that the grain of Nanking 26 is softer than that of Nanking 2905.

**Description of plant.** Plant midtall; stem white and fairly stiff; spike midlong; awn, oblong, lax, erect; spikelet usually with three grains; glume glabrous, white, short; shoulder midwide, rounded; beaks acuminate, about 3 mm. long; kernels red, midlong, ovate; crease middeep with plump seed and midwide with shrunken seed; cheek rounded with plump

seed; brush midsized. The type of head, chaff and kernel of Nanking 2905 is shown in the following pictures.



#### KAIFENG 124 (SALLEE)—AN IMPROVED VARIETY OF WHEAT

R. V. PIH

*Cooperative Station at Kaifeng*

**History.** Wheat No. 124 came from a head selection made at Laoyang, and has been under test from 1926 to 1933 at Kaifeng under the breeding method suggested by Dr. H. H. Love during his first visit to China in 1925. In 1926, wheat No. 124 was put into the ten-rod-row test and yielded at first slightly lower than the check. The following year it remained in the same test, but this time it showed an enormous gain over the check. Hence in 1928 it was promoted to the advanced test and continued in the same test for five years. It showed a constant though varying gain over the check every year. In the advanced test of 1932, wheat No. 124 was compared with two ordinary farmers' varieties and showed a gain of 17.4 percent over the farmers' varieties.

Dr. W. Eugene Sallee, a pastor of the Southern Baptist Mission, started the Agricultural Experiment Station at Kaifeng, giving liberally of his time, energy, and money. Unfortunately Dr. Sallee died two years ago and his death has been a great loss to the agricultural work as well as to the work in which he was engaged. The University of Nanking officially instructed the Agricultural Experiment Station to give wheat No. 124 the name of "Sallee Wheat" in memory of Dr. Sallee.

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**Characteristics.** Kaifeng 124 has given very satisfactory results in field tests. It possesses a stiff straw and is, therefore, able to withstand the dust storms which occur very frequently in Kaifeng, causing considerable damage to crops with weak straw. The plants are tall and bear large heads with smooth white chaff, and the seeds are very hard and golden-reddish in color. The quality of seed is fairly good, and they are sold in the market at a high price.

Kaifeng 124 has been tested for quality by the Shanghai Food Association. Following is the statement given out by the Association: "Hard wheat, good, glutinous; 30 percent can be used at Shanghai. Suitable for making flour noodles in the North."

**Table 2. Results of the Tests of Kaifeng 124 Wheat**

Year	Yield in catties per mow			
	Actual Yield	Check Yield	Gain over check	Gain in %
1926	193.5	205.2	-11.7	-5.7
1927	376.2	265.5	110.7	41.7
1928	176.4	153.9	22.5	14.6
1929	131.4	117.9	13.5	11.4
1930	210.6	199.8	10.8	5.4
1931	284.4	283.5	.9	.3
1922	297.9	259.2	38.7	14.9
<b>Average</b>	238.6	212.1	26.5	12.5

**Table 3. Results of Comparison with Farmers' Varieties, 1932**

Variety	Yield in catties per mow
No. 124	332.91
Farmers' varieties	233.59

### NANHSUCHOW 61—AN IMPROVED VARIETY OF WHEAT

L. Y. MA

*Cooperative Station at Nansuchow*

**History.** Wheat No. 61 was brought to Nansuchow by Dr. J. Lossing Buck. It was originally one of Dean J. H. Reisner's selections from Lungtan, Nanking. The strain was put under test for several years and, after the Nansuchow Agricultural Department had found it to be promising, the seed was multiplied. Since 1925 it has been used by the Department for variety tests of wheat.

**Characteristics.** Nanhsuchow 61 wheat is a red-kerneled, medium-hard winter wheat with brown awns and chaff. It produces club-like heads. Under the conditions at Nanhsuchow this wheat grows to a good height, often approaching four feet; and the heads are large sized, producing forty to sixty kernels. The straw is thick and stiff, highly resistant to lodging. The time required for ripening is between 210 and 220 days, and is considered one of the early varieties of wheat in this region. It is resistant to rust, smut, and especially to nematode. Above all, it is a good yielder as shown by the comparative yield data below.

**Table 4. Yield data of Nanhsuchow 61 wheat as compared with Nanhsuchow 6 wheat, the variety formerly distributed.**

(every yield is calculated from the average yield of 10 evenly distributed plots of three 16-foot rows each)

Year	Yield of No. 61 (Bu. per acre)	Yield of No. 6 (Bu. per acre)	Gain
1926-27	53.4	48.5	4.9
1927-28	32.9	33.4	-0.5
1928-29	45.7	32.0	13.7
1929-30	24.6	21.1	3.5
1930-31	50.1	41.9	8.2
1931-32	26.5	29.4	-2.9
1932-33	26.4	25.8	0.6
<b>Average</b>	<b>37.1</b>	<b>33.2</b>	<b>3.9(11.75%)</b>

According to the above seven years' data, Nanhsuchow 61 wheat gave an average gain of 319 bushels per acre over Nanhsuchow 6, the variety formerly distributed, or 11.75 percent higher yield.

**Table 5. Yield data of Nanhsuchow 61 wheat in comparison with farmers' varieties.**

(every yield is calculated from the average yield of 10 evenly distributed plots of three 16-foot rows each)

Year	Yield of No. 61 (Bu. per acre)	Yield of farmer's variety (Bu. per acre)	Gain
1929-30	29.1	20.6	8.5
1931-32	26.5	18.9	7.6
1932-33	25.7	24.1	1.6
<b>Average</b>	<b>27.1</b>	<b>21.2</b>	<b>5.9 (27.83%)</b>

According to the three years' records above, Nanhsuchow 61 yields 5.9 bushels per acre more than the farmers' variety, or 27.83 percent higher yield.

**Extension.** During the past few years thousands of cattles of Nanhsuchow 61 seed were distributed to farmers in Nanhsuchow and in near-by counties (hsien), but no definite rules for handling the seed were followed. However, the seed was distributed with the understanding that the farmers would within a year or two furnish the pure seed they produced to neighboring farmers in their own or nearby villages, either on an exchange basis or at some fixed price. Last fall members of the Nanhsuchow Agricultural Department held a conference with Professor C. M. Heh of the University. It was decided that the Nanhsuchow Agricultural Department would adopt the following regulations in connection with the distribution of improved pure seed.

1. The farmers who receive the improved seed should rogue their seed plots before harvesting in order to maintain a high degree of purity.

2. These farmers should guarantee that, for a period of two or three years, they will supply their certified pure seed to other farmers in their own localities, either on an exchange basis or at some fixed price to be agreed upon.

Other regulations may be added whenever the Nanhsuchow Agricultural Department and the Agronomy Department of the University deem it necessary.

### KAIFENG 313—AN IMPROVED VARIETY OF BARLEY

R. V. PIH

*Cooperative Station at Kaifeng*

**History.** The barley experiment has been conducted at the Kaifeng Experiment Station since 1926, using the breeding methods suggested by Dr. H. H. Love on his first visit to China in 1925. In 1926, barley No. 313 was put into the ten-rod-row test, and the test was repeated the following year with exactly the same number of strains. In 1928, barley No. 313 was promoted to the advanced test and continued in the same test for five years. In 1929, the test was spoiled by drought and practically no result was obtained. In 1932 barley No. 313 was used as a check for comparison with the ordinary varieties of farmers. The source of improved barley No. 313 cannot be traced.

**Characteristics.** Kaifeng 313 barley yields on an average slightly more than the other strains and the check, and is very resistant to covered smut. The plants are tall and possess a stiff straw which is of great importance in a region like Kaifeng where the rainfall is very scarce and dust storms occur frequently. The heads of the plant do not hang down at maturity when every spikelet is filled with grains. The time of maturity and the size of head and kernel are about the same as the farmers' varieties. The quality of the kernel, which is yellowish-white in color, is good. Seed is sold in the market at a fairly high price.

Table 6. Results of the Test of Kaifeng 313 Barley

Year	Yield in Catties Per Mow			
	Actual yield	Check yield	Gain over check	Gain in %
1926	179.62	173.53	6.09	3.51
1927	305.83	250.46	55.37	22.11
1928	308.70	303.80	4.90	1.61
1930	231.15	231.56	2.59	1.12
1931	304.57	283.01	21.56	7.62
Average	266.57	248.47	18.10	7.28

Table 7. Results of Comparison with Farmers' Varieties, 1932\*

Variety	Yield in catties per mow
No. 313	308.59
Farmers' varieties	254.44

## AN IMPROVED STRAIN OF SOYBEAN—NANKSOY 332

SHEO WANG

*Agronomy Department, Nanking*

**History.** The soybean improvement project of the Department of Agronomy has been under way for about ten years. The work was begun in 1923. During that year Professor George E. Ritchey collected about sixty varieties of soybean from different parts of Shantung, Honan, Hopei, and Shansi provinces. These were planted on the University farm in the spring of 1924, but none of them proved to be adapted to the climate of Nanking as most of them died before blooming. In the fall of 1924, the writer began to make individual plant selections of soybean from the University farms and from the farmers' fields in the vicinity of Nanking. There were 407 individual plants selected, and the plant characters of these were studied.

These individual selections were planted in a plant-to-row test on the Taipingmen farm in the middle of June, 1925. The rows were fourteen feet long and two feet apart. The seeds were spaced every three inches in the row and a check was planted in every tenth row. The check variety was an ordinary variety secured from a farmer in the vicinity of the Taipingmen farm.

\*In the test of 1932 barley No. 313 was used as the check.

In the fall of 1925, 127 individual rows were selected by observation from the plant-to-row series for a further test, following the general procedure outlined by Dr. H. H. Love.

In the fall of 1925, a large number of individual plants were selected in the vicinity of Nanking and of the cooperative stations by staff members at each station. As a result of the plant-to-row test of 1926, it was found that most of the plants selected from the northern part of this country were not adapted to the climatic conditions of Nanking. In the fall of 1930, new selections were made in Changchow, Tanyang Chinkiang, Wuhu, Hochow, Tsuchow, Wui, Pukow and in the vicinity of Nanking by members of the Department.

**Improved Strain.** From the individual plant selections of 1924 a new improved strain of soybean has been obtained. This strain is now named Nanksoy 332, and yields about 45 percent more than the check according to the results of several years' comparative tests. The results of the testing of Nanksoy 332 are summarized in the following table.

Table 8.

Year	Yield in catties* per mow†	
	Actual yield	Gain over check
1926	153.0	72.0
1927	182.7	50.4
1928	116.1	30.6
1930	103.5	37.8
1931	109.8	14.4

\* One catty = 500 grams

† One mow =  $\frac{1}{6}$  acre.

Since 1932, Nanksoy 332 has been used in the experiment as the check variety instead of the former check, so the yield for the years since then have not been included in the above table.

Nanksoy 332 was tested in various places in 1933. One test was conducted at Swenhwachen near Nanking by the Nanking Theological Seminary. The results reported are as follows:

Table 9.

Variety	Yield in catties per mow	
	Seeds	Straw
Farmers'	155.8	298.6
Nanksoy 332	284.6	238.3

The yield of Nanksoy 332 is 80 percent higher than that of the local farmers' variety. In addition to the large gain in yield, Nanksoy 332 matures seven or eight days earlier than the varieties in use. Early maturity is one of the desirable characters of soybean, because after the harvest of the soybean crop, the farmers need time to prepare the land for sowing wheat.

Another test was conducted in 1933 at Hsuyuin, about fifty miles east of Nanking, by Mr. T. S. Chang. The results of this test are as follows:

Table 10.

Variety	Yield in catties per mow
Farmers'	91.0
Nanksoy 332	173.6

Nanksoy 332 yielded about 90 percent more than the farmers' variety, and at the same time it matures earlier than the farmers' variety.

Nanksoy 332 was tested at a number of other places but the results are not sufficiently accurate to be reported here. However, all the experimenters reported that Nanksoy 332 gave better results than their own varieties.

**Description.** Plant, medium high; compact and bushy form with bright brown pubescence; purple flowers; yellow colored medium sized seeds with dark purple hilum; medium early maturity. The type of plant is shown in the figure.

In the fall of 1924, the mother plant of Nanksoy 332 was selected by the writer from a farmer's field at the foot of Tsingfenshan outside Hopingmen, Nanking. This variety was multiplied during the 1933 season and distributed to farmers near Nanking during 1934.

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**ACCLIMATIZED VARIETIES OF COTTON—TRICE AND ACALA**

S. P. PENG

*Agronomy Department, Nanking*

**History.** During the World War the cotton industry of China was given an opportunity to expand on account of the decreased world supply of cotton goods. On the other hand, the cotton mills found that the cotton produced inland did not meet their needs, either as to quantity or quality, so the improvement of cotton became of fundamental importance to the future of the cotton industry.

Since 1915, the University of Nanking has undertaken experiments in cotton growing, particularly with reference to the introduction of American cotton, and has demonstrated the practicability of growing American cotton in the vicinity of Nanking. Recognizing the importance of the cotton industry, the University has given much attention to the question of improved varieties. In 1919 a number of standard sets of cotton seed, representing widely different types of American grown cotton, were obtained from the United States Department of Agriculture, and variety tests were conducted in twenty-six centers, largely mission stations, in Chekiang, Kiangsu, Kiangsi, Anhwei, Hopei, Honan, Hupeh, and Hunan provinces. This provided material for observation regarding the suitability for cultivation in China of certain American varieties and has been used as the basis for the work subsequently undertaken by the University.

During the year, 1919, Dr. O. F. Cook, a cotton specialist with the United States Department of Agriculture, and Mr. J. B. Griffing, the head of the cotton work at the University, made a study in China on the behavior of both American and native cotton and on cotton problems in general. Some of their conclusions were as follows.

1. "Trice" and "Acala", two acclimatized varieties, were fairly encouraging in the regions away from the coast and toward the North.
2. The superior strains of Chinese cotton in the lower Yangtze Valley indicate that there are great possibilities of improvement of the native stock.

With this in mind the University started a three-year program in 1920 in cooperation with the foreign cotton mill owners in Shanghai, and concentrated on the following two lines of work:

1. The acclimatization of American types of cotton.
2. The development of improved strains of native cotton.

Of the acclimatized strains, Acala and Trice, the latter was found to be especially good in the North because of its early maturity. The distribution of these acclimatized strains started in 1923.

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**Description.** Trice—Plants are from 2 to 5 feet high, frequently with a few basal limbs; very prolific; fruiting branches numerous, medium length, and short-jointed; leaves large size, light-green; bolls large, ovate, often angular, 3-5 locked; seeds large, covered with brownish tuft; 70-80 bolls per pound; 3,600 seeds per pound; fiber of fair quality; staple 1 to 1½ inches in length; 31 to 33 percent lint. Adapted to the North.

**Acala**—Plants are larger than Trice, with strong, erect main stem and few vegetative limbs; fruiting branches longer jointed than Trice; lower branches long; upper branches short; leaves large size, dark green; bolls larger than Trice, ovate, with short, blunt points; burrs often pendant, storm-proof; 50-55 bolls per pound; lint 1⅛ to 1¼ inches long; staple extra strong with good drag; 32 to 35 percent lint; earlier maturity than Trice.

