The Cornell-Nanking Story

The First International Technical Cooperation Program in Agriculture
by Cornell University

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Published by The Internet-First University Press
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Acknowledgments

Thanks to Royse P. Murphy, who identified and retrieved this document, making it possible to re-issue it nearly a half-century after this pioneering effort was first described in 1963. Murph’s own legacy is being described by the IFUP. An interview with him by Donald Viands is at http://ecommons.library.cornell.edu/handle/1813/28287
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Joe Metz and Ed Oyer were the content reviewers and Judy L. Singer was proofreader. J. Robert Cooke produced this re-issued document. The Internet-First University Press now makes this report readily accessible worldwide at http://ecommons.library.cornell.edu/handle/1813/63.

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The Internet-First University Press was cofounded by J. Robert Cooke and Kenneth M. King
Foreword

The Department of Plant Breeding is pleased to present this comprehensive documentation of what is considered to be the first notable example of international technical cooperation in crop improvement. Dean Reisner and Professor Love conceived and developed this program. With financial support from the University of Nanking in China and the International Education Board in the United States, Professors H. H. Love, C. H. Myers, and R. G. Wiggans of Cornell and Dean John H. Reisner and faculty members of Nanking initiated this program in 1925. From the beginning, the program was successful and its effects are still evident today as a result of the large number of Chinese specialists in crop improvement that were trained during this period. This program could not have been successful without the enthusiastic participation by the Chinese students and the Chinese and Cornell professors and specialists. On-the-job training as envisioned and developed by the Cornell professors and their associates at Nanking is probably the most significant contribution of this program. This may be seen in other programs in China and Thailand in which Professor Love has participated. Many of the trainees in the Nanking program serve with distinction, directly or through their students, in Nationalist China, in the Food and Agriculture Organization of the United Nations, and so far as is known, in Communist China.

We are pleased to share this story with our students and friends.

R. P. Murphy
Professor of Plant Breeding and
Head of the Department
A Pioneer Project

“The first notable example of international technical cooperation in agriculture was the Plant Improvement project carried on from 1924 to 1931 by Cornell and the University of Nanking with financial aid from the International Education Board. The success of this program in training Chinese scientists to carry on a program of Plant Breeding and Crop Improvement in China led to the great expansion of University contracts under the foreign aid program of the United States in recent years.”

From an address by Dean W. I. Myers, March 22, 1962. “Agriculture at Cornell — The First Century.”

Dean Myers reports another incident which shows the influence of the Cornell-Nanking program. This was in connection with a visit Dean Myers had with one of the members of the Department of State, “in connection with the United States program of technical cooperation. The conversation occurred at a conference in the early days of this project soon after President Truman’s recommendation for a Point Four program. This man told me that the success of the Cornell-Nanking project was one of the basic reasons for the initiation of a more comprehensive program of cooperation between American colleges and their overseas counterparts as an important part of the technical aid program.”
Authors’ Note

The reader may be surprised at the omission of the names of most of the Chinese who rendered valuable service to the program but this omission has been intentional on the advice of and in several cases at the request of those Chinese friends. The reason inheres simply in the political situation on the China mainland. Without the able and enthusiastic cooperation of many Chinese colleagues, this program could not have been carried out to such a successful conclusion. This fact will be evident throughout the report.

In the preparation of this manuscript, information and data have been taken freely from the unpublished reports of the Cornell professors who participated in the program; reports from the College of Agriculture of the University of Nanking; Dr. Myers’ report, written at the end of the cooperative program and published by the University of Nanking as Special Report No. 1, 1934; from the Agriculture and Forestry Notes of the College of Agriculture and Forestry of the University of Nanking; and from certain other reports, some of which were published and some not. The authors appreciate that they have had access to these several different references.
No. 1 John H. Reisner and Harry H. Love.

No. 2 Bailie Hall, named in honor of Joseph Bailie, founder and organizer of the College of Agriculture and Forestry, and its first Dean. Headquarters for the Cornell-Nanking Program.
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Dean John H. Reisner’s Letter of February 4, 1924

to Professor H. H. Love

The Cooperative Crop Improvement Program between Cornell University, through the Department of Plant Breeding of the New York State College of Agriculture, and the University of Nanking, through its College of Agriculture and Forestry – with financial support from the International Education Board – had its origin in a letter to Professor H. H. Love at Cornell from Dean John H. Reisner in Nanking under the date of February 4, 1924, as follows:

“We are looking for a Plant Breeder – a man who is interested in the practical applications of the principles of plant breeding and in getting practical results as quickly as possible. As you probably know, the College of Agriculture and Forestry received a considerable sum from a balance of left-over funds in the hands of the American Famine Fund Committee which had been raised for famine relief in China. The sum given to us is for famine prevention and one of the projects we are developing is the improvement of certain of the major crops, with the idea of increasing agricultural production and the food supply. Our experience so far has been that Chinese crops are very amenable to improvement. In fact, we have already done considerable work in the improvement of wheat, cotton and corn, with very excellent results. There is a tremendous field for this line of work. Naturally, we want a man not only of ability, but of experience and one who is able to see the larger implications of his work. Not only do we have a large farm here in Nanking, but we are cooperating with Mission stations and experiment stations, and individuals throughout China, so that we have an excellent opportunity for the development of a strong organization of pure seed farms in such a way that the work of any man can be very rapidly multiplied.

“We would want a man who had specialized in the small grains. Personally I feel that our more immediate plant breeding problem is one of selection rather than of hybridization. Another fact which makes the work attractive is that assistants are available and one man is able to make his time go a very long way by careful and wise use of them. For instance, Mr. Griffing, who is in charge of our Cotton Improvement work, in three years time, made over 52,000 individual selections of cotton plants, and studied them all carefully in the laboratory and secured an immense amount of extremely valuable data. I am sending his report to you, knowing that it will be of considerable interest.

“We would like to have a man like you or Mr. C. H. Myers, if he could be persuaded to come. The emoluments are not particularly enticing as it were, but quite sufficient for a comfortable living. The enclosure indicates the salary basis on which we are all working. Have you someone to suggest? I hope so and that I may have the privilege of hearing from you soon.”
Formulation of the Program

Dean Reisner’s letter was discussed at length with members of the staff of the Department of Plant Breeding. Reactions were generally favorable. Several sabbatical leaves were due that might be used. However, it was early agreed that a worthwhile program could not be completely organized and placed on a permanent basis in one or two years. There was also the important question as to how the work of the staff members could be maintained while away from the Department if the program were placed on a longer time basis.

Consideration was given to a plan which would bring in plant breeders from other institutions. It was natural that with men from one department engaging in the work that it would be possible to have greater continuity from year to year than by using men from different institutions. It was finally decided to use men from one institution and one department, and this proved to be a wise decision. There was also the question of policy on the part of the College and University authorities with respect to such a long-time program. After much consideration and discussion by the Department of Plant Breeding, a program was drawn up requiring a period of five to ten years for its completion. Dean A. R. Mann, of the College of Agriculture, and President Livingston Farrand, of Cornell University, gave their warm endorsement and approval.

Through correspondence, Dr. Love and Dean Reisner had reached agreement that the longer period of five to ten years would yield much better results and was therefore more desirable. But the proposal also meant that sabbatical leaves would not cover all the time the Cornell professors would be away from Cornell. The University of Nanking had no funds to cover the added expense for this item. It was at this point that a request for financial help was submitted to the International Education Board, through Dean A. R. Mann, on leave from the New York State College of Agriculture at Cornell and serving as the Board’s Director of Agriculture. Fortunately for the program the request was granted.

The program was formally approved by the Board of Trustees of Cornell University, by the authorities of the University of Nanking and by the International Education Board late in 1924. Briefly summarized, with slight modification as presented in Dr. Myers’ report, the program involved the following points:

◊ 1. The purpose of the program was two-fold, to organize and conduct a comprehensive crop improvement program, involving the principal food crops of the famine areas of central and northern China, (cotton was included later) and of equal importance, to train men in the principles, methods, application and organization of crop 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 would go to Nanking, there to be associated with the Department of Agronomy at the College of Agriculture and Forestry and to help develop the plant breeding work of that Department.

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

◊ 4. Cornell University agreed to grant sabbaticals 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.

According to the plan each representative from Cornell would return to Ithaca from three to four months before it was necessary for his successor to leave for China. Thus there would be ample opportunity for conferences relative to the work that would aid materially in sustaining its continuity. At the close of the program, those who had been most closely connected with it felt that this plan had been fully justified.
Political Conditions in China

The Republic of China was 14 years old when this cooperative undertaking began. These years were also the years of the war lords in China, who had carved out spheres of influence for themselves. They were years of sporadic civil wars between the war lords. On March 24, 1927, the Revolutionary army, moving north from Canton, reached Nanking. The ensuing disturbances caused the evacuation of all Consular staffs and other foreign residents in Nanking, including the foreign members of the University faculty. Though intermittent civil wars continued, peace was generally restored in the lower Yangtze River valley, and an era of reconstruction begun. In 1931, Japan moved into Manchuria and in 1937 attacked the mainland of China, driving the Government and many people and institutions to west China, among them the University of Nanking, not to return to Nanking until 1946. The Communists finally took over in 1949, and the Nationalist Government established itself in Taiwan.