**Quality of cotton.** The Bureau of Testing and Inspection of Commercial Commodities at Shanghai gave the following report in 1933 on the quality of these varieties:

Variety	Staple length	No. of twistings per inch	Strength of fiber	Width of fiber
Acala	1½ in.	72.4294	4.433 g.	.000789
Trice	1 in.	84.4198	4.510 g.	.000818

These varieties are superior to native cotton which has a staple three-fourths or seven-eighths of an inch in length and has fewer twistings in each unit of length.

**Yield.** Trice and Acala yield about two hundred pounds, or one hundred eighty catties of seed cotton per mow when grown on good land. Their yield is much higher than that of native cotton according to the tests on the University farm. Some native cotton in other regions may yield as well as the improved strains, but in most cases the quality is inferior.

**Extension.** Since 1923 the University has been distributing the improved seed to farmers directly or through various agencies, such as agricultural experiment stations and agricultural schools. More than a hundred piculs (100 catties per picul) of improved seed have been distributed each year, but the supply is inadequate for the demand. The University has now chosen Wukiang, Anhwei, as the center for the distribution of Acala seed; and Tinghsien, Hopei, and Sian, Shensi, as centers for Trice. It is hoped that in time the demand for improved seed can be met.

### "MILLION DOLLAR"—AN IMPROVED VARIETY OF NATIVE COTTON

Y. S. CHEN

*Agronomy Department, Nanking*

**History.** The "Million Dollar" variety was developed from a boll found in a farmer's field near Woosung, Shanghai by Mr. J. B. Griffing in the fall of 1919. Chinese farmers pick their cotton frequently, and this was the only boll left unpicked on the plant. Although the boll was four-locked, only three locks of cotton with a total of twenty one seeds were obtained. The same year more than a thousand other specimens from individual plants were selected from different places. These selections were given careful laboratory study and three hundred of the most promising were planted in the spring of 1920 in a large breeding plot. Here the plants of each progeny were kept from crossing by covering all the blossoms with paper bags. Of all the progenies so grown, three gave great promise from the standpoint of both yield and quality, and their seed was carefully multiplied in isolated fields in 1921. The most promising of the three proved to be the one given the name "Million Dollar" by the students.

**Characteristics.** Million Dollar is of pure Chinese stock and neither related to or easily crossed with American cotton. The plant is unusually large for Chinese cotton, with an abundance of red coloration especially on the stem and at the base of the leaves. The flowers are large and yellow with purple spots near the base of the petals. The bolls are much larger than those of common Chinese cotton, with many of them four-locked and some even five-locked. The seed is large, white and fuzzy. The lint is very white and strong with a staple of over an inch in length. The plant is more resistant to "Cytosis" and other diseases than common types of Chinese cotton and much more resistant than American cottons. This variety is especially adapted to the delta regions of the lower Yangtze Valley and to the coastal regions of Chekiang Province.

**Results of the Spinning Tests.** In 1923, a sample of Million Dollar lint was examined by an expert sampler and broker in Shanghai and was pronounced equal in value to standard American cotton. Samples were also sent that year to cotton mills in Shanghai for a spinning test. The following extract from the report of the spinning department of one of the mills making the test indicates the value of this variety.

"This cotton surpasses ordinary Chinese cotton in texture, length, quality, and color, and is able to spin much finer counts with increased draft. Revolutions of the front roller and of the spindles were greatly increased. We are confident that, if it were possible to use only this one quality of cotton, it would reduce the cost of labor fifty percent.

"Having spun samples of 14 count warp and 17 count weft for weaving, and 20's, 28's, 32's, 36's and 42's for reeling, we conclude that

32's could be spun commercially and profitably and would not recommend finer counts than 32, being confident that this would hold its own second to none if put on the market."

The complete report of the three mills making this test contains many more details of interest and serves to verify further the merits of this improved variety. This report can be seen in the office of Mr. R. J. McNicol of the Mill Department of Messrs. Jardine, Matheson and Company, Limited, Shanghai.

**Extension.** Through the efforts of the Extension Department of the College, seed of this variety has been extended to different parts of China either through orders or by demonstration. Million Dollar cotton was first extended by the writer to Chekiang Province in the districts of Yuyao in 1924. Improved seed of this variety was distributed to farmers for comparison with native cottons. Because there was no definite place for demonstration and no organized method of controlling the tests, the results obtained were not reliable, and conflicting reports were obtained from farmers, some stating that the new variety gave a higher yield, and others that although the fibre was longer, the yield was not so good. This variety was also tested in some parts of Hupeh and Kiangsi Provinces, and reports from these two provinces were favorable. It is now also being extended in regions near Shanghai by the Department of Industries of the Kiangsu Government. Before extending it to the farmers, a thorough test of the variety must be made in order to be sure that it is superior, both in yield and quality, to the native types.

**Results of Experiments at the Chekiang Cotton Improvement Stations.** Before 1928 several lots of Million Dollar seed were sent to the Provincial Cotton Improvement Station at Yuyao to be tested. In 1928, the College again supplied one hundred catties of the same variety for testing and multiplication at that station, and in 1929, forty piculs more were sent for distribution. The results of the 1928 variety test showed that

Table 11. Results of the Variety Tests at Mao Yien, Yuyao

Name of variety	Average yield (catties per mow)	Number of years under test
Million Dollar	150.764	Average of 4 years' test 1928-31 inclusive.
Kiangying White	145.000	Average of 3 years' test 1928, 29, 30
Nantung Chicken Foot	70.250	1928 only
Shaokan Long Staple	47.930	Average of 1928 & 1929
Yuyao, Siao Sze	145.878	Average of 4 years' 1928-31 inclusive

Million Dollar cotton was the best among the Chinese varieties under test, and this record was maintained in subsequent tests made not only in the Yuyao central station but also in the sub-stations.

Table 12. Comparison of the Lint Quality of Million Dollar with Kiangying White and Yuyao Siao Sze (local variety)

Name of variety	Length of staple	Lint index	Seed index	Percentage of lint
Million Dollar	82.05	5.5	9.2	37.4
Kiangying White	27.55	5.2	8.0	36.5
Yuyao, Siao Sze	28.55	5.2	7.8	40.0

The above two tables are taken from a report on Million Dollar cotton published by the Central Cotton Improvement Station of Chekiang Province at Chipao, Hangchow. The yield of Million Dollar is a little higher than that of the native types, and the fibre is better; but the percentage of lint is not so high as that of the local cotton called Siao Sze. On the whole the variety is superior to the other Chinese varieties under test at that station.

**Extension of Million Dollar Cotton in Chekiang.** Inasmuch as experiments show that Million Dollar is the best among the varieties of Chinese cotton which have been tested, and as the mills are willing to pay a premium of more than twenty percent for this cotton due to its superior quality, all the cotton experiment and extension stations of Chekiang Province are now using this variety for multiplication and distribution to farmers. This will continue until another superior variety is produced through the breeding work at the stations. The native cotton of Chekiang Province is poor in quality due to the coarseness and shortness of the fibre and, as the mills are demanding a longer and finer staple for spinning fine yarn, it is very important that this variety be extended. At the present time, Chekiang produces about four hundred thousand piculs of lint annually, and if each picul is worth \$40, then the total production amounts to \$16,000,000. A twenty percent increase in the price of cotton alone would increase the income of the province \$3,200,000 annually, according to the present area devoted to cotton production. The increase in income to the farmers justifies the amount of time, effort and funds required for improved cotton seed multiplication and distribution.

In 1933, 53,000 catties of Million Dollar seed was distributed to the cotton stations in Chekiang Province, and the area devoted to the cultivation of this variety under the direction and control of the stations was about 5,000 mow. In 1934, the area under cultivation had increased to 26,000 mow under the direct control of the cotton stations. The variety is being rapidly extended into various parts of Chekiang Province.

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Special Report No. 3

March, 1935.

**THE ADVANCEMENT OF SEED DISTRIBUTION  
OF IMPROVED CROP VARIETIES**

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NANKING, CHINA.

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## A REPORT OF THE ADVANCEMENT OF SEED DISTRIBUTION OF IMPROVED CROP VARIETIES

### THE IMPORTANCE OF CROP IMPROVEMENT IN CHINA

There is no doubt that agricultural rehabilitation is the cornerstone upon which the reconstruction of rural China depends. An increase in the quality and quantity of agricultural products is absolutely essential to the maintenance of the well-being of individuals in China, as well as to the growth of national wealth. Among possible means of accomplishing this end, crop improvement is probably the most economical and efficient method of improving agricultural products. The growing of improved varieties increases the crop yield without additional capital or cost, using a given amount of land and labor.

### CROP IMPROVEMENT WORK AT THE UNIVERSITY OF NANKING AND ITS AFFILIATED STATIONS

#### Plant Breeding Work

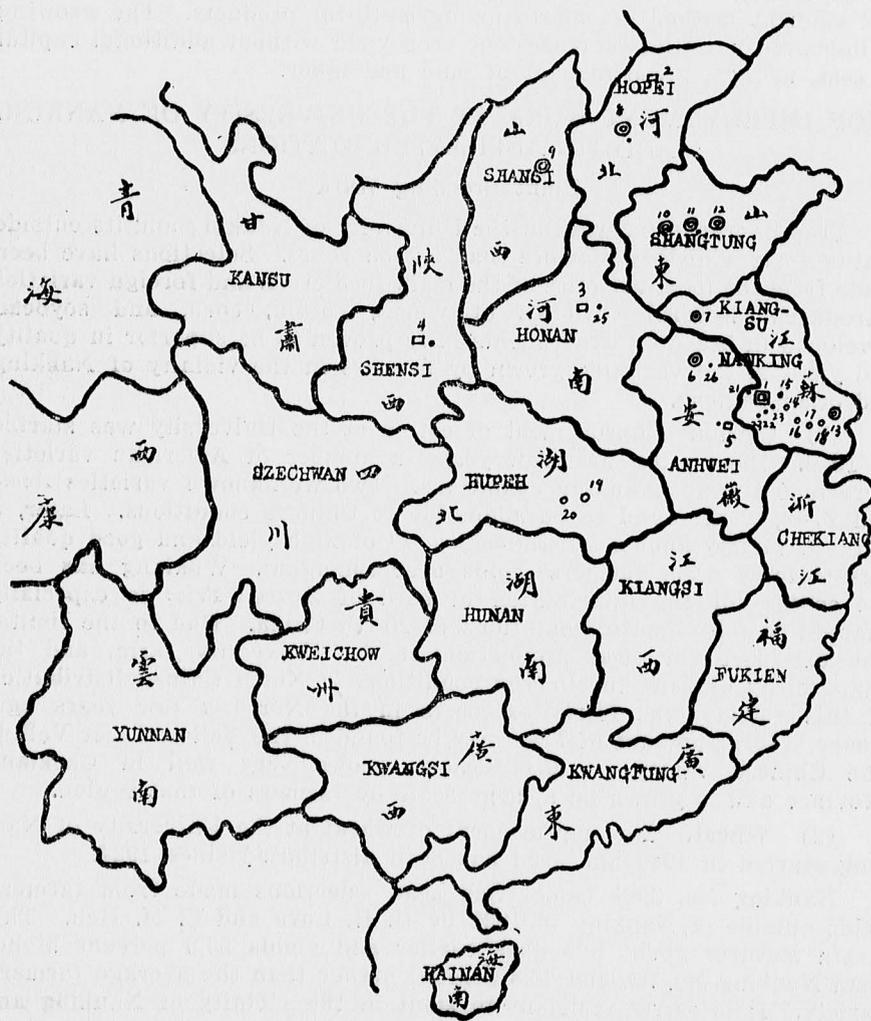
Crop improvement work at the University of Nanking and its outside stations has a history of more than fifteen years. Selections have been made from the local varieties of the main food crops and foreign varieties introduced. Several varieties of wheat, cotton, corn, and soybean developed in breeding experiments have proven to be superior in quality and yield to the varieties grown by farmers in the vicinity of Nanking and other regions.

(1) **Cotton.** Improvement of cotton at the University was started in 1915. During the first few years, a number of American varieties were tested under Nanking conditions. Two well-known varieties *Acala* and *Trice*, were found to be adaptable to Chinese conditions. Later, a Chinese variety known as "*million dollar*" of high yield and good quality was selected from farmers' fields near Shanghai. Wukiang has been the center for the distribution of seed of *Acala*. *Trice* is especially adapted to the climatic conditions of North China. Due to the limitation of space for seed production at the University farm, and the adaptability of *Trice* to climatic conditions in North China, distribution of this variety was fairly extensive in the North a few years ago. Hence, a large amount of *Trice* may be found in the Yellow River Valley. The Chinese variety "*million dollar*", grows very well in Chekiang Province and is grown on a large scale by farmers of that region.

(2) **Wheat.** The improvement of wheat at the University of Nanking started in 1914 and seed has been distributed since 1924.

**Nanking No. 2905** came from head selections made from farmers' fields outside of Nanking in 1925 by H. H. Love and C. M. Heh. This strain matures about five days earlier and yields 24.9 percent higher than Nanking No. 26, and 56.8 percent higher than the average farmers' variety. It is fairly resistant to smut in the vicinity of Nanking and withstands storms well.

金陵大學  
分場合作場及種子中心區  
分佈圖  
Map Showing Location  
of Stations Associated in the  
Crop Improvement Program of the University  
of Nanking



☐ Head Quarters 總場

1-NANKING 南京

☐ Sub-stations 分場

2-YENCHING 燕京

3-KAIFENG 開封

4-CHINYANG 涇陽

5-WUKIANG 烏江

◎ Cooperative Stations 合作場

6-NANHSUCHOW 南宿州

7-HSUCHOW 徐州

8-TINGHSIEN 定縣

9-TAIKU 太谷

10-TSINAN 濟南

11-CHOWTSUN 周村

12-TSINGCHOW 青州

13-PAOSHAN 寶山

○ Cooperative Stations for Regional  
Test 區域試驗合作場

14-CHANGCHOW 常州

15-HWANGSU 黃埔

16-SOOCHOW 蘇州

17-WUSIH 無錫

18-HWANGFU 黃渡

19-WUCHANG 武昌

20-CHINGKO 金口

● Seed Centers 種子中心區

21-PAKUACHOW 八封洲

22-SHUNHWACHEN 淳化鎮

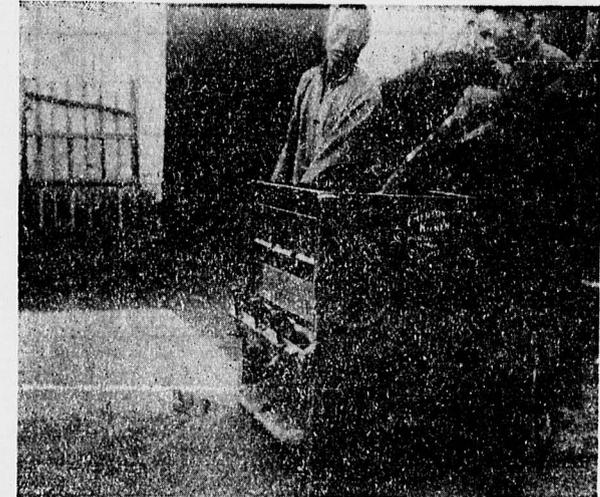
23-TANGSAN 湯山

24-YINHSIANG 殷巷

25-HSIENLUNGTSI 興隆集

26-NANHSUCHOW 南宿州

Fanning mill, last pro-  
cess in taking care of  
the improved wheat  
seed No. 2905 before  
shipment to various cen-  
ters. Nanking Station,  
September, 1934.



Nanking No. 26 has been distributed during the past ten years. It came from a farmer's field at Paohwashan near Nanking and yields about 7 percent more than the best farmers' variety.