The disturbed situation in Nanking in 1927 made it impossible for the Cornell representative, Dr. Wiggans, to function as planned, and the Cornell cooperation was held in abeyance for two years. During Dr. Wiggans’ tour of 1930, access to the northern cooperating stations, which he visited, was only by boat from Shanghai to Tientsin. In 1929, Dr. Love had been stranded in Kaifeng, in Honan Province, due to the military cutting the railway line by which he had traveled. He was forced to go overland by rickshaw and bus to Nanhsuchow, on another railway and return to Nanking. Fortunately, it was possible for the Chinese associates to travel to the cooperating stations at times when traveling by the Cornell representatives was unwise.

In spite of civil wars and the major military disturbances of 1927, no damage was done to the Crop Improvement Program, no plantings were harmed and no seed lost. Too much credit cannot be given to the Chinese associates for their dedication, courage, perseverance and tact under extremely difficult circumstances.

The College of Agriculture and Forestry of Nanking University

The College of Agriculture and Forestry of the University of Nanking, Nanking, China, began work in the summer of 1914, with a class of eight students. It had been brought into being to contribute to the prevention of famines in China, through scientific agriculture and forestry. Its main protagonist and first Dean was Joseph Bailie, born in Ireland, educated there and in the United States, who went to China as a Presbyterian Missionary, and later taught mathematics at the University. He had been granted leave from the University to take part in relief work for those caught up in the disastrous famine in the Hwai River area in 1913. This was no new experience for him, but he was increasingly disturbed at each relief program. He finally came to the conclusion that the only answer to these perennial situations, requiring relief in greater or lesser amounts and affecting tens of thousands of people, largely rural, was to attack the root causes, and that progress could only come as men trained in agriculture and forestry became available to the Nation. He was supported by the officials of the University, and the College of Agriculture and Forestry came into being, but with serious doubts on the part of a good many that a university should become involved in such an undertaking. The College in due time became the largest in the University.

In 1920, another serious famine occurred in the same general Hwai River area. President Woodrow Wilson responded by setting up a Committee of One Hundred for China Famine Relief. The famine relief work ended sooner than had been anticipated and the Committee found itself with considerable unused funds and the problem of how they could be most wisely used.

A proposal was submitted to the Committee by the Dean of the College of Agriculture and Forestry, that some of these funds should be used for famine prevention purposes in the fields of agriculture and forestry. This proposal was acted on favorably and $1,000,000 appropriated; three-fourths being assigned to the University of Nanking for its College of Agriculture and Forestry, and one-fourth to Yenching University for its Department of Agriculture.
These funds were administered in China by the China Famine Fund Committee appointed by the U. S. Ambassador to China. The Crop Improvement Program was supported by a portion of the funds assigned to the University of Nanking.

In 1931, on the initiative of Yenching University its program was reorganized into a crop improvement program, under the supervision of the College of Agriculture and Forestry at Nanking, and the balance in the original appropriation to Yenching University was transferred to the University of Nanking.

The College operated on the philosophy that it should limit its operations but maintain high standards in what it undertook to do. In part, this was necessitated by limited funds, but was also a matter of policy. Only eight departments are listed in the annual report of the College for 1925; Agricultural Economics and Farm Management, Agronomy, Biology including Bacteriology, Botany and Plant Pathology, Cotton Improvement, Extension, Forestry, Rural Education and Sericulture. The Department of Forestry was for a number of years the only one in China. The College has to its credit, the first Farm Management survey, the first Crop Disease survey, the first Crop Reporting system and the first Department of Extension and many other firsts.

By 1931 the ratio of Chinese to foreign faculty was 64 to 4 compared to a ratio of 41 to 9 in 1925. One hundred sixty-three students were registered in the College. By June, 1931, 215 men had been graduated; 151 in Agriculture and 64 in Forestry, with Bachelor of Science degrees respectively in Agriculture and Forestry, granted by the Board of Regents of the University of the State of New York. Forty of the college graduates had proceeded to foreign countries for graduate work, most of them to the United States, and became closely associated with the remarkable advances in agriculture and agricultural education that took place in China after 1930.

Instruction was in the English language and English textbooks were used. It was in the period of 1920-1930 when the greatest progress was being made in developing Chinese teams for the applied sciences of agriculture and forestry, and the beginning of the production of textbooks in Chinese. In 1914 there was one Chinese Government College of Agriculture, that in Peking. Although National and Provincial Agricultural Colleges were organized during the years after the Revolution, disturbed political conditions and inadequacy of financial support were unfavorable to the continuity of their operation. As a private institution, the University of Nanking was able to maintain its program without serious interruption — an important factor in the success of a crop improvement program.

As already noted the College moved to Chengtu when the Japanese attacked in 1937. This move included faculty and families, many students, library books, laboratory equipment, records, and everything essential to the Crop Improvement Program.

The College of Agriculture and Forestry was given official recognition by the Central Government of the Republic of China in 1925.

The Administration of the College of Agriculture was unique in that it had two Co-deans who were also Co-directors of the Experiment Station – one Chinese and one foreign – with a division of responsibility that was both natural and effective.

The Cooperating Stations

Before this Cooperative Crop Improvement Program had come to a close in 1931, some 14 cooperating stations had become associated with it. These stations added greatly to the effectiveness of the work centered at Nanking. Most of them were related to Mission stations where there were agricultural missionaries or others interested in local agricultural conditions. In every case there was land available that could be used for experimental purposes. They were located in areas representative of the major crops of north, central and east China. As private organiza-
tions, they continued to function for the most part in spite of civil disorders, and they were centers from which large selections from the major crops could be made, first for local testing and later for exchange with the other cooperating stations for advanced testing. In view of the fact that the experimental methods in use were common to all stations as well as Nanking, comparable data could be achieved.

The following is a list of the cooperating stations operating in 1931. Among the directors, seven were graduates in Plant Breeding of the College at Nanking and all had received training in the Summer Institutes of Plant Breeding as part of the Cooperative Crop Improvement Program.

In 1930-1931, the cooperating stations were as follows:

- Anhwei Provincial Agricultural Experiment Station, Anking, Anhwei.
- Central China Teachers College, Wuchang, Hupeh.
- College of Agriculture, Central University, Nanking, Kiangsu.
- Jefferson Academy, Tunghsien, Hopeh.
- Kaifeng Baptist School, Kaifeng, Honan.
- Kiangsu Wheat Experiment Station, Hsuchowfu, Kiangsu.
- Nanhsuchow Station, Presbyterian Mission, North Nanhsuchow, Anhwei.
- Oberlin Shansi Memorial Schools, Taiku, Shansi.
- Shantung Agricultural and Industrial School, Yihsien, Shantung.
- St. Paul’s Hospital, Canadian Mission, Kweiteh, Honan.
- Weihsien Station, Presbyterian Mission, North, Weihsien, Shantung.
- Yenching University Agricultural Experiment Station, Peiping, Hopeh.

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**Participating Cornell Professors**

As plans developed, it was agreed that three professors from the Department of Plant Breeding at Cornell would participate in the program, Drs. Love, Wiggans and Myers. It had been possible to arrange for the continuation of their research work, while absent in China, more easily than that of the staff members engaged in full-time teaching.

Dr. Love had specialized in small grains and biological statistics, Dr. Wiggans in open-pollinated crops such as corn, also in forage crops, and Dr. Myers in vegetable and forage crops. Each one had experience with other crops and was fully acquainted with the experimental methods and techniques in use at Cornell and many other experiment stations. All had received the Doctor's degree from Cornell and had worked together for a number of years. Due to unsettled political conditions, the participation of the Cornell representatives was interrupted partially in 1927 and completely in 1928. Each professor made two trips to China as follows:

- Professor H. H. Love - 1925 and 1929
- Professor C. H. Myers - 1926 and 1931
- Professor R. G. Wiggans - 1927 and 1930
The Program

The program had two main objectives. One was to develop by appropriate methods better varieties of the important field crops of China. The other was to train, during the course of the experimental work, a large number of Chinese who would be capable of continuing the investigations after the Cornell staff had completed their trips to the University of Nanking.

Crop Improvement

With all the crops, high yield was important and, at the same time, the quality of product had to be considered. Then there were other characteristics of plants to which attention had to be paid, such as a stiff straw or stalk, so that the plants of the new sorts would stand up better in the field than was true with some varieties commonly grown by the farmers. The problems of disease resistance also needed to be considered as the work progressed and did receive attention.

It was decided that the first phase of the program would be that of making a large number of individual plant or head selections from farmers’ fields to form the basis of the first work in crop improvement. One might ask why concentrate on selection rather than to engage upon a program of hybridization or crossing the varieties that were already available? When beginning a program of crop improvement in a new area or region where the varieties of different crops have not been studied and compared by yield tests as to their ability to yield, it is better to begin by making selections rather than to embark upon a hybridization program. In other words, if a study covering several years had not been made in variety evaluation of the many different varieties of a particular crop, then it would be unwise to begin a crop program without more knowledge as to which varieties were actually the best for the given area.

In addition, it is also important to have information as to the types or kinds of varieties that would be more desirable for the general area under consideration. So when entering upon a crop improvement program where such information is not available, it is best to start with a selection program, and a variety evaluation program may be conducted along with the selection program. Naturally, as a selection program is carried out, it also gives information on variety evaluation.

Another reason for beginning a program by selection is that it is the cheapest and quickest way to find some good types. Selection enables the plant breeder to pick out from a field a lot of different types and then find the best ones from this particular lot of selections.