Nanhsuchow No. 61 was found to yield about 12 percent more than No. 6 which was already under extension. In the tests from 1927 to 1933, it showed over 30 percent better yield than the best local farmer's variety. It matures early, is resistant to nematode, has stiff straw, and other desirable characteristics. No. 61 has been distributed to farmers since 1932, replacing No. 6 in the seed distribution program.

Kaifeng No. 124 shows about 12 percent gain in yield over the standard variety and yields about 17.7 percent higher than the local farmers' variety. In addition, it is of good quality with stiff straw and is smut resistant. It has been used as the check variety and distributed to farmers since 1933.

Table I. The Yield of the New Strains of Wheat and Soybean compared with the Standard Variety at Nanking, Kaifeng and Nansuchow, 1926-1933

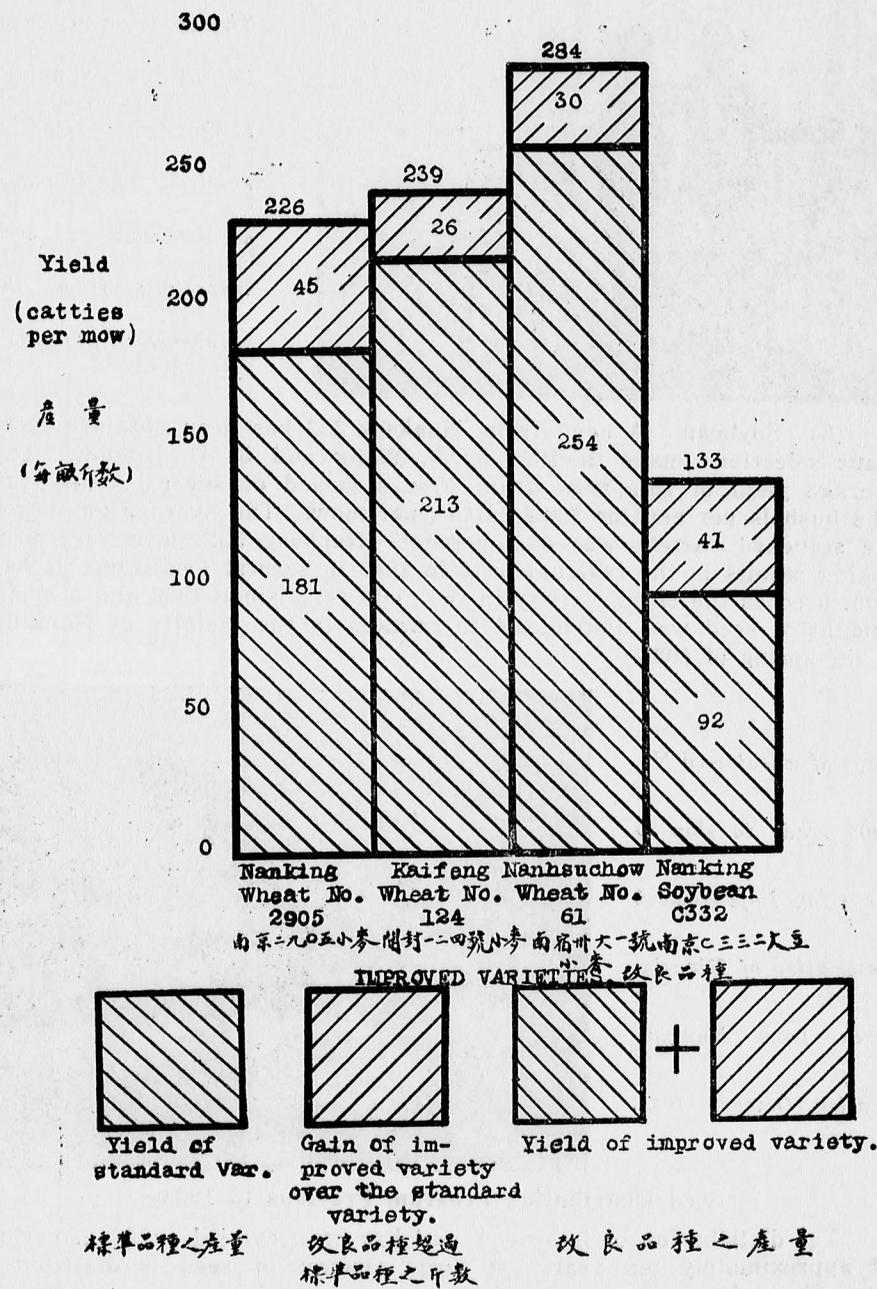
Crop	Year	1926		1927		1928		1929		1830		1931		1932		1933		Average		REMARKS	
		Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G	Y	G		G in %
Wheat	Nanking 2905*			322	149	221	66	401	202	307	73	176	-4	211	58	213	32	226	45	24.9 56.8††	Early, Good quality stiff straw
	Kaifeng 124	193	-12	376	111	176	22	131	13	211	11	284	1	299	39	Used as new standard	239	26	12.2 17.7††	Early, stiff straw, resist to nematode.	
	Nansu-chow 61			121	5	332	31	335	88	230	30	451	74	238	26	288	8	284	30	11.8 33.9††	Relatively drought resistant.
Soybean	Nanking C332	153	73	183	50	116	31	Severe drought no yield taken		103	38	110	14	Used as new standard			133	41	44.7		

Y=Actual yield in catties per mow (One catty=500 grams and one mow=666.67 square meters).  
G=Gain over the standard in catties per mow.

\* The average yield for Nanking wheat No. 2905 is based on the data of 1928, 1930, 1931, 1932, and 1933. The yield data in 1927 and 1929 are excluded, because the data of 1927 was based on the two-row test which is only preliminary in nature and should not be emphasized, and the standard variety in 1929 was unusually poor owing to an accident and cannot be considered normal.

† The yield data before 1933 were taken in bushels per acre and have been converted into catties per mow by multiplying by a factor '9'.

†† Percentage gain over the farmers' variety.





The first farmer who indicated a willingness to have his field inspected. The two men at the right are seed inspectors from the Nansuchow Station.

(3) **Soybean.** A new strain, Nanksoy 332 has been obtained from plant selections made in 1924 by S. Wang and G. E. Ritchey. The average yield of this new strain over a period of several years was 14.8 bushels per acre or 133.2 catties per mow. The average gain over the standard variety was 45.1 percent. Nanksoy 332 gave very promising results in the regional tests in 1933 in several localities. It has been used as the check variety in the yield tests since 1932 and a small amount of seed was distributed to farmers in the vicinity of Nanking in the spring of 1934.

Bags of wheat seed No. 2905 ready to ship to the Crop Improvement Association of Ningshu Area from Nanking Station, October, 1934.



Seed Distribution Program Previous to 1934

The distribution of improved seed has been carried on for a period of approximately ten years. A large amount of seed is distributed annually to different provinces based on requests from various organizations. In 1930, the University of Nanking cooperated with the Central

Table II. Gain in Yield of Promising Varieties of Wheat over Standard Variety in Regional Tests of Wheat, 1932-34 (in catties)

STATIONS	Check Varieties	Wheat, 1932-34 (in catties)										Average	
		(A)	(A)	(A)	(B)	(B)	(B)	(C)	(C)	(A)	(A)		
Nanking	516	3.8	1.7	14.7	1.5	31.8	-8.2	12.5	-28.1	-30.6	-	-29.6	-24.8
	2899	17.1	-5.4	19.0	-1.5	25.5	-	6.8	-3.9	-22.3	-	-9	3.55
	2902	9.6	-22.5	26.6	-2.4	25.0	-	3.1	-59.2	-34.5	-	3.2	2.83
	2903	17.7	-14.8	9.1	-5.6	27.9	-	4	-20.7	-29.0	-	7	.21
	2905	16.9	-1.8	18.1	-2.9	29.1	5.5	1.8	-14.7	-26.6	-	7.5	2.33
	2915	19.4	-9.0	2.0	2.8	28.8	-	4.1	-52.8	-16.4	-	-28.5	-3.67
Nansuchow	2941	5.9	-22.6	16.0	3.6	21.0	-	6.8	-10.0	-21.5	-	-2.7	4.51
	1691	-46.5	-42.2	14.4	3.7	24.9	-	11.7	-66.2	-23.9	-	-9	3.92
	2634	-66.1	-55.6	-44.7	-27.3	-	-	-	-	-	-	-29.6	-44.92
	6	6.1	-4.4	-49.9	-49.0	-	-	-	-	-	-	-	-35.20
	61	1.3	9.5	-5.7	-1.4	4.3	-	18.5	-4.2	-15.0	-	-55.1	13.85
	124	-	-	-	-1.4	1.2	-	29.1	-8.0	-15.1	-	-7.8	-4.63
Kaifeng	812-2	-	-	-	-	-	4	21.4	2.9	2.9	-	-128.6	-12.2
	323-3	-	-	-	-	-	4.9	7.0	1.6	1.6	-	-57.7	-7.1
	320-8	-	-	-	-	-	9.6	17.3	5.9	5.9	-	-46.6	-10.46
	5	-	-	-	-	-	19.6	-14.6	5.6	5.6	-	-98.2	-1.28
	1462	-	-	-	-	-	12.8	13.6	-5.3	2.4	-	-19.0	17.78
	1485	-	-	-	-	-	10.0	1.0	-4.1	-4.1	-	-7.1	2.25
Yih sien	1507	-	-	-	-	-	4.9	-1.6	-13.8	8	-	-71.3	-10.53
	1878	-	-	-	-	-	4.8	-6.2	1.1	1.1	-	-89.4	-9.47
	-	-	-	-	-	-	8.0	-6.4	3.9	3.9	-	-22.0	-14.14
	-	-	-	-	-	-	-11.3	-	4.8	4.8	-	-8.8	-7.07
	-	-	-	-	-	-	-18.3	-	3.9	3.9	-	-23.4	-33.72
	-	-	-	-	-	-	-	-	-	-	-	-	-

(A) Local Variety. (B) Nanking No. 26. (C) Since the year 1932, No. 124 has taken the place of farmer's Variety as the Standard Variety at Kaifeng Station. (D) Since the year 1932, No. 61 has taken the place of local farmer's variety as the Standard Variety at Nansuchow Station. (E) At Nanking Station, the Standard Variety was No. 26 in 1931 and 1932. Since 1933, it has been No. 2905.

Agricultural Extension Committee to establish the Agricultural Extension Experimental Center to deal with the extension program at Wukiang, Anhwei. In this region seeds of improved strains of cotton and wheat have been distributed for some time. Crop improvement and marketing associations have been well organized. After a number of years of extension efforts, the merits of improved seed and the importance of crop improvement work have been acknowledged by the farmers and they no longer hesitate to use improved seed.

Since 1931, regional tests of promising varieties have been conducted through cooperation with organizations in various districts in the valleys of the Yangtze and Yellow rivers with the object of studying the regional adaptability of different varieties and to provide for the extension of suitable strains. The results with wheat are summarized in the following table.

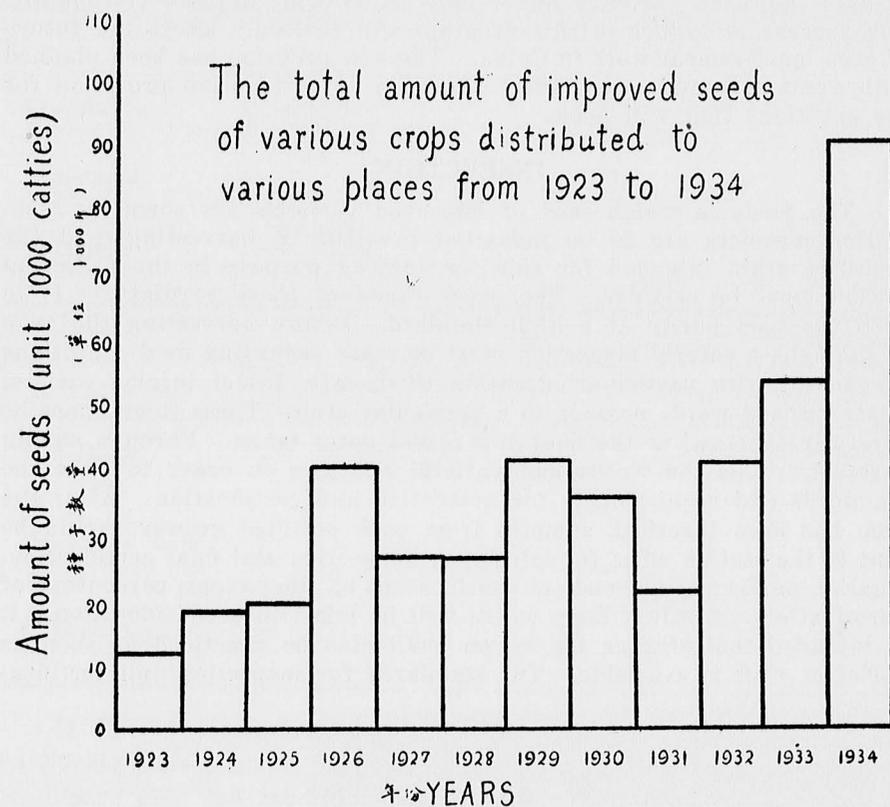
From Table II, it may be seen that each of the promising varieties selected from various stations reacts differently to environmental changes; in other words there is a distinct limitation to the area in which a particular variety may be profitably grown. Outside of the area, there is little chance for its competing favorably with other varieties. This is the reason why regional tests for all improved varieties are essential before distribution is begun.

Table III. The Total Amount of Improved Seeds of Various Crops that have been Distributed from 1923-1934

Distributed Seeds of Various Crops at Different Stations	1923-	1924-	1925-	1926-	1927-	1928-	1929-	1930-	1931-	1932-	1933-	1934-	Total (catties)
Nanking Wheat	5,625	5,997	—	14,063	12,974	18,054	16,876	19,528	15,490	22,072	24,075	28,700	183,454
Nan hauchow Wheat	1,400	2,000	2,560	2,000	—	—	10,985	5,840	4,305	5,394	10,411	46,470	91,365
Kaifeng Wheat	—	—	—	—	—	—	—	—	—	—	2,205	15,380	17,585
Nanking Cotton	5,200	9,966	16,132	20,000	9,808	4,739	12,411	6,300	1,512	11,889	15,667	—	113,624
Nanking Soybean	—	—	—	—	—	—	—	—	—	602	1,124	—	1,726
Nanking Corn	—	90	1,200	4,000	4,216	4,000	990	3,665	500	222	—	—	18,884
Grand Total	12,225	18,053	19,892	40,063	26,998	26,793	41,269	35,333	21,807	40,180	53,482	90,550	426,638

As shown in the table, the total amount of improved seed distributed through 1934 was 426,638 catties. Due to the lack of seed control and organization among farmers, we did not succeed in keeping records of the seed distributed. Under the old system, there was no control after the seed was removed

from the original station or the original breeders. Without efficient supervision the farmers using the seed may allow it to become mixed with other varieties so that the later generations are not pure seed of the improved strains, or the seed may be distributed in regions where conditions are not suitable for its growth. It is therefore essential to control the conditions under which the improved seed is grown by organizing the farmers.