Value of Selection

What does selection do? Selection with crops like wheat, barley, rice and certain other crops, does not create anything new, but with crops like corn and other naturally cross-fertilized plants, continued selection toward a definite goal will change the type of plant. In this respect, it differs decidedly from a hybridization program. When one looks at a field of wheat, barley, rice or other similar crops, he is inclined to look at the entire field and sees a lot of plants growing together, and does not really observe closely the individual plants unless he is trained in plant improvement and is looking for variations. It is important to point out that where a good agricultural program has not been conducted in the area, that the field of grain one may be looking at contains hundreds and even thousands of different types of plants. That is, some of them may be shorter than others, some may yield more grain — there are many different types. Some of these differences can hardly be noticed by the naked eye. The yield of such a field is made up of the individual yields of all the plants in the field. If it were possible to go into this field and pick the best plant, it might be possible to obtain a new high-yielding sort by keeping the seed of this plant separate from all others and multiplying it. This one might produce as much as 30 or 40 percent more than the average one would obtain by continuing to sow the seed of the crop harvested from the field from which this selection was made.
It is impossible to be sure of this without further study, since the plants as observed in the field vary in their ability to produce grain. Some produce a large amount of grain, but this may be due to the environment or nurture in which the plant grows, and, if this is the cause of the large yielding plant, one would not necessarily expect to get any improvement from this particular selection. If, on the other hand, the plant yields well due to its hereditary nature, meaning that it possesses hereditary units for high yield, one would expect to obtain a high-yielding sort. So plants vary due to the environment, or nurture, and to heredity or nature. When making selections in the field, one is not sure whether he is selecting plants that inherit the ability to yield well, or whether they are better due to the fact they had a more favorable spot in the field. For this reason, it is best to make a large number of selections and test them out in small plots or rows, each row having been sown to a different selection and grown under as nearly identical conditions as possible.

By saving seed from those rows that produce high yields under the conditions of the tests and continuing this process for four or five years, it should be possible to obtain some types or lines, as sometimes designated, that will give, by reason of the hereditary units they possess, a high yield. This shows that the original high yield was not due to environment alone. It is possible that one may not find an outstanding line even after testing the yielding ability of a large number of selected heads. By making these selections on a large scale from different fields and different locations, one will have a good representation of the varieties usually grown by the farmers in those areas, and the performance of the plants in their yield tests will show whether one variety may be better than another from the standpoint of its ability to produce high yields from a selected head as a result of heredity.

Unfortunately, when making these selections in the field, there is very little that will guide even the best-trained plant breeder to the most outstanding plant in the field. He must rely upon a large number of selections and these must be from a number of different parts of a field and from a number of different fields. Above is mentioned the importance of having a large number of selections, and one may ask what is considered to be a large number. If one is thinking of starting such a program with 50 or 100 selections, it may be just as well not to start because one needs many more selections than this in the first lot that he is testing for yield in the field. Several thousand selections represent more nearly the number that one would choose. The number to be made depends largely on the facilities which are available for handling the work, meaning by this that there must be a sufficient area of relatively uniform land, and the labor available for planting, caring for, harvesting and threshing of the material. It is most important that sufficient technical help be available to handle the crop and make preparations for further tests another year.

One may be inclined to make selections from fields located in distant places, like other states or provinces, hoping to obtain some especially good types, but varieties that are grown within a certain area are more often likely to produce better selections than those made from faraway places. Often, in beginning programs of crop improvement, one may think it is wise to obtain a large number of varieties from countries located in different parts of the world. Occasionally, one may find one or more good varieties in collections of this sort, but often one may find very few, if any, as they may not be adapted to the locality where the material is to be grown. These collections are of value because it may be that some varieties will be found among the lot that may have useful characteristics, such as disease or insect resistance, and may be of use in the breeding program when hybridization becomes a part of the program.

**Comparison of Selections**

For testing the head selections of wheat, rice and barley, rows long enough to contain 25 or 30 seeds are grown and the number of seeds used is the same for all rows, either 25 or 30, or some other number not greatly different. The seeds are spaced at equal distances apart in the row. For wheat and barley, a distance of two or three inches is satisfactory, (in centimeters this is about 5 to 7.5 centimeters).

A check row is placed every 10th row in the field. The seed used for check rows is always a good variety grown in the area, if one variety is recognized as the best for that given area. As the work progresses and new high-yielding
sorts have been produced, use one of these for the checks. The purpose of this check is to determine any differences that may be present as far as productivity of the field is concerned. It is a common experience to find that many fields have good and poor spots, such that the plants may be much better on one part of a field and poorer on another part. If check plots or rows are not grown, one might be inclined not to make any selections of rows where the growth is poor. If checks are used and the rows of the check variety yield poorly on certain parts of the field, and yet do well on other parts, then one may be certain that the difference is most likely due to soil and not due to variety. By having check plots grown at regular intervals, then when studying the rows from selected seed to make selections to continue the work, one may be guided by comparing the plants that are grown from selected seed with those in the check rows. For example, if one is observing rows 41-49 he would compare them with check rows 40 and 50. As the field varies in fertility, the changes will be shown by the performance of the check. One would then likely make some selections from spots of poor fertility, since a type that shows up well on the poor fertility spots may do especially well on good soil.

Generally when one has about 5,000 head selections to compare, he is likely to save about 2,000 for testing the second year. This varies, so it is not necessary to try to obtain a definite number. Sometimes, when the lot of selections does not contain any very good ones, one may have very few that are worth saving.

For the second year, one longer row may be sown from each selected head row, and if sufficient seed is available, two rows from each plant row may be grown, but not side by side. It is best to plant one row from each selection and then repeat the entire series in the same field. Check rows of the same variety are sown every 10th row. The check variety should be a good variety and not changed too often, but as the program develops and a better new variety is produced, it is best to use this for the check and replace this in a few years, if a better sort has been developed. So the process continues until one is certain that a few of the selections will continue to yield well year after year. This would be due to their heredity. If one finds, at the end of the first or second year that he does not have any good lines, he discards all the material and makes more selections.

A thorough-going program will include making some new selections from farmers' fields about every two or three years until it is felt that the best plants of the area have been obtained. Then the breeder will resort to crossing or hybridization, which now can be planned, since the selection work has indicated what types of plants do the best in the locality where the work is being done, and also may furnish information as to what new selections may be the most promising as parents from the standpoint of yield, and perhaps others from the standpoint of disease resistance, stiff straw or some other good quality.

In the work, as it was developed in connection with the Nanking program, this was the general plan that was followed. Selection came first, followed by hybridization, which again must be followed by special selection and testing of the plants produced. Naturally, the ultimate aim of crop improvement programs is to produce enough seed of the improved types, so that they may be multiplied and eventually seed of these be made available to the farmers.

Training of Men

An equally, if not even more, important purpose of the program, was to leave in China a group of well-trained men who could carry on and expand the work after the Cornell representatives had left. This training was carried on by formal lectures, in the College, and by Summer Institutes. Informal training was a continuous process, whether in the office, laboratory or field. By the end of the program, all had come to feel that this had been Cornell’s single most important contribution. Because of this, the training program is described separately and at some length. Details will be found under, The Training Program.

However, this is an appropriate place to mention the training of one Chinese student, who was to play a key role in the developing program at Nanking. Mr. T. H. Shen, after receiving a Master’s degree at the University of Georgia, came to Cornell in 1924 to complete work for a Doctor’s degree in Plant Breeding and Genetics.
Soon after arriving in China in 1925, it occurred to Dr. Love that it would be extremely valuable if Mr. Shen could come to China in 1926 with Dr. C. H. Myers. In a letter to Dr. Myers, Dr. Love suggested this point, and Dr. Myers agreed that it would be a valuable thing for Mr. Shen to receive training in his own land, working closely with one of the professors with whom he was to take graduate work. This proposal was presented to the International Education Board, and they approved it, agreeing to provide a fellowship for Mr. Shen and to furnish travel expenses from Ithaca to Nanking, and return. Mr. Shen joined Dr. Myers in March, 1926, and they worked together for seven months, returning to Cornell in the fall of 1926, when Mr. Shen continued graduate studies.

Dr. Myers, in his report for 1926, states “this report would be incomplete without especial mention of the services of Mr. T. H. Shen, who was granted a fellowship by the International Education Board, to accompany the writer, and assist in the Crop Improvement Program. This fellowship was unique in that it provided for Mr. Shen, a Chinese, to go from the United States to China, for special work and study.

“In a preliminary report sent to the International Education Board, the writer has already mentioned the excellent work done by Mr. Shen. As a matter of formal record, he desires to repeat here, that any contribution he himself was able to make to this important work, was due in no small measure to the very able assistance of Mr. Shen. Reference has already been made to the courses of instruction which he gave, and to the work which he did in the experimental fields. In addition to his own lectures during the Summer Institute, he also acted as interpreter in the lectures of the writer, as well as in the conduct of the laboratory work. His knowledge of China and his acquaintance with educational leaders everywhere made possible many contacts that would otherwise not have been made. It is gratifying to be able to state that before leaving Nanking, Mr. Shen was appointed to a professorship in the Department of Agronomy, to which he will return as soon as he completes his graduate work at Cornell, some time in the autumn of 1927. Thus, his influence and usefulness will continue with the work there.”