#### PURPOSE AND METHOD OF ESTABLISHING SEED CENTERS OR CROP IMPROVEMENT ASSOCIATIONS

In 1934, the Department of Agronomy organized a new program for the distribution of wheat and cotton seed. This consists in the centralization of the distribution program and the control of seed propagation. Farmers using the improved seed must plant their crops according to the regulations of a crop improvement association. The association is organized by the seed growers under the direction of the Department or one of its cooperative stations. The crop is inspected in the field and the seed certified in seed laboratories. The certified seed must be bought from the growers at a comparatively high price

by the organization in charge of the extension work, which redistributes the purchased seeds the following season. In addition the members of the association have the privilege of borrowing money from the association for crop work, and farm products may be sold more profitably through the cooperative marketing association than by individual marketing.

Under this program of seed multiplication and distribution, the area of improved varieties under cultivation will increase continually. The success or failure of this program will seriously affect the future of crop improvement work in China. The new program has been planned with great care and every effort has been made to make provision for the questions that will arise.

### INSPECTION

The fields in which seed of improved varieties are sown by association members are to be inspected previous to harvesting, and the threshed grain intended for sale for seeding purpose in the following season must be certified. The main object of these regulations is to keep the seed purity at a high standard. Before harvesting the crop in the field, a careful inspection must be made regarding field conditions in general with particular attention to disease, insect injury, varietal mixtures, and weeds noxious to a particular crop. These items must be carefully observed in the field and actual notes taken. Farmers should carefully rogue the weeds and varietal mixtures in order to meet the standards and requirements for inspection and certification. After the crop has been threshed, samples from each certified grower should be sent to the station office for laboratory inspection and final certification. Quality, purity, the presence of weeds, seeds of other crops, percentage of germination and injury from weeds will be taken into consideration. It is intended that storage inspection shall also be practiced as soon as sufficient staff is available. The standards for inspection and certifica-



*Inspection at Kaifeng of a field of 124 wheat.*

tion of wheat and cotton were decided upon in the first part of 1934 to meet the present needs. These are given below:

Table IV. Requirements for Wheat

Classes	Purity %	Weeds	Foreign Material %	Mixture of Other Crops %	Germination %	Catties Per Tou	Disease (Smut) %
Foundation stock	99.5	No wild oats or wild peas etc.	None	0.1	95.0	15.0	0.5
Registered seeds	95.0	-do- Noxious free; others 1 %	0.2	0.2	92.0	15.0	1.0
Certified seeds	92.0		0.5	1.0	90.0	14.7	1.5

Table V. Requirements for Cotton

Classes	Purity %	Germination in %	Varietal Mixture %	Catties Per Tou	Damaged Seeds %
Registered seeds	92	83	6	8.8	3
Certified seeds	90	80	8	8.0	5

If the seeds meet the requirements, the station will issue an official certificate which can be secured by the farmers from the station. The results of field and laboratory inspection will be clearly stated on the certificates. The number of certificates which the growers may secure from the station or crop improvement association depends entirely on the amount of improved seed harvested.

A limited amount of improved seed of the highest purity may be obtained annually to meet the needs of seed centers and crop improvement associations. As the number of seed centers or crop improvement associations increases, the area of land needed for multiplying improved seed must be increased. This is why we ask our stations to reserve at least one-half of the total farm area for the purpose of increasing

## Sample of Certificate

<p>Save this tag for future use</p> <p>REGISTERED SEED</p>  <p>Save this tag for future use</p>	<p>Save this tag for future use</p> <p><b>REGISTERED SEED</b></p> <p>Seller.....Certificate No .....</p> <p>Address.....</p> <p>Kind of seed.....Variety name.....</p>
<p><b>Central Station and Sub-stations</b></p> <p>of the</p> <p><b>University of Nanking</b></p> <p>Official Certificate Issued by Seed Inspection Committee</p> <p>The container bearing this tag contains registered seed inspected and certified in both field and laboratory in accordance with requirements of seed certification.</p> <p>Certified Date..... Inspector.....</p> <p>Certificate No..... Station.....</p>	<p><b>FIELD INSPECTION</b></p> <p>Kind of disease.....Percent.....</p> <p>Varietal mixtures.....Percent.....</p>
<p><b>LABORATORY INSPECTION</b></p> <p>Purity.....% Germination.....%</p> <p>Weed seed.....% Noxious weeds.....%</p> <p>Mixture of other seeds.....%</p> <p>From.....</p> <p>To.....</p> <p>Date .....</p>	

improved strains. Consequently each station formulates a method of selecting heads from its own fields of improved varieties by hand-picking to avoid any possibility of mixing, and plants these seeds on its own farm with the idea of replacing every third year the pure seeds which have been used by the associations of farmers.

**Table VI. Results of Seed Certification of Improved Varieties of Wheat at Nanking, Nansuchow and Kaifeng in 1934**

Stations	Varieties	In Field					In Laboratory			Germination %
		Disease (Smut) %	Varietal Mixture %	Purity %	Seeds of other crop %	Seeds of weeds %	Foreign Materials %	Insect injuries %		
Nanking	26	1.48	.14	99.3	.5	.18	.67	5.5	91.6	
	2905	.26	.10	99.5	.4	.10	.47	6.42	85.75	
Nansu-chow	61			99.4			.30	1.25	95.55	
Kaifeng	124	.3	.4	99.8			.20	.60	98.00	

**Constitution of the Crop Improvement Association in the Ningshu Area.**

1. Name—This organization shall be known as the Ningshu Area Crop Improvement Association.

2. Object—The object of the organization of this Association is to improve the quality and quantity of field crops cultivated by members of the Association.

3. The affairs of the Association shall be conducted under the direction and supervision of the Crop Improvement Directory Committee.

4. Any trustworthy farmer is entitled to membership in this Association. There must be at least seven charter members.

a. Privileges of members.

(1) Improved seeds and farm implements may be purchased through the Association.

(2) Loans for crop production may be secured through the Association.

(3) Cooperative marketing of farm products.

b. Duties of the members.

(1) To maintain the highest purity of improved varieties now in use.

(2) To submit to the decisions of the Association and the directions of the Directory Committee.

(3) Without the permission of the Directory Committee, seeds must not be used as food or sold.

5. Dues of fifty cents annually shall be collected from each member and accumulated in the bank as the reserve fund of the Association.

6. One to three officers shall be elected to take charge of the affairs of the Association. The term of office shall be one year.

7. Member meetings are to be held monthly and business meetings semi-monthly. Additional meetings may be called and regular meetings may be postponed, if necessary.

8. Farmers may make loans from the Bank or other organizations through the recommendation of the Crop Improvement Directory Committee. All the members of the Association are responsible for their own financial obligations.

9. Items not included in this constitution should be taken care of by the Directory Committee.

10. This constitution may be amended by the Directory Committee.

**Regulations Governing the Distribution of Wheat  
Seed No. 124 (Sallee) from the Agricultural  
Experiment Station at Kaifeng.**

1. Limitation of varieties. Farmers who desire to use the improved variety of Sallee wheat may plant only this variety on their farms. No other varieties of wheat may be used for seeding purposes.

2. Loans. Farmers who receive the improved seed must be members of agricultural growers associations or crop improvement associations which are organized under the supervision of the Bank of China. Money may be borrowed from the Bank. The amount of money which the Bank will loan varies according to the area of the wheat field of the borrower. This will be decided upon by an agreement between the Bank and the association.

3. The use of seed. The seed purchased by the members of each association should be used only for seeding (not for feed, etc.) The improved seed should not be mixed with the seed of other varieties.

4. The purchase of grain. The Experiment Station will purchase the improved seed from the farmers at a comparatively high price. It should not be sold to others or used as food stuff.

5. Directions for planting. The station staff has full authority to direct the farmers regarding method, time, and other factors to be observed in planting.

6. Directions for harvesting. Harvesting, threshing and storing of the improved seeds should be supervised by the station staff.

7. Field inspection. Prior to each field inspection, association members are required to rogue out the varietal mixtures, other crops, and weeds very carefully so as to meet the standards and requirements for certification.

8. Seed certification. Association members whose fields have passed the field inspections should send a representative sample of seed to the laboratory for certification as soon as the threshing is finished.

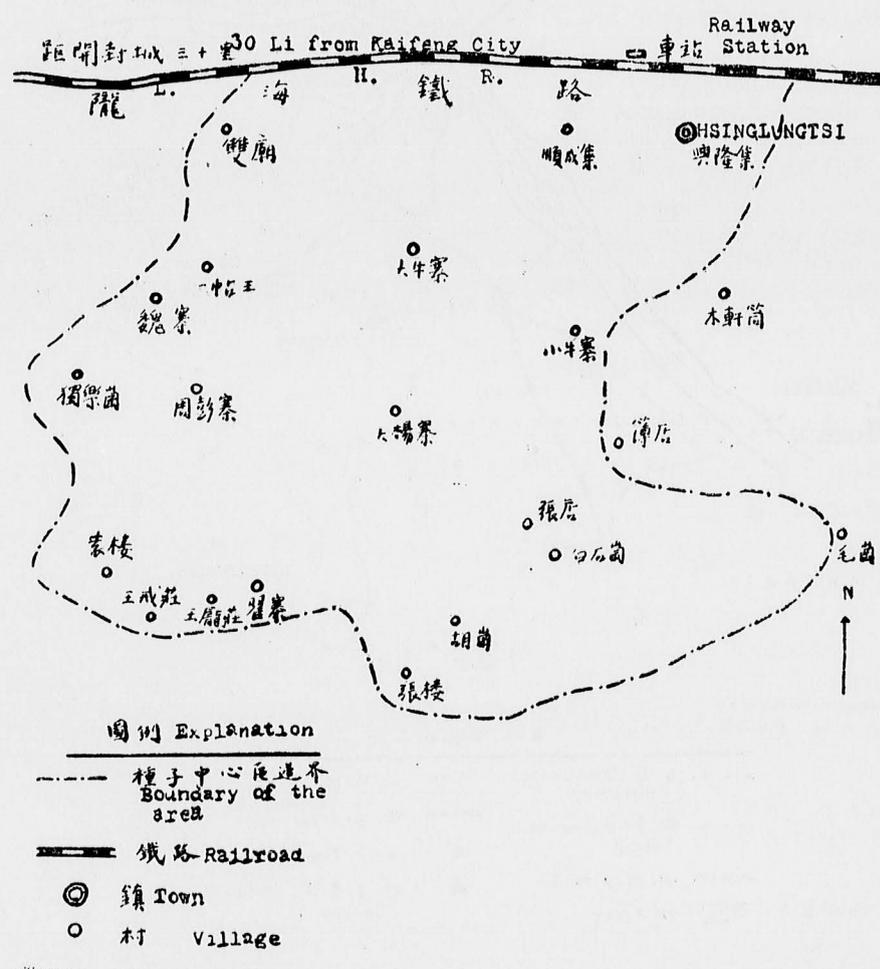
開封興隆集種子中心區一二四號小麥分佈區域圖

The Map Showing the Crop Area of Wheat

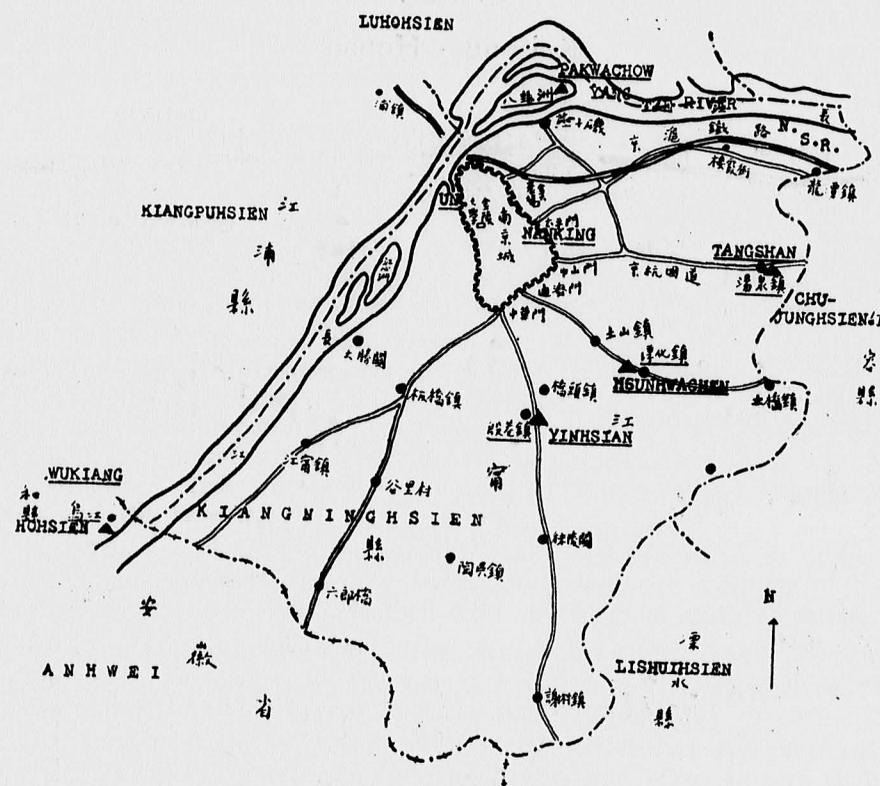
No. 124 at Hsinglungtsi Seed

Center.

Kaifeng - Honan



南京附近種子中心區分佈圖  
Map Showing the Location of Seed Centers and Crop Improvement Associations in Nanking Area.



圖例 Explanation	
++++	省界 Provincial Boundary
-----	縣界 Hsien Boundary
~~~~~	城 City wall
~~~~~	江 River
———	公路-Highway
———	鐵路-Railroad
●	市鎮 Town
▲	種子中心 Seed Center

FINANCIAL SUPPORT AND COOPERATION

The associations are supported by the organizations which are interested in the program of rural improvement. Members of a crop improvement association may borrow money from the association for productive purposes at an interest rate which is little higher than that charged by the Bank. The surplus is used for the expenses of the association. After the crop from the improved seed is harvested and is found meet the standards and requirements of inspection and certification, the entire quantity of seed must be purchased at a price ten percent higher than the market price by the crop improvement association. The purpose of this is to keep the seed from being used by the farmers for feed during the winter months, or from being contaminated by other seeds.

The Bank of China at Nanking and Kaifeng and the Shanghai Commercial and Savings Bank at Nansuchow are now cooperating in the establishment of associations. Since 1931, financial problems in connection with extension work at Wukiang have been solved through the cooperation of the Shanghai Commercial and Savings Bank.

In addition to the banks, we have the cooperation of the Central Agricultural Extension Committee, the Ningshu Agricultural Relief Association, and the Rural Mass Education Center at Pakwachow, to assist in the distribution work at Nanking.

MEMORANDUM OF AGREEMENT

covering the cooperation between the.....Cooperative Station of the College of Agriculture, University of Nanking, hereinafter designated as Party A, and....., hereinafter designated as Party B, for the multiplication and distribution of improved varieties of.....

**Purpose:** To utilize improved seed for the purpose of increasing farm production and raising the rural standard of living.

- I. Obligations of Party A under this agreement.
  - a. The supplying of seed of improved varieties. Party A shall supply seed of improved varieties to Party B at a price ten percent higher than the market price.
  - b. Percentage of germination. Party A must guarantee a germination percentage of above eighty-five percent.
  - c. Directions for planting. Party A is responsible for supplying directions as to the rate, date, method of planting, and other cultural practices.

- d. Inspections. Field inspection, laboratory inspection, storage inspection and seed certification are to be conducted by Party A.