The International Education Board continued Mr. Shen’s fellowship until he completed the work for his degree and then made a grant to cover his return to China. Dr. Shen continued as a professor in the College of Agriculture at the University of Nanking for a number of years. It may be added that time has demonstrated that the training that was made possible for Dr. Shen, along with his experience, has enabled him to make outstanding contributions to the agriculture of his country. He is, at present, one of the five Commissioners of the Joint Commission on Rural Reconstruction in China, and has served in this capacity since 1948. Dr. Shen’s evaluation of the Cornell-Nanking program will be found on page 60.
Dr. H. H. Love’s First Trip

The first work in the field began in 1925 and Dr. H. H. Love was the first Cornell staff member to go to China arriving in Shanghai, April 10, where he was met by Dean and Mrs. Reisner and all went on to Nanking arriving April 11. Dean Reisner introduced him to the several members of the staff and showed him the equipment, including buildings, lands, and the like. It was a great pleasure to be received with such kindly spirit by the several members of the facility. It indicated the willingness on the part of all concerned to enter wholeheartedly into the cooperative work that was contemplated.

The first few days were used to become better acquainted with the members of the faculty of the University, especially those with whom it was expected he would be working closely in developing the program. Conferences were held with Dean Reisner, George Ritchey, and the Chinese members of the staff. These conferences were held with individuals or at times group conferences were held. The facilities that were available at the University were discussed, such as land and the labor needed to look after the crops to be grown and the matter of the storage of harvested material, so that the seed could be properly protected from rodents and insects.

Facilities for the Program at the College of Agriculture

The facilities for plant breeding work at Nanking, when the cooperative program began in 1925, were simple but adequate. Two hundred and twenty acres of good land on three farms outside the city of Nanking were available, and used entirely for experiments and seed increase purposes. The Chinese abacus was efficient and rapid in making all calculations, including biometrical measurements. Balance scales were used to weigh out individual row plantings. Paper bags, envelopes, and tags were made to order by the ambulatory patients in the University hospital. All markers were made of bamboo purchased from the local market.

Land was plowed and the seed beds were prepared with the use of water buffalo. Head and rod row plantings were done with a hand hoe with a high degree of uniformity and accuracy. Small seed drills were later secured, but some hand planting was continued. Chinese-three-row seed drills were used on the increase plots and for general field planting. The main concessions to modern farm machinery were the moldboard-steel plows, harrows and a threshing machine used to thresh the increase plots and cater to the surrounding village farmers, whose demands were always greater than could be met.

The field house, at the experiment station, had a hanging capacity of some 8,000 head and rod rows, as well as storage and fumigation rooms, animal and tool sheds, kitchen and quarters for the permanent working force. Close by was the school provided by the College for the children of neighboring villages, and this also served as a night school for the adults.

The threshing and winnowing of all experimental material was done by hand by neighboring village women and put into properly numbered paper bags. A large concrete drying floor provided space for sunning and drying the experimental material and reserves of seed. Storage space for experimental material was available at the College where all final weighings and checkings were made. Materials were moved between the experiment station and the College by horse cart. Much needed fumigation facilities were added in 1925. Other important facilities were added later. In 1931, two greenhouses with a floor space of 3,750 square feet, with head house providing space for two offices and two small fumigation rooms, and a wire cage covering a fifth of an acre for growing experimental plants, were constructed on the University campus and added greatly to the crop improvement facilities at the College.

The projects which were being used for the crop improvement work already under way were reviewed and some of them rewritten and others covering the new lines of work to be undertaken were written. These projects are important as guides for those doing the experimental work, otherwise some investigators might be inclined to undertake lines of work which are not even contemplated in the project which they are supposed to be following. It is important to review projects frequently.
The reorganization of the program at Nanking, and later at the cooperative stations, and indeed the whole program as it developed from year to year involved a process of education that was continuous, whether in the field making selections, at work on the experimental plots, in the laboratory or in the more formal lectures in the classroom. By the end of the cooperative program, it was agreed by all that the training provided by the Cornell professors had been their most important contribution to China. The training program is described in some detail in a later section.

To standardize the crop improvement methods to be used at Nanking and the cooperating stations, Dr. Love prepared two detailed memorandums. The first was “General Suggestions for Methods of Selecting and Testing to be Followed in Crop Improvement Work by the Department of Agronomy and Cooperating Organizations.” The second was “Methods for Rod Row Testing.” These detailed instructions were translated into Chinese and widely used. A start was being made that resulted in standardized methods of crop improvement for practically all of China.

The College of Agriculture and Forestry had been working with a number of Mission stations and it was the plan from the beginning of the program that this cooperation would be continued, and at the same time it was made clear that cooperation would be welcomed with government institutions or experiment stations and other organizations. It was gratifying that, as the program advanced, different government agencies and other organizations indicated that they would like to participate. Perhaps it might be with only one crop at first but often more were added and as time passed it was not long before those engaged in the program had the pleasure of working with a number of these different agricultural organizations.

It is well to point out that, in making plans in the earlier years, those Mission stations that could be reached without requiring considerable time for travel were contacted. China was not covered by an extensive railway system, and good roads were not available in all areas and, of course, plane travel was not yet possible. There were other Mission stations and organizations making some studies in the field of agriculture in south and west China, but in those days it might take at least three weeks for a traveler to reach west China from Nanking, and it was not thought desirable to attempt work in areas where it would take so long for the Cornell University and the University of Nanking staff to make the long trip to these outlying places. Naturally, if any one at those stations had questions that could be sent by mail, some one endeavored to give them the best help possible.

It will also be noted, as one proceeds, that a large program for rice improvement was not developed since the station at Nanking was the only institution of those with which cooperation was planned at the outset that was located in a region where a considerable amount of rice was grown. It is true that rice was being grown to some extent in all the different areas where they were working, but no station was well located for rice investigations. In later years, the rice crop received greater emphasis.

After spending some time in considering the facilities and opportunities for the program as planned, one of the first pressing needs was that of getting ready for an expanded effort with wheat and barley. These crops were among the first to mature after Dr. Love arrived. Since wheat matured earlier at some of the stations in north central China than at Nanking, a trip was planned to these stations.

On May 18, Mr. G. E. Ritchey, Mr. W. C. Lowdermilk and Dr. Love left Nanking for Yihesien, Shantung. While Mr. Lowdermilk busied himself with forestry matters, Mr. Ritchey and Dr. Love inspected the wheat work which had been started by Mr. K. M. Gordon and made selections from his head rows which had been planted the previous fall. Altogether 134 selections were made from these head rows. They then returned from Yihesien to Lincheng and were detained on account of delay in the train schedule, due to political disturbances, and spent 50 hours waiting for the train connections. While at Lincheng they stayed at a Mission chapel and had time to go out and make a few wheat and barley selections. The wheat was not ripe enough for many selections, nevertheless it seemed advisable to collect some so as to have representative types from that region. Mr. Ritchey and Dr. Love left Lincheng for Kaifeng, Honan, and Mr. Lowdermilk went directly back to Nanking.
They arrived at Kaifeng and spent three days with Mr. Gordon K. Middleton going over his various wheat and other experiments. He had something over 2,000 head selections of wheat sown in head rows ready for them to inspect and make selections. They selected 208 rows from the lot. They went over his rod rows indicating the strains that were to be continued in the test for 1925-26, and also took notes on some cooperative flag smut tests which had been arranged by Mr. R. H. Porter, Plant Pathologist of the College of Agriculture and Forestry. Some field inspections for flag smut were made and some head selections made from these fields. These observations indicated the desirability of planning work looking toward the development of varieties resistant to this disease. The Forward variety which had been developed at Cornell in connection with the wheat improvement work was showing high resistance to this disease in China.

Leaving Kaifeng Mr. Ritchey and Dr. Love returned to Hsuchowfu where again they were delayed by train schedules so much that Mr. Ritchey felt it necessary to return directly to Nanking with the first train, while Dr. Love stopped at Nanhsuchow, N. Anhwei, to talk over the wheat work with Mr. H. H. White at that point. They went over the work that was underway and planned for a considerable enlargement in the wheat project. They were able to take notes on the flag smut tests and make a few hundred head selections of wheat from various farmers’ fields.

Upon returning to Nanking on May 31 the lectures that Dr. Love had been giving to the students and which had been interrupted on account of the trip were not continued as originally planned on account of the Shanghai incident of May 30 and the resulting students’ strike throughout the country, which also involved the University of Nanking. While the students of the University of Nanking behaved very well during these troublesome days, they were not in condition to profit by any lectures. While the lecture work was interrupted the experimental work was not so it was possible to give even more time to this phase of the program.

First Conference with Cooperators

Toward the end of the summer, it was decided to ask the cooperators from the different stations to come to Nanking for a conference at which time many questions on methods and procedures would be raised and answers given so far as possible. Condensed plans of procedure would be discussed in detail so that those men working with what are called winter crops in China, to which wheat and barley belong, would have detailed plans for planning their work on these crops in the fall of 1925.

On September 25th and 26th the conference was held at the University of Nanking between representatives of the Mission stations at Kaifeng, Nanhsuchow and Weihsien, and representatives of the University of Nanking, College of Agriculture and Forestry. There were present Mr. Gordon K. Middleton, representing the Kaifeng station, Honan; Mr. H. H. White, representing the Nanhsuchow station of the Presbyterian (North) Mission, Nanhsuchow, Anhwei; Mr. A. L. Carson, representing the Weihsien station of the Presbyterian (North) Mission, Weihsien, Shantung; together with Deans Reisner and Kuo, Messrs. G. B. Ritchey, R. H. Porter, the Chinese associates and Dr. H. H. Love of the University of Nanking. No representatives were present from Kweiteh, Wuchang and Yih-sien, but previous correspondence and conferences indicated the willingness of these three stations to engage in the cooperation.