### II. Obligations of Party B under agreement.

- a. The technique of seed production. The technical side of seed production shall be under the direction of Party A. Party B must fulfill the regulations for cultural practices authorized by Party A.
- b. Limitation of varieties used. Farmers who have been organized under the supervision of Party B are absolutely prohibited from planting more than one variety of any one crop on the same farm in the same season.
- c. The organization of associations. Party B is responsible for money loaned to association members for purposes of production, purchase and storage of seed.
- d. After a sufficient amount of seed is produced, Party B may begin to establish the enterprise of cooperative marketing in full consultation with Party A.

### III. Obligations of both parties.

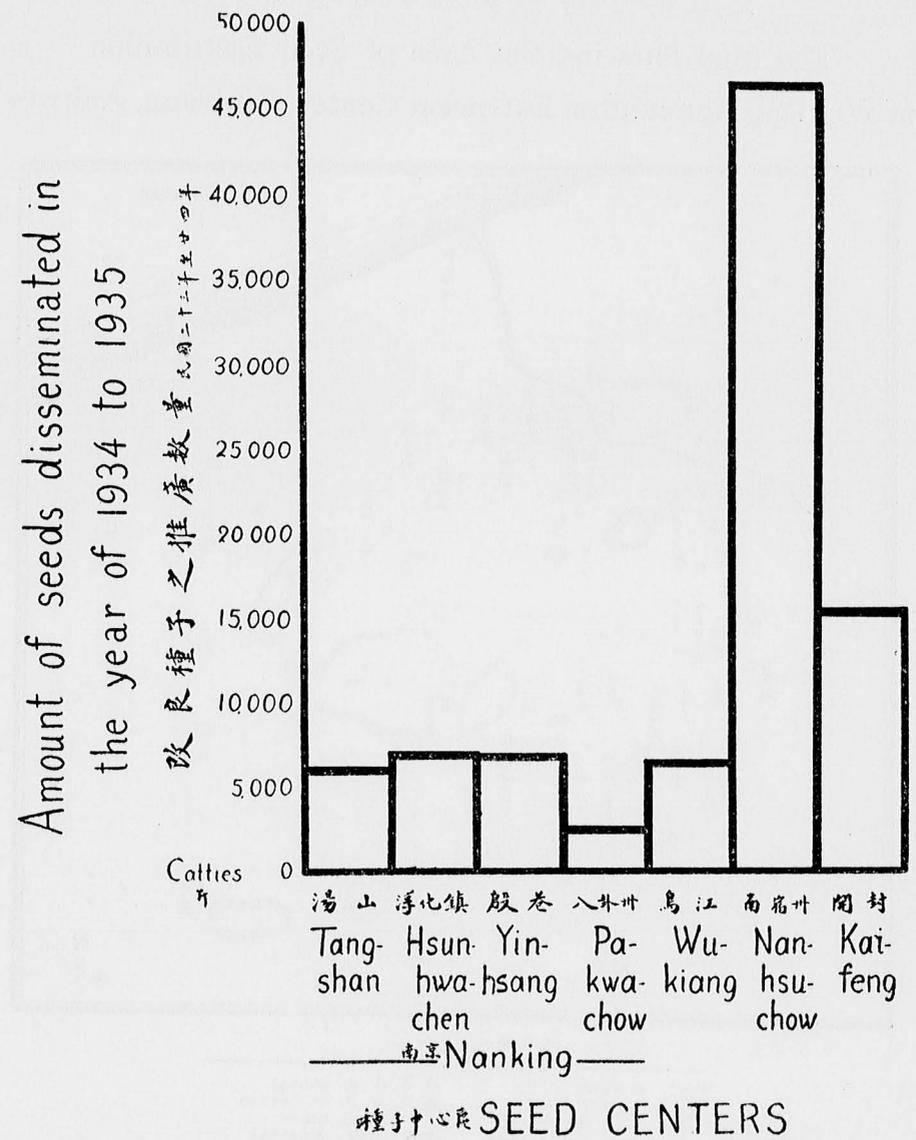
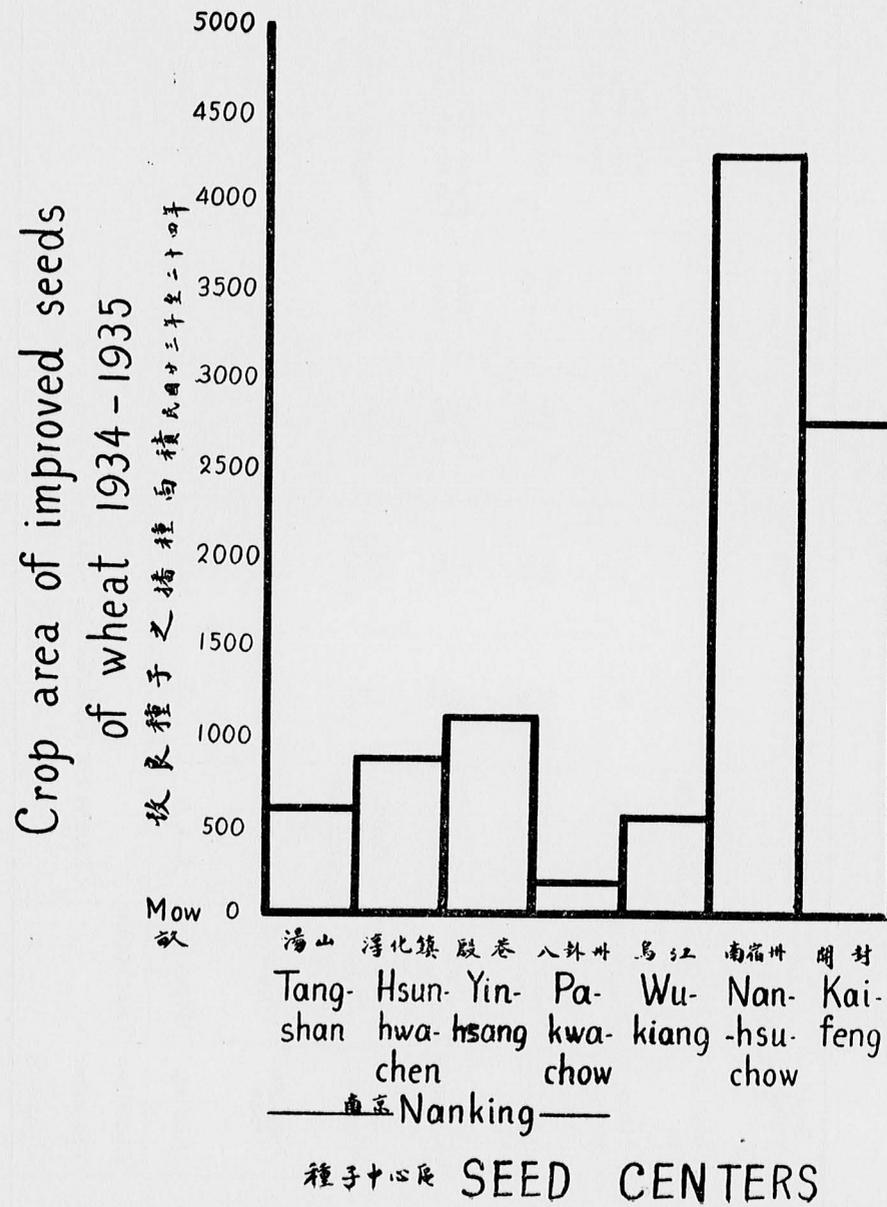
- a. The records of percentage of germination, percentage of weed seeds, and yield data on previous experiments with seeds supplied by A should be available for the use of Party B. After the seeds are accepted by Party B, Party A is not responsible for the final results which may be affected by accidents during the growing period.
- b. The seed centers should be near the experiment station where the transportation facilities are convenient. Locations are to be chosen by official representatives of both parties concerned.
- c. This memorandum of agreement will be effective after being signed by both parties.
- d. The duration of this agreement will be.....year.
- e. This memorandum may be amended by agreement between official representatives of both parties.

### SEED DISTRIBUTION IN 1934

Seven centers have been established for the distribution of seed. Of these, four are located near Nanking, two in Anhwei, and one in Honan. Four improved varieties of wheat and two improved varieties of cotton have been extended.

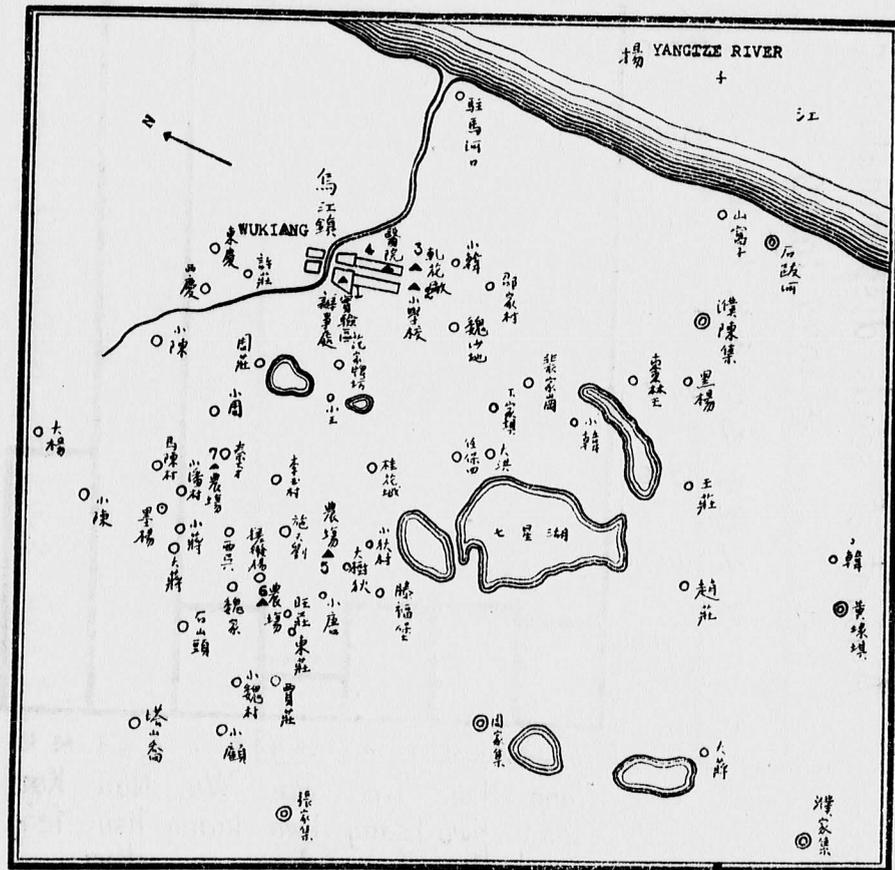
Table VII. Seed Distributed at Different Centers in the Year 1934

Regions	Seed centers	Kind of seed extended	Organization	Number of Farms	Area in mow	Amount of seed extended (catties)	Expected amount of seed next season (catties)	Cooperation with
Lower Yangtze Valley	Tangshan	Wheat 2905	Crop improvement Association	117	607.5	6,075	60,750	1. Central Agricultural Extension Committee
	Hsun-hwachen	Wheat 2905	C. I. A.	78	852.2	5,965	69,654	2. Ninghsu Agricultural Relief Association
	Yinhsang	Wheat 2905 25	C. I. A.	20 92	100 982	600 6,210	6,000 62,100	3. Bank of China
	Pakwachow	Wheat 2905 26	C. I. A.	13 20	71 100	1,000 1,400	10,000 14,000	Rural Mass Educational Center of Pakwachow
Hwai River Valley	Wukiang	Wheat 2905 cotton acala	Crop Growers' Association	30 249	535.8 2,801.2	6,450 25,257	64,500 252,570	Shanghai C. & S. Bank
	Nanhsu-chow	Wheat 61	C. I. A.	128	4,294.0	46,470	464,700	Shanghai C. & S. Bank
Yellow River Valley	Kaifeng	Wheat 124	C. I. A.	55	2,743.5	15,380	153,800	Bank of China
North China	Chowtsun	Trice cotton						
	Tingsien	" "						
	Chingyang	" "						
(Results not available this year)								



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烏江種子中心區種子分佈區域圖  
 The Map Showing the Area of Seed Distribution  
 of Wukiang Agricultural Extension Center, Wukiang, Anhwei

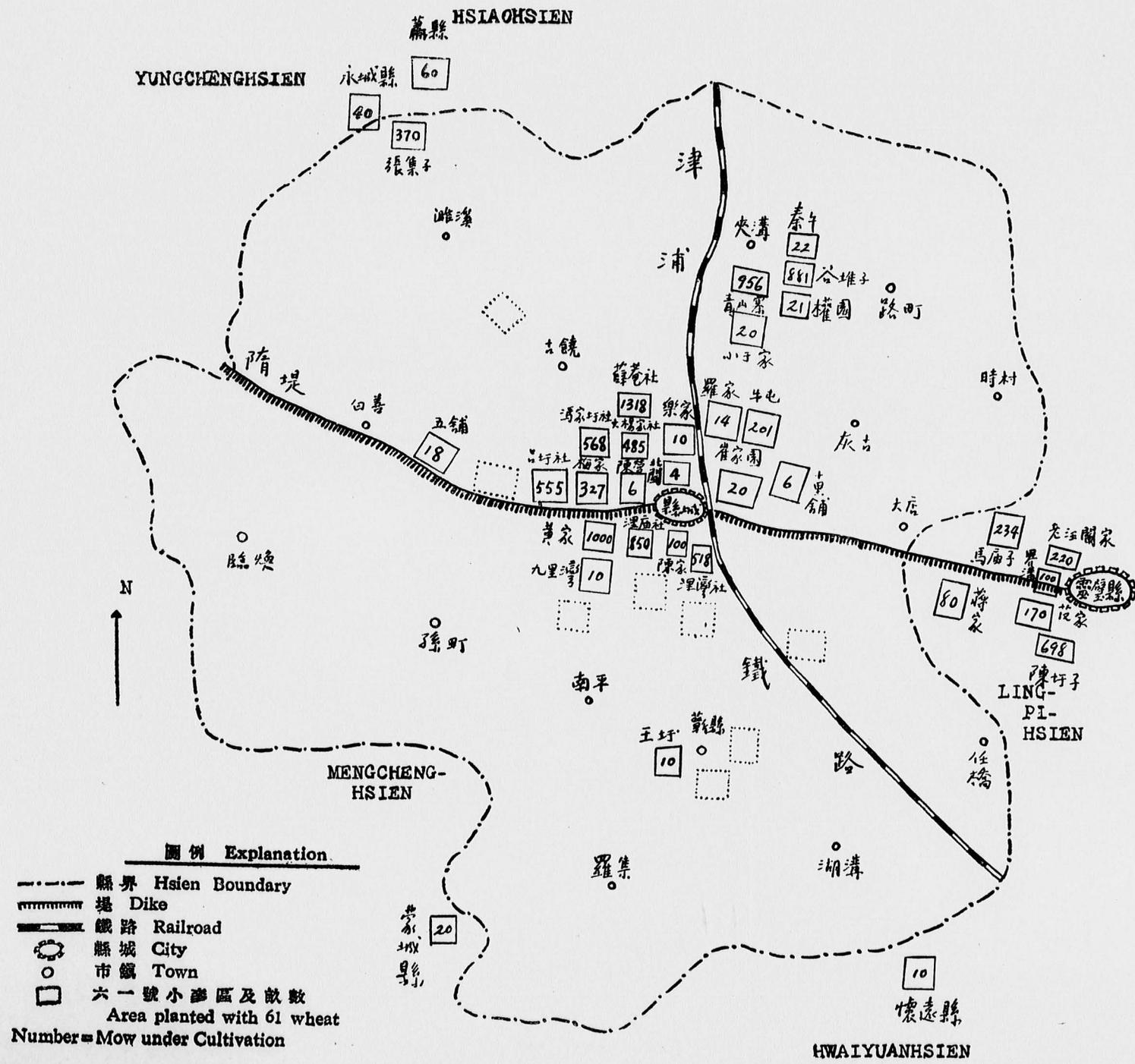


圖例 Explanation

- |  |                                       |
|--|---------------------------------------|
| 江 River                                    | ▲ 2. 學校 School                        |
| 湖 Lake                                     | ▲ 3. 棉花及 Cotton gain house.           |
| 烏江鎮 Wukiang                                | ▲ 4. 醫院 Hospital                      |
| 小鎮 Small town                              | ▲ 5, 6, 7 Farms of Wukiang Experiment |
| ▲ 1. 農林辦事處 Office of the extension center. | ○ 村 Village                           |

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南宿州種子中心區種子分佈區域  
 Map Showing The Area of Seed Distribution of Nansuchow Seed Center, Nansuchow, Anhwei.



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The total amount of wheat seed distributed in 1934 by the Department of Agronomy and its cooperating stations at Nansuchow and at Kaifeng was 90550.4 catties. These seeds are now being cultivated in an area of over ten thousand mow as shown in the following table.

**Table VIII. The amount of wheat seed distributed by Nanking University and its cooperative stations at Nansuchow and Kaifeng.**

	Total amount of seed catties	Farmers Organized	Area in which improved wheat is being cultivated
<b>Nanking Varieties</b>		(approx.)	(Mow)
2905	21,090.4	258	2,166.5
26	8,884.5	112	1,082.0
<b>Nansuchow Variety</b>			
61	46,470.0	128	4,204.0
<b>Kaifeng Variety</b>			
124	15,380.0	55	2,743.5
	91,744.9	553	10,286.0

These seeds were distributed according to the system described in this bulletin as the new plan. A small percentage of seed is distributed to miscellaneous organizations and records of these are not included in the regular tables. As the amount of seed may be multiplied ten times annually, the possible amount of seed of four improved varieties would be over one million catties, while the area covered by the improved wheat varieties could be from 12,000 to 120,000 mow in 1935.

The wheat areas of Honan, Kiangsu and Anhwei are 59,528,000, 32,127,000 and 21,295,000 mow respectively. We may expect that in 1940 all the wheat growing area in these three provinces will be planted with improved varieties, if these varieties are found to be adapted to the climatic conditions in these provinces.

A total amount of 25,257 catties of cotton seed (Acala) has been distributed this year in a crop area of 3929 mow at Wukiang. Growers have been organized and the fields have been inspected.

In North China, three Trice cotton seed centers were established in 1934, namely, the Northwestern Agricultural Experiment Station at Chin Yang Hsien, Shensi; the Tingsien Agricultural Experiment Station in

Hopei and the Cheeloo Agricultural Experiment Station at Chowtsun, Shantung. Distribution of Trice seed will be started in the spring of 1935.

#### THE FUTURE OF THE DISTRIBUTION PROGRAM AND FURTHER IMPROVEMENTS.

This report has included the work which was done under the old procedure and the plan which has been suggested as a basis for a future seed distribution program. There is no doubt a good deal of room for improvement and modification of the new program before distribution can be carried on with maximum efficiency. It is hoped that this will gradually be expanded on a sound basis in order to meet the growing needs and thus help rural rehabilitation in an effective way. In order to keep pace with the demands from other organizations, the program must be enlarged and the equipment must be proportionately increased.

#### SUMMARY

1. Increased agricultural production is the corner stone upon which to build the rural reconstruction of China because it is the most effective way of increasing the incomes of individuals. To increase agricultural production, the distribution of improved, high yielding varieties of seed is essential.

2. Crop improvement work at the University of Nanking and its outside stations has been carried on for more than fifteen years. Three improved varieties of cotton, four of wheat, one of soybean and one of corn, have been produced and distributed to farmers since 1923.

3. Table II in this paper, shows the various promising varieties of wheat from each station which have been tested and gives the reactions of these varieties to different environmental conditions. Knowledge of regional adaptation is essential to an efficient seed distribution program.

Table III in this paper indicates, that previous to 1934, 426,638 catties of improved seed of wheat, cotton, corn and soybean were distributed to growers. Due to lack of adequate methods of seed control, organization of farmers, and regional tests, the value of the improved seed was limited.

4. The technique of seed distribution is being entirely changed beginning from 1934. Seven crop improvement associations have been established with the idea that seed control must be through the organization of growers. Various attempts have been made to work out a system by which production and marketing may be combined. In order to facilitate this, requirements for inspection and certification have been standardized.

5. Wide cooperation between governmental agencies, banks and agricultural institutions has been started. Two outstanding banks have already invested a large sum of money in this program. Under the new program, 90,550.4 catties of wheat and cotton seeds have been distributed and 10,286.0 mow of land have been planted with improved varieties.

...the most effective ...

RESULTS

...the most effective ...

20111111

For Exchange

Special Report No. 4

August, 1935

A REPORT ON  
THIRTEEN YEARS WORK IN RURAL  
LEADERS' TRAINING

Y. W. Chang



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

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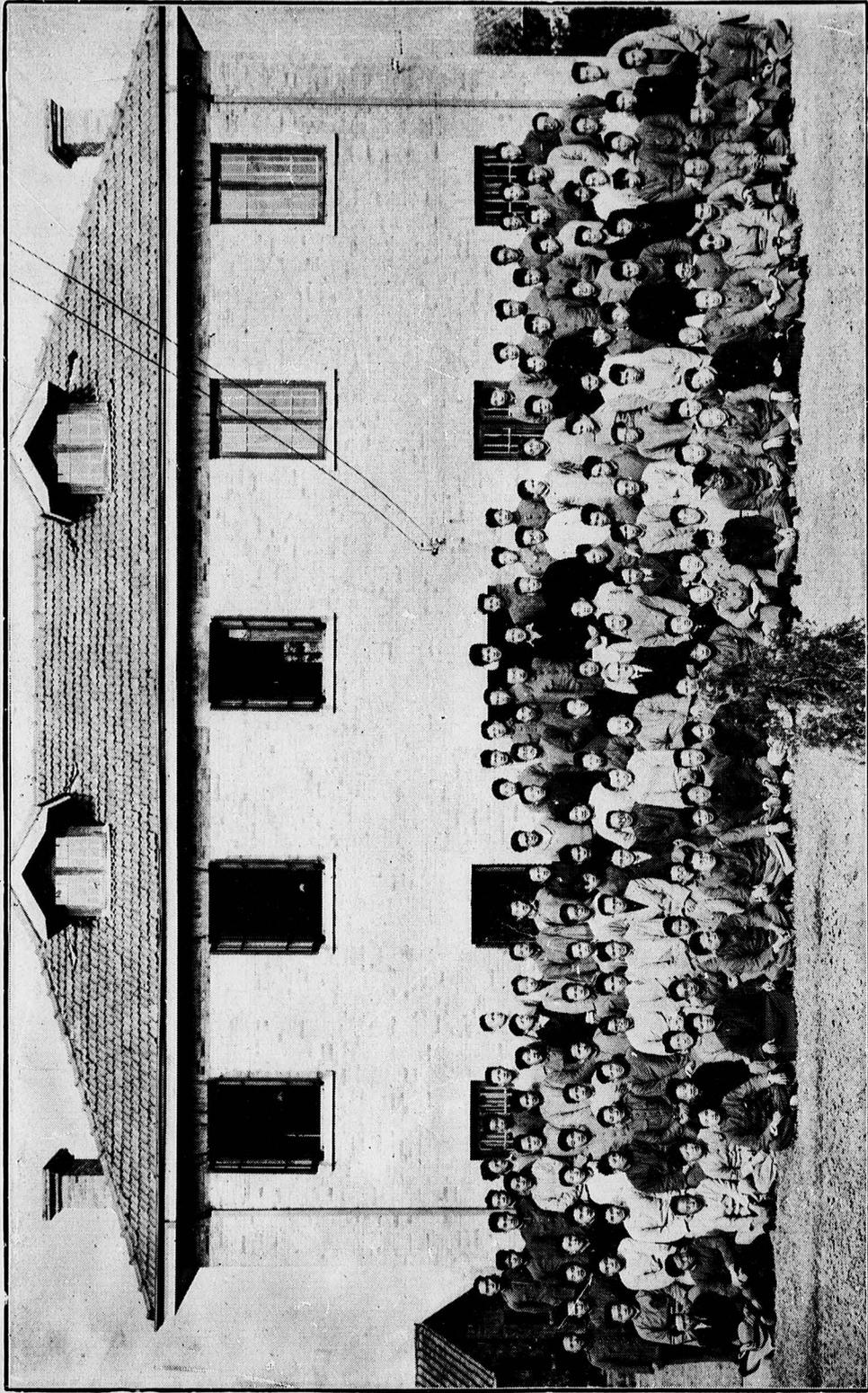
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*Faculty & Student Body, Rural Leaders Training School 1934*

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**A REPORT ON  
THIRTEEN YEARS WORK IN RURAL  
LEADERS' TRAINING**

**INTRODUCTION**

China is primarily an agricultural country and over eighty percent of its population lives on farms or in rural communities. In the very early centuries, farming was considered the most praiseworthy occupation and scholastic pursuits were next in order. Most of the ancient scholars, such as Confucius, were brought up on farms and were trained in farm work.

In later centuries, there was a complete change from this early attitude. Scholars devoted their lives to reading and writing of classics and looked upon manual labor as degrading. As a result, the entire agricultural enterprise was left in the hands of illiterate peasants. The educated people would have nothing to do with production from the land, and considered themselves superior to those who cultivated the soil.

Although centuries of intense and industrious farming have given the Chinese farmers great skill in soil cultivation and irrigation practices, the methods used are far too primitive to compete with the highly mechanized methods used in other parts of the world today. The improvement of agriculture is undoubtedly one of the most fundamental needs in China today and a definite start has been made in that direction. However, there are a number of difficulties to overcome, such as lack of transportation facilities, illiteracy, and lack of organization among farmers.

The realization of these needs led the University to offer courses for the training of rural leaders. Practical and theoretical work are combined in these courses with a view to training rural leaders who are acquainted with the practical needs of farmers, plus the knowledge to attack the problems scientifically. A rural leader cannot succeed completely unless he is willing to live among the farmers and can understand their hardships and needs.

For thirteen years the training courses in the University have been carried on, under various names and differing in length of period and subjects taught, but the original idea has remained the same. The unfortunate conditions of the Chinese farmers today, due to political, economic, and natural causes for which they are not responsible, show clearly the need for strong rural leaders. The object of the Rural Leaders Training School is to send out men who are leaders in at least one of the following groups:

- Scientific and practical farmers.
- Agricultural extension workers.
- Rural social reformers and organizers.
- Teachers of farmers.
- Teachers of children in rural communities.

### HISTORY OF THE DEVELOPMENT OF THE SCHOOL

In order to provide training in practical agriculture for men who were not equipped to take the regular agricultural course, Professor J. B. Griffing organized in 1922 a one year course in agriculture, known as a "Short Course" which was part of the College of Agriculture and Forestry. The next year he was responsible for the opening of a "Rural Normal School" for training rural teachers. Professor Griffing's idea was to select mature men from the country who were unable to secure higher education because of financial limitations, but who were of good character and physically strong. Both courses were limited to one year, including one summer, and costs were kept at a minimum. The method used was that of "learning by doing." All class work was arranged for the forenoon and all field work for the afternoon. From 1922 to 1927 there were five classes of graduates in the Special Course in Agriculture and four classes in the Rural Normal School. Most of the students had been working on their own farms or at government agricultural stations, or had been teaching in rural schools.

On account of the Nanking Incident in 1927, both the courses were suspended for a year. In the fall of 1928, the Special Course in Agriculture and the Rural Normal School were reorganized and combined, resulting in the Rural Leaders' Training School which has grown steadily since that time.

Since the reorganization, the scope of the work has been enlarged to include practically all rural problems which bear on rural improvement. Courses in teaching methods and rural sociology are an important part of the curriculum, and the students are required to take part in social service activities at the community center. The period of training has been extended to two years. Two classes have graduated under this system.

The two-year schedule began with the eighth class which registered in the school. The program of study is formulated in compliance with the regulations laid down by the Ministry of Education. The first year's work consists of general courses which give the students an idea of the scope of agricultural study and rural problems. In the second year the students are required to develop a certain amount of technique in various branches of rural work by selecting a major and a minor subject. There are only two major subjects, agronomy and forestry, and two minor, sericulture and horticulture.

The curriculum has been readjusted again and the actual change will be inaugurated in the fall of 1935. The first year's courses will remain approximately the same. The second year's courses will be divided into two groups, plant production and rural cooperation.



*Starching, a part of the process of weaving woolen material*



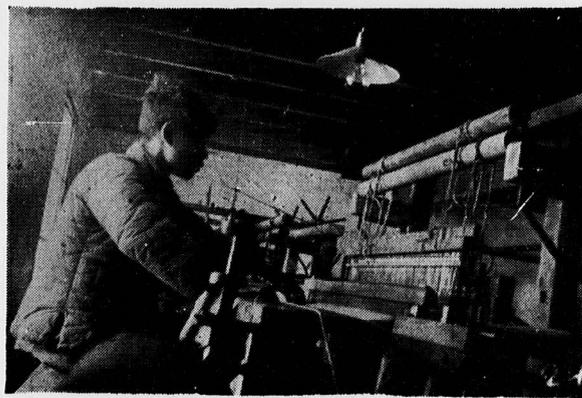
*The class in wool weaving*



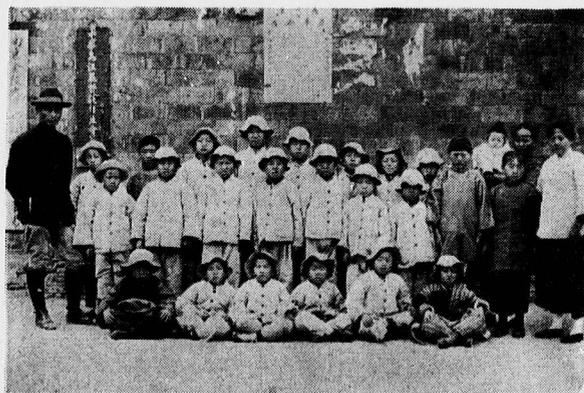
*Preparing the soil and carrying water as part of the entrance examination*



*Hoeing Cotton*



*Weaving Woolen Cloth*



*Rural School at Wukiang, conducted by a graduate*

**GRADUATES**

The total number of graduates from the eleven classes which have graduated from these special courses between 1923 and 1935 is 388, representing 23 provinces. A recent survey shows over ninety percent of these men engaged directly in agricultural and rural work. Details may be found in the following tables.