In the conference a general discussion was held on the important food crops for north central China and a plan was made suggesting that each station grow a winter crop and a major and minor summer crop, to which it would be giving attention. The discussion resulted in the following plan:
Cooperative Crop Improvement Program – Distribution of Crops

<table>
<thead>
<tr>
<th>Station</th>
<th>Winter Crop</th>
<th>Major Summer Crop</th>
<th>Minor Summer Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaifeng</td>
<td>Wheat</td>
<td>Kaoliang</td>
<td>Beans (Millet)</td>
</tr>
<tr>
<td>Nanhsuchow</td>
<td>Wheat</td>
<td>Beans</td>
<td>Kaoliang</td>
</tr>
<tr>
<td>Yihsien</td>
<td>Wheat</td>
<td>Kaoliang</td>
<td>Beans</td>
</tr>
<tr>
<td>Weihslan</td>
<td>Wheat</td>
<td>Kaoliang</td>
<td>Beans</td>
</tr>
<tr>
<td>Wuchang</td>
<td>Wheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kweiteh</td>
<td>Wheat</td>
<td>Kaoliang</td>
<td>Beans</td>
</tr>
<tr>
<td>Nanking</td>
<td>Wheat</td>
<td>Cotton</td>
<td>Beans</td>
</tr>
<tr>
<td></td>
<td>Barley</td>
<td>Corn</td>
<td>Rice</td>
</tr>
</tbody>
</table>

As a result of the conference it was agreed that the work of crop improvement in China would proceed much more satisfactorily if all of the interested agencies would join together in one large plan of cooperation rather than for each individual or station to work separately. It was agreed that the same plans for selecting and testing the various crops would be used at all places so that the results would be strictly comparable.

In planning and conducting this cooperative work in crop improvement it was understood that the improvement work would be very closely associated with the question of control of plant diseases such as seed treatment and disease resistance studies; and that with the different crops cooperative work would be undertaken with the Plant Pathology division of the Biology Department. Mr. R. H. Porter was in charge of this work and several cooperative projects covering the work in breeding for disease resistance were already underway.

In proceeding with such a plan, the authorities at the University of Nanking understood that it would be necessary at times to send assistants to the several stations and particularly when the person in charge might be on furlough with no well-trained assistant left in charge of the work. For example, at that time, Mr. Gordon at Yihsien was away and the Department of Agronomy of the University of Nanking sent help to look after the planting and harvesting of the crops included in the cooperative agreement at Yihsien. The same aid would be furnished other stations as occasion demanded.

At this conference, a Memorandum of Understanding for Cooperative Work in Crop Improvement between the College of Agriculture and Forestry of the University of Nanking, and Cooperating Agencies was discussed, and the details made available to the several cooperating institutions. The important points covered by this Memorandum are here presented:

MEMORANDUM OF UNDERSTANDING FOR COOPERATIVE WORK IN CROP IMPROVEMENT BETWEEN THE COLLEGE OF AGRICULTURE AND FORESTRY OF THE UNIVERSITY OF NANKING, AND COOPERATING AGENCIES

CROPS TO BE INVESTIGATED:

The crops to be worked on are those that have been agreed upon and are given in the table on page 13. No new work in crop improvement that will interfere with the work on the crops agreed upon will be undertaken by any of the stations on any crops unless agreed upon after a conference with the representatives of other stations, and the University of Nanking.

METHODS OF WORK:

The methods to be followed for selecting and testing are those used by the Department of Agronomy, as set forth in “General Suggestions for Methods of Selecting and Testing”, and “Methods for Rod Row Testing”.

13
When it seems desirable to change the methods or introduce new ones it will be done only after careful consideration and with the approval of the Department of Agronomy.

RECORDS:

Complete plans for planting the different crops will be made out and approved by the Agronomy Department before planting time and then after planting a map of the field indicating the location of the rows or plots and other details will be made. All such plans are to be made in duplicate and one copy filed at the College of Agriculture and Forestry, and kept with the records of the Department of Agronomy. Records covering seed treatment and other phases of plant pathology will be filed in the Plant Pathology office. A copy of all records of field notes and yields will also be furnished for filing with the Department of Agronomy. These will be available to all stations cooperating under this plan. In making out these records, the assembling of yields and, in fact, all work in connection with these plans should be done with great care.

SEED:

It seems desirable to have all the different varieties of a particular crop numbered and listed so that there will be no confusion arising from the fact that the same variety may be known by a different number at each of the several stations. It is understood that each one having varieties that are not now grown at the University of Nanking will list them and send the names in at once so that a number may be assigned and a complete record may be made. This does not apply to new selections until they have established themselves and are practically ready for distribution.

It is understood that for the benefit of the work there will be free exchange of seed between the different stations, and sufficient seed of the several strains will be held in reserve to be distributed as directed by the Agronomy Department of the University of Nanking. In this connection the storing and handling of seed should also be emphasized. Each cooperator should see to it that his seed is kept free from moth and other injury and that when samples are requested from other stations or persons that the seed is properly packed and tagged with its proper name or number. Such work as the handling and shipping of seed cannot be left to untrained help.

REPORTS:

It is understood that reports covering the results of the investigations of the different crops will be made and filed with the College of Agriculture and Forestry of the University of Nanking by January 1 of each year. These reports are to be filed with the records of the Department of Agronomy, University of Nanking and in this way will be available for use at any time. Such reports should give the results of the year’s work in such a way that it will be possible to note the progress. The records of yields may be included with these reports or cited as a part of the report.

PERSONNEL:

In selecting assistants to help in this work care must be exercised to secure men who are perfectly willing to do the field work and look after the details necessary in handling this type of experimental work and undertake such additional training as may be recommended.

FURLough:

In order that there may be no interruptions in these projects at the several stations due to absence on furlough, the Department of Agronomy agreed to provide additional help.

EXPENSES:

Wherever necessary, the University of Nanking agreed to meet part of the expenses of the cooperating stations as agreed upon.
SUPPLIES:

The various supplies, such as note books, paper for planting plans, tags, paper bags, envelopes, and the like, will be standardized as far as possible.

CONFERENCES:

An annual conference will be held at Nanking or some other station in order to discuss results, plans for enlarging or improving the work and methods used.

TERMINATION OF COOPERATION:

Conditions under which the Cooperation could be terminated were agreed upon.

* * *

Since it was expected that some rice work would be done, especially on the university farm at Nanking, Dr. Love raised the question about sowing rice directly in the field on dry ground and then irrigating it. Apparently there was no experience in China with this kind of rice growing and some raised the question as to whether rice would grow under such conditions. Some of the farmers around the university farm felt certain it would not, so a small test was conducted that year, preparing the soil and sowing the seed directly in the field. Sufficient water was added after the seeding to wet the soil thoroughly and the field was watered occasionally until the plants developed to the stage where it was safe to keep plenty of water on the field as is usually the practice for rice culture. Those who had doubted whether the rice would grow were surprised to see that at the end of the season a good crop was harvested.

The purpose of this test of direct planting was to show that if the rice grew well one could avoid, in the improvement tests, the necessity of having to plant a large number of very small seed beds where one would grow plants and then later transplant them in the field. This meant additional work that would not be required with the direct method of sowing the seed. The fact was at the time of this test that there were large acreages of rice grown by this method, especially in the United States, and comparisons made later in China showed that when the seeding in the field was made at the same time the small beds for producing seedlings were started, that the yields of the different varieties compared very favorably.

At the end of the 1925 season after some of the wheat experiments had been sown, Dr. Love returned to Cornell and completed a report of the work, copies of which were distributed to the President of the University, Dean Mann of the College of Agriculture, and made available to Drs. Myers and Wiggans. This gave the two men who were to go to China later a general understanding of the work of the first year and, as a result of this report and numerous conferences with those who were to go out later, plans could be agreed upon regarding any changes in methods that seemed desirable, so that when the next Cornell staff member arrived in Nanking, he was prepared to continue with the program.

Dr. C. H. Myers’ First Trip

Dr. C. H. Myers was the second representative from Cornell to take up the work in China, arriving at Nanking March 24, 1926. As was mentioned earlier, a fellowship had been granted to Mr. T. H. Shen, who arrived in Nanking a few days before Dr. Myers. The first few days were used for conferences with members of the Nanking staff and to become acquainted with those who would be associated with the work, and to check the facilities that were already available. Dr. Myers mentioned an important addition that proved to be very useful. It was the construction of a fumigation room on the first floor of the storage building at the Tai-ping-men Farm.

One of the first crops that needed attention was wheat, as it matures fairly early in the season. Harvesting may begin at some of the stations in May, so Dr. Myers and Mr. Shen visited most of the cooperating stations, and pro-
vision was made for other members of the University staff to see those stations not visited by Dr. Myers and Mr. Shen.

A total of about 8,000 head rows was grown at Nanking and at several cooperating stations – Kaifeng, Nanhsuchow, Soochow, Weihsien, Wuchang, Wusih, and Yihhsien in 1925-1926, each row coming from a single head, which had been selected from farmers’ fields in 1925. After looking over all of these selections carefully, there was a total of about 2,000 chosen out of the 8,000 head rows for further testing in 1926 and 1927. These would be grown in larger plots for this second year of the test, and careful notes would be made of the crop before and at maturity time in 1927. Dr. Myers and Mr. Shen also provided for additional head selections to be made from farmers’ fields at Wusih, Soochow, Nanhsuchow and Kaifeng. While looking over the head rows at the different stations they observed and took notes on all other wheat tests located at the several stations.

Barley matures at about the same time as wheat, and there were 2,400 head rows grown from selections made in 1925. When making selections from these head rows, those concerned with the improvement program, were aided greatly by Prof. R. H. Porter, who was a trained pathologist on the staff of the College. Not only did Prof. Porter aid in the barley work, but he cooperated fully with the program in many way. It was especially important to have Prof. Porter’s aid since barley suffers severely from both covered smut and loose smut. Each of the 2,400 head rows of barley had been inoculated with these diseases by Prof. Porter. At harvest time, it was found that out of the 2,400 rows, there were 230 which showed no trace of either of the smuts and these were saved for further tests.

A collection of barley varieties had been obtained from the Office of Cereal Investigations of the United States Department of Agriculture and these were grown along with the other material. Some selections were made from this collection for further testing. Dr. Myers and Prof. Porter also visited a number of farms along the Shanghai-Nanking railway and made head selections from farmers’ fields for planting in the fall of 1926.

There was a large planting of soybean plant rows grown at Nanking, Kaifeng, Nanhsuchow, Weihsien and Yihhsien. In all some 10,000 selections were made. It is noted that the words “plant rows” are used. The only difference between a plant row and a head row is that with certain crops, for example, beans, when making selections it is possible to remove the whole plant without disturbing other plants near it. Thus, with a crop like soybeans, one has the seed of the whole plant to use for planting while with rice, wheat, barley and similar crops, the seed of only a single head is available.

Dr. Myers and Mr. Shen assisted in the soybean planting at some of these stations, but, since planting time came about the same time every place, they could not help at all of the other stations but it was done by experienced personnel. Dr. Myers and Mr. Shen were also able to assist with the selection of the plant rows of soybeans (at the end of the season) at Nanking but since their time to leave China was close at hand, they were not able to help with the selections at other stations.

Dr. Myers also made some recommendations relative to including some of the vegetable crops as part of the overall program. The division of Vegetable Gardening at the University of Nanking had been growing vegetable seeds to sell to growers, and it was thought wise to begin work that would lead to better sorts of these crops, One of the Chinese associates was much interested to see this project undertaken and was in charge of it for some time.

Dr. Myers also suggested that millet be added to the program. It is an important crop in China, and there is much opportunity for obtaining better sorts by selection and breeding. Some work was already underway at Kaifeng and since no project had been written covering this crop, one was made, and this crop was added to the program of several of the northern stations.

The time for Dr. Myers and Mr. Shen to leave China came about the time of the meeting in Tokyo of the Pacific Science Association. This is always a most important scientific gathering and since Dr. Myers and Mr. Shen were to pass through Japan on the way back home, they arranged for time to stop for this meeting, which proved to be a valuable experience for both men.
Dr. R. G. Wiggins’ First Trip

Professor R. G. Wiggans was the third member of the Cornell staff to go to China, and when it was time for him to leave Ithaca in the spring of 1927, the political conditions in China did not look favorable. The difficulty was that part of the Chinese Army was on the move from south China to central and north China. Everyone assumed that this army would pass Nanking without any disturbance. Dr. Wiggans sailed from San Francisco and arrived in Shanghai on schedule, but by then conditions around Nanking had changed radically, and the foreigners were forced to leave Nanking. This affected Dr. Wiggans’ plans, as he had to remain in Shanghai, but the Chinese members of the Agronomy Department, responsible for the crop improvement work, were able to travel from Nanking to Shanghai for conferences.

During these conferences, plans for the various experiments were discussed and many of the planting plans were outlined in considerable detail. The fact that the plans were well laid out and the experiments at Nanking and the cooperating stations were conducted in accordance with the arrangements made in Shanghai, is evidence of the care and interest on the part of the Chinese staff. At these stations, a total of 46,229 rows or small plots were grown that year. Dr. Wiggans’ shortened visit was disappointing to all concerned, but his encouragement and the conferences were most helpful to the Chinese staff members. After one month in Shanghai, he returned to his work at Cornell.

The University of Nanking authorities felt that it would be unwise for a Cornell representative to go to China in 1928. It is important to note that without any of the Cornell staff being present, the planning for the crops that needed to be planted in the fall of 1928 and the plans for 1929, were carried forward in a highly satisfactory manner. There was a total for all stations of 66,071 rows and plots planted in 1928-1929. This was a considerable increase over the season of 1927-1928. This increase was of particular significance in view of the political conditions existing at the time.

Dr. H. H. Love’s Second Trip

It was planned that Dr. H. H. Love would return to look after the program in 1929 and thus was making his second trip. Naturally, he was interested to learn first hand the condition of the many different experiments; so, very soon after arriving, a series of conferences with the Chinese staff members were held. It was of special interest to learn whether any of the experiments “had suffered because of the interruption and the very serious trouble of March 1927 and the period following”. It was very satisfying to learn that the experimental work had not been interfered with at all either at the University or on the farm or at any of the cooperating stations. The men in charge had labored very hard and earnestly to see that the experimental work went forward satisfactorily and no seed or records were lost.

The material had been carefully saved and protected during the troublesome times and as an extra precaution the remnants of the seed had been divided into two lots and placed in different places so that there would be sufficient seed of the samples saved in the event that seed at the College would be lost. Since this did not take place, all seed was saved without loss of any kind. All the members of the staff were busy working at Nanking and were most enthusiastic about the program of crop improvement, and each one had given careful thought and study to his part in the program. It was found that in general the records were well kept and in good shape, so that the results for the different years were readily determined. The same may be said for the cooperating stations which it was possible to visit. Also, from records received, it was evident that in the other cooperating stations the work was being conducted with extreme care.

Since the wheat crop was one of the first to mature, plans were made to see the plantings before harvest time and to make selections of the lines to be continued in further tests in 1929 and 1930. Several days were spent in studying these new selections, observing the way they had been affected by winter conditions and especially noting the
rows which had come through the winter well. Also, those that seemed to possess a stiff straw and appeared to be good yielders were saved for further study. Susceptibility to diseases was noted, and those that showed little or no disease were saved for testing. If a head row appeared as though it would yield well and yet showed that it was readily affected by diseases, it was eliminated. Out of a total of about 10,400 head rows grown at Nanking, 2,300 were selected for further observation.

The winter conditions of 1928 and 1929 were rather severe for wheat production, especially on the field at Tai-ping-men Farm where the wheat investigations were planted. Ice had formed on some of the plots during the winter, resulting, in some cases, to a damage of 60 or 70 percent on a plot. Naturally, the plots so affected were not harvested for yield.

Some fields had been sown at Nanking to increase the seed of certain varieties. The one which had been most promising up to that time was Nanking No. 26. This variety had been distributed quite widely around Nanking and adjacent territory. It was decided that a new lot of pure seed was needed, and in order to accomplish this, a number of bundles had been harvested from this variety. They were examined and only those heads that seemed to possess the exact characteristics of Nanking No. 26 were saved to sow some small increase plots for the 1929-1930 season. Dr. Shen and his associates had a large planting of hybrid wheat material, along with some varieties which had been obtained from various sources, including the United States, and plans were made for taking notes and designating what should be tested in 1929-1930.

Dr. Shen and Dr. Love made a trip to Kaifeng to look over the barley and wheat work conducted at that station, but when they were ready to leave Kaifeng, planning to go back to Nanking with a stop at Nanhsuchow, it was learned that due to political disturbances the railway had been cut at Kweiteh, a short distance east of Kaifeng, so it was necessary to take an all-day trip by rickshaw from Kweiteh to Po Chow (a distance of about 45 miles) and then by bus the next day, to Nanhsuchow.

It was rather interesting that they were taking this trip because, as they had been going to Kaifeng by train a few days before and had passed by that general area, Dr. Love had mentioned to Dr. Shen that he would like to take a cross-country trip through that part of China sometime, and here they were taking it without having planned it so.

The train they expected to take from Nanhsuchow to Nanking was delayed due to political problems, and this gave them more time to look over the experiments conducted by the Presbyterian Mission under the direction of a Chinese associate, and after looking over the experimental work, some farmers’ fields in the general area were visited. They were interested and sorry to find that barley was suffering greatly from smut. Dr. Shen and Dr. Love made some counts and found one field where 45 percent of the plants were taken by smut. They realized that this could be controlled by a simple chemical treatment, and regretted that a larger staff was not available so that extension work could be done to control such diseases.

They also noted that the nematode disease of wheat was bad, and observed that a variety known as Nanhsuchow No. 6 was apparently highly, if not entirely, resistant to this disease. They began to observe this more closely, and found that Nanhsuchow No. 6 showed only a small amount of injury compared to the local variety. This variety is of American origin, being a large-kernelled selection from Fulcaster.

The cotton investigations, which formerly were conducted by Mr. J. B. Griffing, had been transferred to the Department of Agronomy after Mr. Griffing did not return to the College following his furlough. In earlier work, a variety known as Million Dollar was developed by him from selections of native Chinese cotton.