**Table I. Distribution of Graduates by Provinces**

Province	Class											Total
	I 1923	II 1924	III 1925	IV 1926	V 1927	VI 1930	VII 1931	VIII 1932	IX 1933	X 1934	XI 1935	
Kiangsu	12	13	3	12	9	13	10	5	3	7	4	91
Anhwei	3	2	10	5	3	3	3	4	1	5	5	48
Hunan	5	3	3	5	—	—	1	1	1	8	4	31
Szechwan	5	4	9	—	1	—	1	3	2	4	1	30
Shantung	5	—	3	5	5	1	3	3	1	—	3	29
Shensi	3	3	1	1	—	—	—	—	—	6	12	26
Fukien	2	1	—	1	3	2	3	1	—	2	3	18
Honan	1	2	2	3	3	—	2	1	—	1	1	16
Chekiang	—	3	—	3	2	2	1	1	—	3	1	16
Kwangtung	2	2	1	—	—	1	3	—	2	3	1	15
Hopei	1	—	—	2	3	—	2	—	2	1	4	15
Shansi	—	—	1	1	3	1	2	—	1	1	—	10
Liaoning	—	—	—	2	1	—	3	3	—	—	1	10
Kwangsi	—	—	—	—	—	3	1	—	1	2	2	9
Kiangsi	—	1	—	1	—	—	1	—	1	2	2	8
Hupei'	—	—	2	1	—	—	—	—	4	1	—	8
Chinghai	—	—	—	—	—	—	—	—	—	2	1	3
Yunnan	—	—	—	—	—	—	—	1	—	1	1	3
Kweichow	—	—	—	—	—	—	—	—	—	1	1	2
Kirin	—	—	—	1	—	—	—	—	—	—	—	1
Heilungkiang	—	—	—	—	—	—	1	—	—	—	—	1
Kansu	—	—	—	—	—	—	—	1	—	—	—	1
Chahar	—	—	—	—	—	—	—	—	—	—	1	1
<b>Total</b>	<b>39</b>	<b>34</b>	<b>35</b>	<b>43</b>	<b>33</b>	<b>26</b>	<b>37</b>	<b>24</b>	<b>19</b>	<b>50</b>	<b>48</b>	<b>388</b>

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Table II. Distribution of Graduates by Occupation

Class	Occupation	Agricultural experimental work	Agricultural education	Rural reconstruction	Agricultural extension	Officials in rural organizations	Agricultural cooperatives	Others	Unknown	Died	Total
I 1923		7	3	2	2	5	2	10	7	1	39
II 1924		3	10	3	1	2	1	4	4	6	34
III 1925		4	9	3	3	5	2	3	5	1	35
IV 1926		6	8	4	1	5	2	7	7	3	43
V 1927		5	3	4	2	1	4	10	3	1	33
VI 1930		6	9	2	1	1	3	2	1	1	26
VII 1931		9	12	4	3	1	3	2	2	1	37
VIII 1932		9	2	1	3	2	1	4	1	1	24
IX 1933		5	6	2	2	—	1	3	—	—	19
X 1934		18	15	2	4	2	2	5	2	—	50
XI 1935		10	12	4	7	3	5	3	4	—	48
<b>Total</b>		82	89	31	29	27	26	53	36	15	388

## ORGANIZATION AND ADMINISTRATION

The Rural Leaders' Training School is a part of the College of Agriculture and Forestry of the University of Nanking. The school is directed by a principal who acts in consultation with the dean of the college. The activities of the school are divided into four parts, namely, administration, instruction, agricultural projects, and rural service.

The people who have been in charge of the school during the past thirteen years are Messrs. J. B. Griffing, T. H. Shao, M. I. Chow, C. W. Chang, and Y. W. Chang.

*Organization of the Rural Leaders Training School*

President of the University

Dean, College of Agriculture and Forestry

Head, Department of Rural Education

Principal of the School

*Administration*

Business office

Library

Publications

Miscellaneous

*Instruction*

Registration

Examinations

Admission

Vocational guidance

*Agricultural projects*

The farm

The garden

The apiary

Poultry husbandry

Animal husbandry

*Rural service*

Wool weaving center

Rural clinic

Farmers' organization

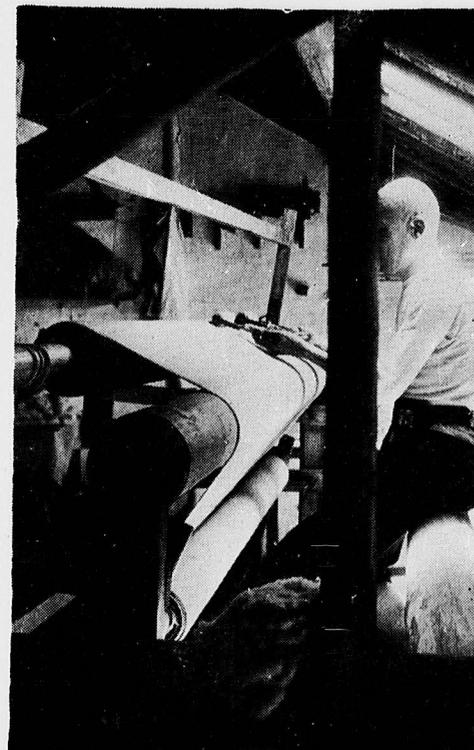
Education of farmers

Rural surveys

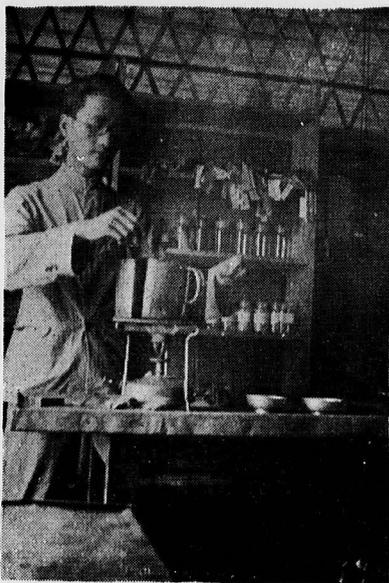
Agricultural extension



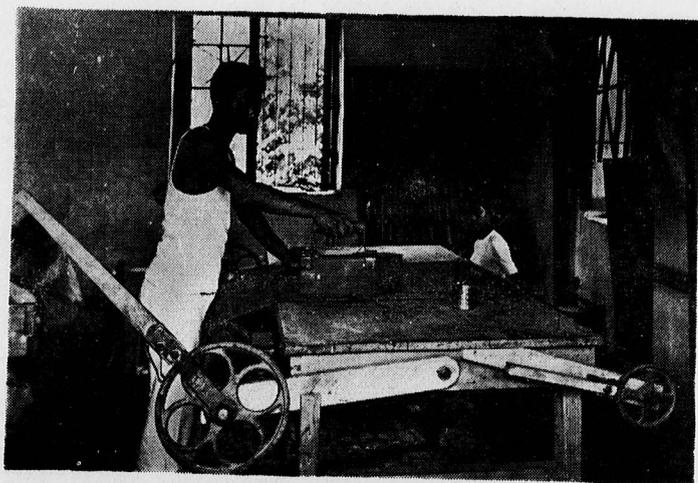
Buffalo show supervised by a graduate



Teaseling the Newly Woven Woolen Material



*An experiment in dyeing*



*Pressing at the Wool Weaving Center*

### BUILDINGS, LAND, AND EQUIPMENT

The Rural Leaders Training School is located about two 'li' to the northwest of the University. When the school was started, this was predominantly a rural district, most of the residents being farmers. However, the district is now rapidly growing into a popular residential section.

**Buildings.** The school consists of three two-story buildings and seventy 'jen' of Chinese style houses. The garden, ponds, orchard, athletic field, etc. around the buildings cover about 100 mow. The school has the privilege of using the facilities of the College and in addition has its own library, tools, and other equipment.

The buildings comprising the school are built in the most economical way possible. The available space in the school buildings may be divided into five groups:

1. Administration and instruction, including offices, classrooms, laboratories, library.
2. Student dormitories, including bedrooms, kitchen, dining rooms.
3. Faculty residences, including houses to accommodate ten full time staff members and their families.
4. The community center, including wool spinning, weaving and dying rooms, the clinic, etc.
5. The farm buildings, including tool room, crop hanging room, greenhouse, shelters for animals.

**Land.** The College owns about 2000 mow of land outside the city of Nanking which is used for experimental farm work, and also co-operates with a number of experiment stations in north and central China. This is all available for practice work by students in the Rural Leaders' Training School. The School itself has flower and vegetable gardens, fruit and mulberry orchards, crop fields and nursery. Each student is assigned a small plot of land for growing farm crops for which he has full responsibility. This gives the students an opportunity for a practical application of their classroom work.

**Library.** The students in the Rural Leaders Training School are permitted to use the large general library of the University. The School also has a small library limited to Chinese books and magazines dealing with agricultural and rural subjects. At present there are approximately 2,750 books and 55 magazines in this branch library.

**Equipment and Collections.** In the early years, the School used the equipment in the college, such as the chemistry, botanical and soil laboratories, but it is gradually building up its own supply of equipment. Eleven balances and twenty microscopes have just been purchased. Students make collections of economic plants, insects, seeds, and woods in connection with their various courses.

The School also owns a large collection of tools, bee keeping equipment, a chicken incubator, spinning wheels, looms and machines for wool weaving, and medical supplies and instruments for the clinic and rural health work.

#### METHODS OF TRAINING

All the courses in the Rural Leaders' Training School are taught in Chinese. Emphasis is placed on demonstrations by the teachers, and the doing of practical work by the students. In the field work and in the rural service center, the best progress is shown when teachers and students actually do the work together.

In the classroom, the deductive method is used. Emphasis is placed on questioning and reasoning. Lecture notes are given when no suitable text is available but the pure lecture method is avoided. Reference readings and reports are required in all classes. The general courses are taught by full time teachers and special subjects are given by experienced men in the College. Students are given a chance for individual work by the use of the project system.

The aim of the school is to create a friendly atmosphere in which students and teachers live, work and play together. Both teachers and students are required to board in the school. The teachers are an example to the students in study, work and play. There is no feeling of compulsion about tasks assigned to students, and there is an atmosphere of pleasant willingness to work and participate in all the activities of the school.

**Summer practice at Wukiang.** After finishing the first year's work, the students are required to spend one summer at Wukiang, the College extension center, before they are permitted to continue with the second year's work. While at Wukiang, they take an active part in farm practice, social service work, and other activities.

#### THE ADMISSION OF NEW STUDENTS

Great care is taken in selecting the right type of young men for admission to the school. The men must have grown up under rural conditions; they must be senior middle school graduates and have at least two years of practical experience since graduation. In addition to the written entrance examination, each applicant is required to do half a day's field work under the burning sun in order to demonstrate his fitness for field work. Each man is given a number which is fastened to his back, as is done in the case of football players, and he is observed and marked on his work in the field.

### THE CURRICULUM

Requirements for the first year—General

#### FALL SEMESTER.

No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agronomy 130	General farm crops	3	4	4
Horticulture 130	General	3	4	4
Soils 130	Soils	2	—	2
Agricultural Economics 130	Rural sociology	2	4	3
Rural Education 130	General	2	—	2
Agricultural Economics 131	Agricultural Statistics	2	—	2
Farm Machinery 130	Shop work	1	4	1
Farm Practice 130			5	
Rural Health 130	Health and sanitation			2
Total				20

#### SPRING SEMESTER

No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agronomy 131	Special crops	3	4	4
Horticulture 131	Vegetable gardening	2	8	4
Forestry 131	General and nursery practice	2	4	3
Soils 131	Fertilizers	2	—	2
Agricultural Economics 132	General	2	—	2
Agricultural Extension 131	Extension methods	2	—	2
Biology 131	Agricultural botany	2	4	3
Total				20

Requirements for the Second Year—Plant Production

#### FALL SEMESTER

No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agronomy 140	Plant breeding	2	4	3
Biology 140	Agricultural entomology	1	4	2
Horticulture 140	Pomology	2	4	3
Agricultural Economics 140	Cooperatives	3	—	2
Project 140	Plant production	—	4	1
Seminar 140	Plant production	2	—	1
Electives				8
Total				20

## SPRING SEMESTER

No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agromy 141	Plant breeding	2	4	3
Biology 141	Plant pathology	1	4	2
Horticulture 141	Preservation & canning	1	4	2
Surveying 141	Plane surveying		4	1
Agricultural Economics 146	Farm management	1	4	2
Project 141	Plant production		4	1
Seminar 141	Plant production	2	—	1
Electives				8
Total				20

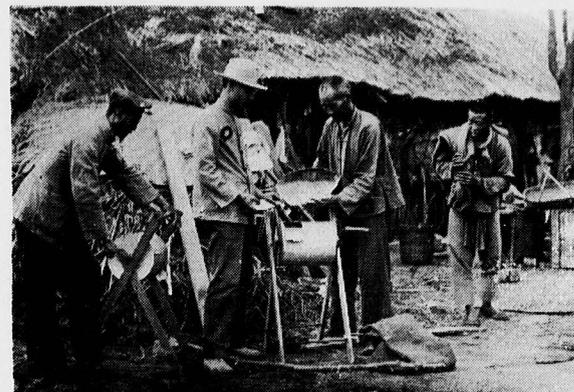
## Requirements for the Second Year—Rural Cooperatives

## FALL SEMESTER

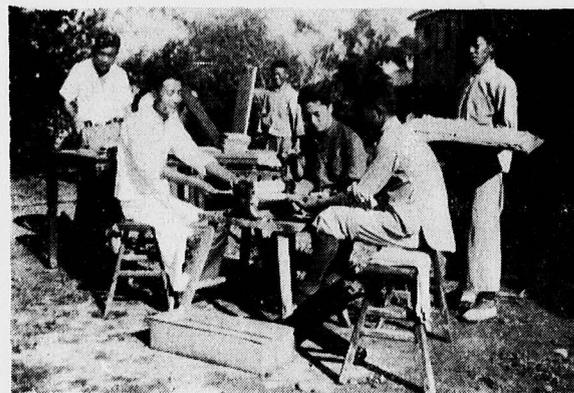
No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agri. Econ. 140	General cooperatives	3	—	2
" " 141	Cooperative marketing	4	—	3
" " 142	Accounting and book-keeping	2	4	3
" " 143	Cooperative organization	3	—	3
" " 144	Rural credit cooperatives	2	—	2
" " 145	Seminar	2	—	1
Electives				6
Total				20

## SPRING SEMESTER

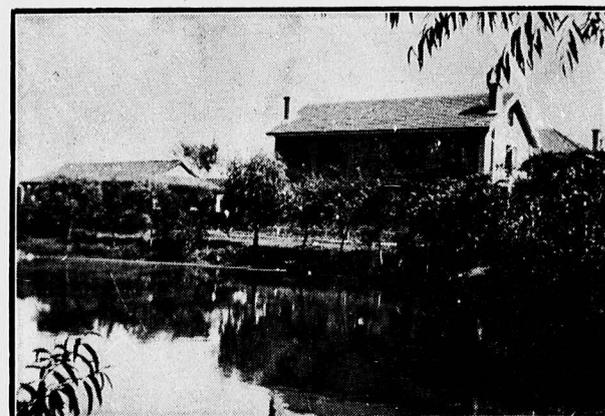
No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Agri. Econ. 146	Farm management	1	4	2
" " 147	Rural finance	4	—	3
" " 148	Auditing	3	—	3
" " 149	Agricultural prices	2	—	2
" " 150	Coop. financial administration	2	—	2
" " 151	Seminar	2	—	1
Electives				7
Total				20



A graduate demonstrating the control of wheat smut by the use of copper carbonate