In the early years of its introduction, this variety proved quite satisfactory for many growers. Later, however, it showed a high number of individual plant variations and it became necessary to reselect to obtain pure seed. From the studies that had been made, it seemed that this variety was better adapted to the areas around Shanghai and Hangchow than it was around Nanking and especially the areas further north. It was found that the Acala, Trice
and Stoneville No. 4 varieties from the United States did better north of the Yangtze River than did the Million Dollar cotton.

By 1929 it was evident that seed distribution might very well be expanded to include some of the newer plant selections. It was demonstrated from the field tests that had been conducted and from observations in the field, that the wheat selection No. 2905 appeared to be an improvement over the farmers’ varieties, and one of the soybean selections, Nanking No. 332, was also giving considerable increases in yield over the local varieties.

The Nanking No. 2905 wheat is a selection which was made a short distance southeast of the city of Nanking by one of the staff of the College of Agriculture and Dr. H. H. Love in 1925, while driving through the country for the purpose of making head selections. One field was so different from any yet seen, they were at once attracted to it and were sure that some selections should be made. The owner was contacted and the program and what they were planning to do was explained to him and that they would like to make some head selections from his wheat field; of course, offering to pay him a fair sum for the heads taken. He readily gave his consent, and they selected more than a hundred heads. The farmer watched and did not ask them not to take any more heads, but suggested his neighbor, a short distance away, had a better field of wheat than did he. Both men grasped his meaning and did not make further selections. The farmer refused to accept any payment whatever.

It was interesting that from these selections made from this field, there were several that were almost as good as the Nanking No. 2905, but this wheat, together with Nanking No. 26 wheat and some other selections, was sown for the purpose of increasing seed to distribute to the farmers when the supply was sufficient. To carry the story a little further, by 1931 a fair amount of seed of Nanking No. 2905 was available. That was the year of one of the most serious floods China has had in modern times, and the farmers, many of whom had lost their wheat seed, needed seed for sowing. It was possible to supply a number of these farmers near Nanking with some seed of this new variety and reports from several of them, after the crop had been harvested in 1932, were that they had harvested yields at least 40 percent higher per unit of land than they had ever been able to harvest before. This variety had already demonstrated its ability to yield well in the experiments and proved again from the results the farmers obtained that it was worthy of further extension.

The work that was being done on the other crops included in the program will not be discussed in great detail. There was some increase in the barley studies. It has been mentioned earlier that the barley crop was greatly affected by smut. The staff of the Plant Pathology division were studying this problem and were using the material grown in the barley tests for this purpose in addition to some planting of their own. Their cooperation was most helpful for as a result of inoculating most of the varieties and selections grown in the improvement program it was shown that certain of these did not develop the disease. If some varieties continue to be resistant year after year they will be most useful in a hybridization project.

The cooperation of Prof. R. H. Porter and his staff of Plant Pathologists was appreciated by all of those concerned with crop improvement. What they had time to do along with their other duties indicated how much more could be done if additional well-trained men could be added to the staff of the division of Plant Pathology. Dr. Love emphasized this point when discussing the further expansion of crop improvement investigations.

The studies with corn were expanded somewhat. The lines of Nanking Yellow that had been selfed for three or four years were again selfed in 1929. Several of the inbred lines had been crossed to furnish some material for Dr. Wiggans to observe in 1930, since he was expected to emphasize corn as one phase of his work. It was also recommended that the Agronomy Department make plans to collect a large number of corn varieties from different parts of China to have ready for 1930.

Kaoliang, grain sorghum, is an important crop for north central and northwestern China. It withstands drought better than other grain crops. A certain amount of natural crossing occurs in this crop so studies were being made on this problem. It was evident that to obtain seed of greater purity for yield comparisons the heads should be
bagged. Observations from short time tests indicated that yields would not be appreciably reduced for two or three generations. These studies were to be continued.

While the present varieties of kaoliang are somewhat resistant to drought it would be most beneficial if varieties could be found or produced which would be even more resistant than those now available.

During a visit to Peking in August 1929, Drs. Shen and Love were made acquainted with a plan that had been made by a Mr. Outerbridge to test out some imported drought resistant grain sorghums and they were informed that steps were under way to purchase large amounts of this seed from the United States. No adequate experimental evidence had been obtained to prove whether these imported strains were the equal or superior to the native sorts. The matter of purchase had gone so far that apparently there was nothing to do about it at the time. Drs. Shen and Love raised the question of whether a mistake was not being made and they trusted none would be made because it would mean a large expenditure of money for seed and if it failed it would be a setback to improved agriculture which would have to be overcome by years of careful work. Nevertheless, without exact experimental evidence a large quantity of seed had been contracted for early in 1929 and this seed was sown in 1930. Some results will be presented in connection with Dr. Wiggans’ trip in 1930 (page 21).

Work with soybeans was continued and expanded in 1929 but the tests at Nanking were almost a total failure due to the unusually dry weather that season. Most of the flowers dropped off the plants so only a small amount of seed was obtained and seed for sowing in 1930 came from the remnant seed that had been saved. This shows the importance of saving remnant seed each year. This was one of the directions that was stressed in beginning the program. A seed multiplication field of one of the high yielding selections was grown in 1929, but due to the dry season it was almost a complete failure.

Millet was another crop that needed to receive greater attention in the Crop Improvement Program. It was necessary to handle the plants in a similar manner to the method used for kaoliang, since some natural crossing occurs in millet. The heads needed to be bagged during flowering time to obtain pure seed. At the Tungchow station a large number of new selections was made in 1929. Head smut of millet was a serious disease and the division of Plant Pathology was conducting important studies along this line.

Due to the shortage of water, as mentioned before, the rice experiments were not satisfactory. One lot of new head selections was grown on a field where some water was available and a large number of these were selected for further tests.

With cotton a large program of selfing the flowers to obtain pure seed was conducted in 1929. A number of promising plants had been selected in 1928 and these were planted in plant rows and the better plants were selfed to obtain pure seed for 1930.

The results from the different experiments had begun to show that new selections with certain crops were definitely superior in yield to the varieties commonly grown by the farmers. The ultimate goal of all crop improvement and breeding research is to make available to growers seed of these better sorts so they may obtain better yields from their land without changing their cultural methods. Dr. Love emphasized the need to give more consideration to the problems that would arise in connection with the multiplication and distribution of good seed. He pointed out it was time to get ready for this part of the program by planning ahead. Since this phase is the most important of all the efforts made in crop improvement, it must not fail. The problems of keeping seed of the several varieties pure; the inspection of fields of a new sort grown for seed and the removal of any off-types or mixtures; selection of the best method for distribution; these are only a few of the many problems. It was fortunate that it was decided early to distribute seed to localities, or villages, rather than to send small lots here and there. The plan to distribute seed by localities made it possible to create a greater interest on the part of the farmers in good seed and helped develop a community interest. If the new variety was good its use would move to other farms nearby and soon a large area would receive benefit. If some of the farmers wanted to grow and sell good seed it would make inspection and roguing easier by having the farms to be inspected close together.
Drs. Shen and Love made a trip to north China and looked over some of the experiments at Tungchow, and discussed the work being done on the crops which were included in their program. The crops were corn, wheat, kaoliang and millet. The work on kaoliang and millet was observed in the field. Some promising selections and varieties of these crops were noted and from the wide differences in yield, it was evident some good yielding sorts should be obtained after further tests could be completed.

Tungchow is only a few miles from Peking and Drs. Shen and Love went to that city where the Chinese Science Society was holding a meeting and Dr. Love spoke at one of the sessions. This Society has a close association with Cornell according to the information that was reported to Dr. Love. Several Chinese students studying at Cornell had learned from their professors about the American Association for the Advancement of Science and other organizations in the United States established for special fields of research. These students met in one of the entomology laboratories on the Cornell Campus and discussed the need for a Chinese organization to further the interest of science in their country. They agreed that such an organization was needed in their country and as a result of their conferences decided that after returning to China efforts would be made to interest others in the proposal. Thus the Chinese Science Society was born and in a few years had developed into a useful organization to advance greater interest in science in that country.

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**Dr. R. G. Wiggans’ Second Trip**

Dr. R. G. Wiggans made his second trip to China in 1930 to continue with the Crop Improvement Program, and arrived in Nanking March 29th, remaining until October 29, 1930. Dr. Wiggans had an interesting and busy year as his report, completed after returning from Nanking, indicates. His reactions to conditions as he found them, especially after the experience he had had in 1927, are of interest. In his report, he states the following:

“As stated in previous reports, it seemed doubtful in 1927 that the Crop Improvement Program could be carried on successfully as a result of the political conditions then existing. It is, however, a great satisfaction to report that during those trying times of changing and reorganizing governments, when all foreigners were forced to evacuate Nanking as well as a very large part of the interior where cooperative work was established, when institutions were in a state of upheaval, and when individuals were unable to plan for the future with any degree of certainty, that not a single loss of any of the Crop Improvement material occurred. The personnel in charge were so thoroughly interested in the work and impressed with its importance that no sacrifice was too great in order to prevent loss.

“With this fact in mind it is a great pleasure to renew the relationships with the program and with the faithful members of the staff who have so successfully carried on under extreme difficulties in most trying times. The greatest confidence can be had in the ultimate success of the program so long as the personnel in charge is made up of such a group of men.”