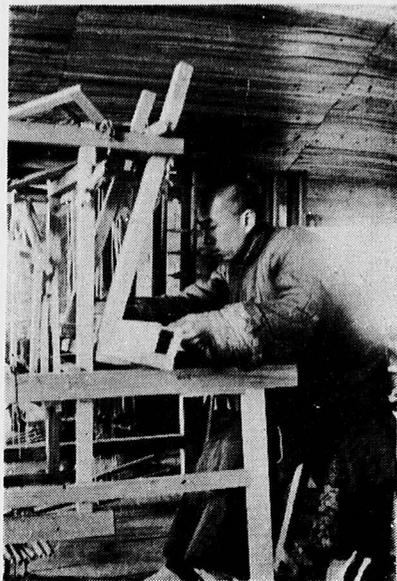
Making Wax Foundation for Beekeeping



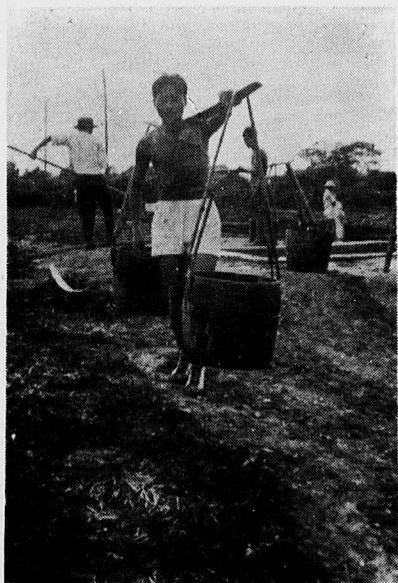
Building containing Class rooms and Laboratory



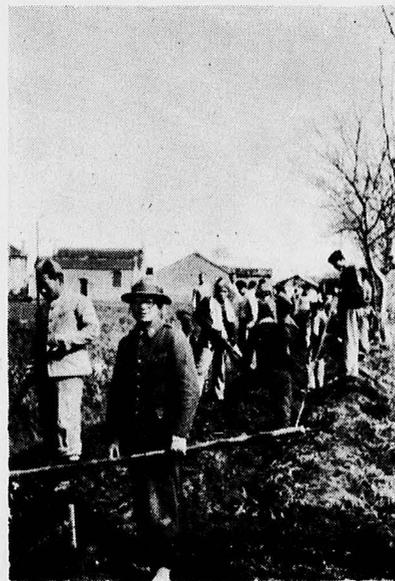
A trip into the country for a rural survey



Making samples of woolen materials



Carrying night soil



Building roads

SECOND YEAR ELECTIVES

No. of course	Description	Hours per week		Credits
		Class	Laboratory	
Farm Machinery 141	Implements	1	4	2
Meteorology 141	Agri. meteorology	2	—	2
Horticulture 141	Floriculture	1	4	2
Animal husbandry 141	General	1	4	2
Sericulture 140	Mulberry growing	2	4	3
" 141	Silkworm rearing	2	4	3
Forestry 141	Silviculture	2	4	3
Biology 142	Beekeeping	2	4	3
Rural Education 141	Rural school administration	3	—	3
" "	Rural school supervision	3	—	3
" "	Educational methods	2	—	2
" "	Social education	3	—	3
" "	Methods of teaching agriculture	2	4	3
" "	Rural library work	2	—	2

FEEES AND EXPENSES

	First year		Second year		Summer	REMARKS
	Fall	Spring	Fall	Spring		
Tuition	\$20.00	20.00	20.00	20.00	—	Managed by student
Board	36.00	36.00	36.00	36.00	12.00	
Room and incidentals	12.00	12.00	12.00	12.00	5.00	Figured on actual cost
Lecture notes	3.00	3.00	3.00	3.00	—	
Laboratory	4.00	4.00	4.00	4.00	—	Figured on actual cost
Magazine	1.00	1.00	1.00	1.00	—	
Library fee	1.00	1.00	1.00	1.00	—	Figured on actual cost
Medical fee	1.00	1.00	1.00	1.00	—	
Badge	1.00	—	—	—	—	Figured on actual cost
Uniform	8.00	—	—	—	—	
Athletics	0.50	0.50	0.50	0.50	—	Collected for student council
Student council	0.50	0.50	0.50	0.50	—	Returned
Deposit	2.00	2.00	2.00	2.00	—	
Graduation fee	—	—	—	1.00	—	
<b>Total</b>	<b>\$30.00</b>	<b>81.00</b>	<b>81.00</b>	<b>82.00</b>	<b>17.00</b>	

STUDENT ASSISTANCE

There is a small loan fund available for students who cannot afford to pay tuition. The loans do not exceed the amount of tuition each semester. Some student assistants are used in the school and there is some opportunity for part time work.

### SOCIAL SERVICE ACTIVITIES OF THE SCHOOL

Students participate actively in social service work for the people in the neighborhood of the school and the farmers at Wukiang. The projects are listed below:

#### Popular education

1. An evening school with two classes for adults.
2. A reading room containing papers and magazines, and a bulletin board on the street on which news items of general interest are posted daily.
3. Children's clubs, such as the spinach club, the corn club, etc.
4. Women's clubs.

#### Recreation

1. A social room with facilities for indoor games.
2. Supervision of ball games and other outdoor games for children and adults.
3. Social gatherings for the farmers.
4. Plays and movies are given on special occasions.
5. Picnics and trips are organized for the farmers and their families.

#### Hygiene and sanitation

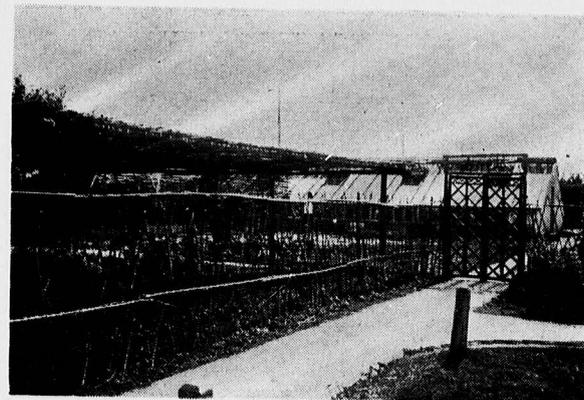
1. Clinic for the treatment of common ailments and for vaccination against smallpox.
2. Lantern slide lectures and exhibitions of pictures on health.
3. Village sanitation movements.
4. Baby shows.

#### Agricultural Extension

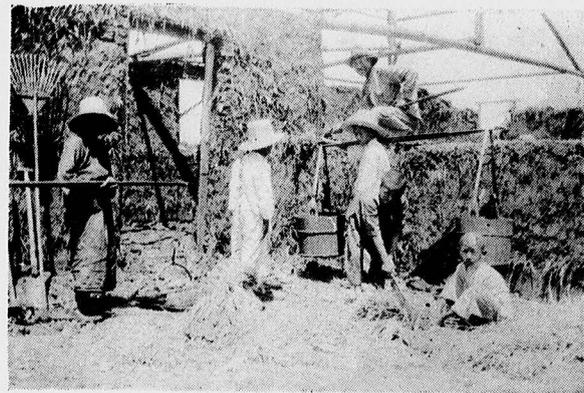
1. Exhibits of agricultural tools and products.
2. The organization of fish breeders and vegetable growers associations for cooperative selling.
3. The distribution of vegetable and crop seeds.
4. The promotion of chicken breeding.

### PROJECTS CARRIED ON IN CONNECTION WITH THE SCHOOL

The Rural Leaders' Training School undertakes a number of projects in rural industries and rural education. Among these the wool weaving project, rural primary schools, and the preparing of printed material for teaching work are among the most important.



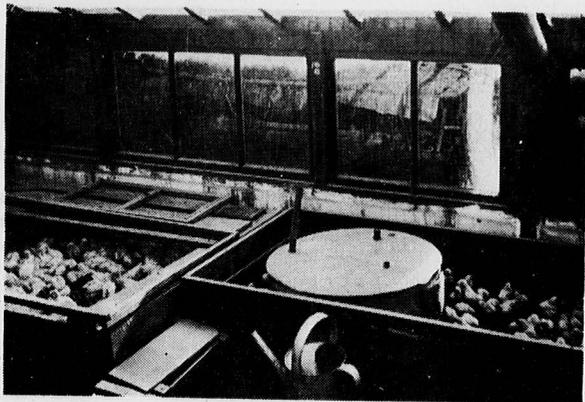
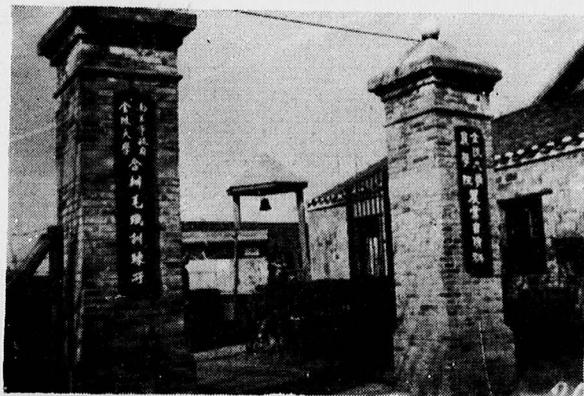
*The Garden*



*A Graduate Supervising the Building of a Rural School House with Mud and Straw*



*Sheep, Han-yang Breed*

*Baby Chicks**Winners in a plowing contest conducted by a graduate**Entrance to the School*

**The Wool Weaving Project.** In cooperation with the Sociology and Agricultural Engineering departments of the University and with some financial support from the Nanking Women's Club, a wool weaving center has been established for the purpose of giving employment to skilled weavers formerly engaged in the silk industry. Investigations were made on the methods of weaving in use in various parts of China. The Rural Engineering Division has made a number of improvements on the machinery and equipment. With the idea of extending this project to other villages, all the machinery is hand operated. The rural districts are not yet ready for motor driven machinery.

At present the center is equipped with steam and ordinary dyeing outfits, carding and spinning machines, seven kinds of looms, teaseling machine and ironing board. Blankets and woolen cloth are woven and dyed. It is expected that the sale of these products will eventually pay for the equipment. In addition to the Training School students who work at the center, there are about twenty full time students learning this industry.

**Rural Primary Schools.** The Rural Leaders' Training School formerly carried on three rural schools, one at the School, one at the University farm outside of Taipingmen Gate, and the third at Wukiang. The purpose was to demonstrate proper administrative and teaching methods. A number of social activities were carried on in connection with these schools. Since the increase in the number of public schools in Nanking, this project has been discontinued. The Wukiang Rural School is still running but under the responsibility of the local farmers, with some supervision from the Training School.

**Publications.** An "Agricultural Text book" for use in the higher primary or junior middle school was written by Professor J. B. Griffing and translated into Chinese by Mr. T. H. Shao. Two editions of both the text and the teachers' manual have been published. Leaflets on agricultural subjects and nature study have been written by Mr. Y. W. Chang. When time and funds are available more work will be done along this line. The School is now issuing a monthly magazine containing articles on practical agriculture and rural problems which serves as a guide for rural workers.

#### RELATIONSHIPS WITH OTHER INSTITUTIONS

Many institutions, both public and private, send their men to the Training School before sending them out to do rural improvement work. Missions throughout China apply to the School for rural workers. In order to take care of the applicants who are not eligible because they have not graduated from a registered senior middle school a certain number of "visitors" are allowed in each class. They receive the same training as regular students but do not receive the Government certificate at the end of the two-year period. Visitors are only received on the

recommendation of some institution provided they have a guarantee of a position after completion of their training.

**Cooperation with the Nanking Theological Seminary.** A plan has been inaugurated whereby a few students from the Seminary spend one year in the Rural Leaders' Training School in order to fit them for the rural ministry.

**Cooperation with the Shensi Government.** At the request of the Provincial Government of Shensi, beginning from the fall of 1933, a special three year course was opened for students from Shensi who cannot meet the requirements of the regular course. The Government contributes \$5,000 a year for the work. In addition, the best twenty students in the class receive scholarships of \$250 a year and the remaining fifteen students receive \$200 a year.

#### FOLLOW-UP WORK WITH GRADUATES

Rural reconstruction is recognized by all classes as a matter of utmost importance in China. Success in rural improvement depends on the workers. Graduates from the Rural Leaders Training School are found in rural centers throughout China. There are not enough graduates to fill the demand.

The School keeps in close touch with the graduates and the monthly magazine serves as a kind of correspondence between students and School. When graduates are out of work, they are urged to return to the School where they are permitted to attend classes and to use the library, and are recommended for new positions as they become available. When the students are at work, they are still "backed up" by the School.

#### PLANS FOR THE FUTURE

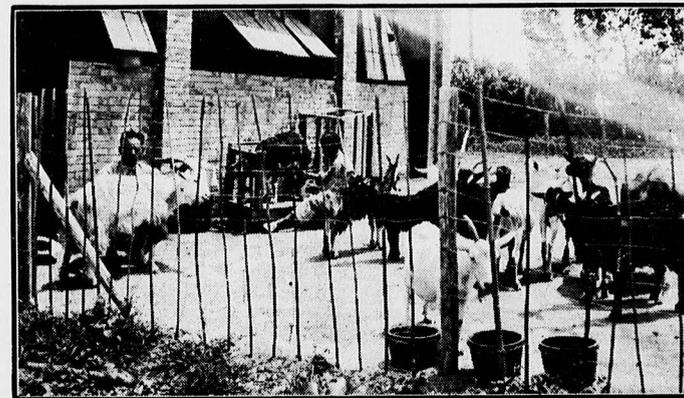
The greatest problem at present is the location of the School. Since Nanking became the capital of China in 1928, there has been a steady and rapid increase in population. The School is no longer in a rural environment and many kinds of rural activities are handicapped. The summer season in Wukiang is not sufficient; the school should be located in the country throughout the year, in spite of the fact that this would eliminate the use of the facilities of the University and the teaching by part-time faculty. A number of places have been suggested as possible locations for the school. Wukiang is probably the most promising inasmuch as it has been the extension center for the College for about ten years and the farmers are receptive to the work. The confidence of the farmers is a very important factor in such work as the School is trying to do.



*Blacksmith Shop*



*Class in Carpentry*

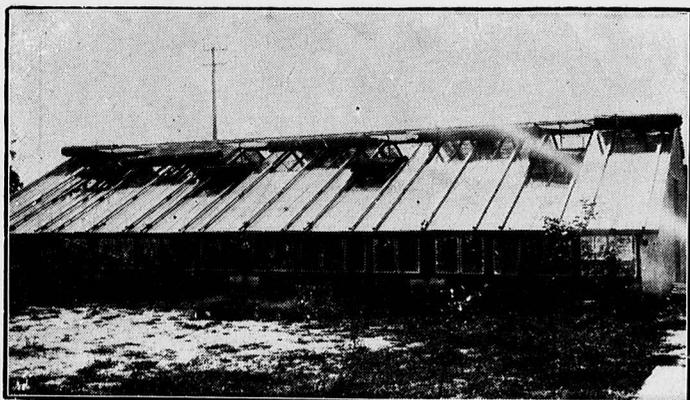


*Milk Goats*

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1  
3  
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3



*Shensi Special Class*



*Greenhouse*



*Bringing in the Wheat*

The two big difficulties in making the change are the loss of part-time teachers and the finances needed. It is hoped that the School can be located on a farm of about 1000 mow which will serve as a source of income. The land, buildings, tools, and equipment needed will cost from sixty to one hundred thousand dollars.

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