When Dr. Wiggans returned in 1930 he was pleasantly surprised to see how well the Nanking associates and the staff members of the cooperating stations had done over the years. By this time it had developed into what perhaps was the largest singly directed program of crop improvement to be found anywhere. Not only had the program itself expanded, but the number of cooperating institutions had also increased.

Wheat was one of the first crops to require Dr. Wiggans’ attention; since, as mentioned before, it is one of the earlier crops to mature. He found that at the 11 stations where wheat improvement was being conducted, that there was a total of 33,248 plots or rows grown in 1930. Among these was a total of 2,697 head rows in the hybridization program, grown for making practical selections or to make selections to continue genetic research.

Dr. Wiggans, during this trip to China, placed emphasis on the breeding of an open-fertilized crop such as corn. This was very desirable, and it was time to begin to emphasize not only corn as a crop, but to illustrate the methods
for breeding an open-fertilized crop. These methods enlarged the training of all those working in the program and the students and staff members who attended the short-course lectures.

As mentioned earlier in this report, corn improvement was begun by Dean J. H. Reisner when he first went to the College of Agriculture and Forestry in 1914. He followed the ear-row method that was being used at most experiment stations in the United States at that time by the selection of individual plants and continuing the selection process. The Nanking Yellow developed by this method proved to be a good variety, especially in the area of the Yangtze River, and it also did well in some areas farther away. Changes in breeding methods were being made which focused the attention on the importance of producing crosses from inbred lines and double crosses.

Quoting from Dr. Wiggans’ report:

“The experiments 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 six 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 F₁’s of native strains.”

As Dr. Wiggans was working on corn improvement at Cornell he was able to suggest methods and train those who were to work especially with this crop and thus made an important contribution to the program. In addition to training the staff members he had the students specializing in the department spend hours becoming familiar with the methods involved.

“The material from the United States was selected to represent the best varieties and recent productions of plant breeders from the entire corn belt. Material was secured from experiment stations in New York, Connecticut, Michigan, Wisconsin, Minnesota, Illinois, Nebraska, and Iowa, as well as from some seed firms. Duplicate lots of this material were planted at Nanking, Tunghow, and Tsangchow and checked against the best local variety.

“The results are not available except for Nanking, but it is interesting to note that only two of the introduced sorts yielded as much or more than Nanking Yellow. Results from farther north will probably show the foreign sorts to better advantage. In the test were cross-bred combinations of inbred strains of native stock which out-yielded Nanking Yellow by large margins. This statement is made to show that too much cannot be expected by introduction of high-yielding varieties of an open-fertilized crop into an entirely new and different environment.”

The work with the other crops included in the program was reviewed and recommendations made for future work. It was most unfortunate that due to political conditions it was not possible during Dr. Wiggans’ stay for a foreigner to travel in the area where several of the cooperating stations were located. It was possible for members of the Chinese staff to reach all but two. The cooperative stations in the North could be visited by going from Shanghai to Tientsin by boat and by train the rest of the way.

Dr. Wiggans emphasized the importance of conducting an adequate program with soybeans as it is one of the main food crops of China. He mentions the fact that until the beginning of the work at Nanking the many varieties of this crop had never been scientifically studied in China. He reports that larger collections had been made by representatives of the United States for tests in that country than had been made for China. Since the crop was one of the important ones in the Crop Improvement Program this no longer holds, but it does emphasize the fact that the improvement of China’s crops was long neglected. The results of a test for three years comparing the new selection No. 332 with a check variety was reported by Dr. Wiggans. The selection showed an increase in yield of 52 percent over the check, a substantial gain. Dr. Wiggans recommended that the studies on the effect of self-fertilization be continued to be sure of obtaining pure seed for yield comparisons. It was important to determine how much natural crossing occurred and also to learn whether self-fertilization would result in lower yields. The
results obtained from yield trials of some foreign varieties which Dr. Wiggans took to China compared with a good native variety show that at the Tungchow station the native type yielded better than any of the seven foreign sorts. This is an interesting result as will be made clear from what follows.

Without covering the details of the work that Dr. Wiggans did on the other crops used in the program, it is important to point out the special contribution he and Dr. T. H. Shen made on the study of field experiments and results that had been obtained, especially in north China, from several varieties of sorghums, introduced from the United States, by the China International Famine Relief Commission at considerable expense. As mentioned earlier, Dr. Shen and Dr. Love had tried to stop this large importation of seed, before the varieties to be used had been thoroughly studied under Chinese conditions, but this could not be done.

It was planned that Drs. Shen and Wiggans should make a special trip to north China for three purposes. These were “(1) to conduct an Institute of Crop Improvement for the Nanking University cooperators, (2) to study the needs for crop improvement in north China, and (3) to make a special study of the recent introductions of foreign seeds into the famine areas of north China.”

After making many observations in the fields and obtaining reports from a number of those who were growing some of the introduced sorghum varieties, Drs. Wiggans and Shen summed up their conclusions on the value of the recent introduction of foreign seeds, as indicated in the following statement:

1. That there is little doubt that no small proportion of the seed of foreign sorghums distributed in north China in the spring of 1930 was of low vitality, that a considerable percentage of the seed of many lots was either dead or produced such weak seedlings that they were unable to survive the adverse conditions existing in many places, but that under the most favorable conditions of moisture and temperature a better stand was secured.

2. That certain lots germinated better and resulted in a better stand than others.

3. That there is no significant evidence of greater adaptation or yield of foreign sorghums over native sorghums, either from the observations made or the reports of careful experimental work except in Suiyuan where the evidence is very strong to the effect that all the introductions are entirely too late.

4. Neither is there any evidence that the local kaoliangs are better suited for all conditions than the introduced types.

5. That there is great need for careful experimental tests in several representative localities in the various areas, including both dry and irrigated land, over a series of years, before the facts of the comparative merits of the various types and varieties can possibly be known.

6. That tests are just now beginning to be made where the introductions are being compared with representative local sorghums in an adequate way from the experimental standpoint.

7. That large expenditures for recently introduced and comparatively untried crops, regardless of the kind, should be made with extreme caution. This statement is made due to observation and statements reported above and to the fact that there are few examples in the history of crop improvement where new introductions made on a wholesale plan have proven successful from the start. In nearly every case successful introductions of crops into a new area has resulted from a small beginning from which the later successful variety or crop has been produced. The successive generations permit certain adjustments and adaptations of the plant to the particular environment.

8. That the areas visited show the great need of careful and consistent plant improvement work. The varieties and types of all crops are numerous and mixtures are almost universal. There is little doubt that material increases in production can be made by an application of the present knowledge of inheritance in plants.
The field of crop improvement is practically untouched and without doubt offers a partial solution of the important problem of permanent famine relief if properly carried on under the guidance of men scientifically trained for such work.

Dr. C. H. Myers’ Second Trip

Dr. C. H. Myers made his second trip to China in 1931 to continue the Crop Improvement Program; he was also the last staff member from Cornell to participate in the program. Upon his return, Dr. Myers prepared a most complete report which was published by the College of Agriculture and Forestry of the University of Nanking as Special Report No. 1, dated March, 1934.

Reorganization of the Agricultural Program at Yenching University

In the autumn of 1930, the President of Yenching University asked the University of Nanking, through its College of Agriculture and Forestry, to take over the work of its Department of Agriculture, on the understanding that the work in the future would be confined to a crop improvement project.

Dr. Myers, who was to spend most of 1931 in Nanking, by mutual agreement of both Universities was asked to arrive as early as possible in order to spend some time at Yenching University to study the situation and make recommendations. On the basis of his consultations with members of both Yenching and Nanking Universities, his study of previous reports, and his own investigations, Dr. Myers recommended that the agricultural operations be limited to one major project in crop improvement, and conducted by the University of Nanking on behalf of, and in the name of, Yenching University with complete control of its Agricultural Experiment Station land, financial resources and other pertinent assets.

He also made recommendations regarding the disposal of the various undertakings of the former Department of Agriculture. His report, dated May 26, 1931, was approved by the two Universities and the China Famine Fund Committee.

The College of Agriculture and Forestry, of the University of Nanking, formally took over the work at Yenching University in April, 1931. Dr. Myers also helped to reorganize the staff and the program of the new crop improvement work.

The general recommendations agreed upon were as follows:

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 effecting 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.

The general recommendations made by Dr. Myers were well received by the officials of Yenching University and approved in principle by the China Famine Fund Committee, and later approved by the Board of Managers of Yenching University and the Board of Directors of the University of Nanking.

Dr. Myers made the following statement, based on his observations, soon after arriving at Nanking. “The writer’s first contact with the field work of this program was in 1926, the second year of the cooperation. While a real beginning had been made at that 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 18 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 13 cooperating stations was in good condition and political conditions were relatively stable. In short, the whole program was in a healthful condition, having made surprising progress for the period of its organization.”

Since Dr. Myers was the last representative from Cornell, he not only studied carefully all the various experiments underway, but also made some recommendations resulting from his observations for improvement and extension of the general program. These included a revised memorandum of agreement and the revision of the projects. The following paragraphs on the Revised Memorandum of Agreement and Revision of Projects are taken from Dr. C. H. Myers’ Report of March 1934.

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 had 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 strong one. The work started in 1925 is beginning to produce results.

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.

During the year 1931, China experienced one of its most serious floods. Dr. Myers comments on this and also on the condition of our experimental material at the end of the flood in the following statement:

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 Yangtze 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.
Dr. Myers did not find it possible to visit all the cooperating stations in 1931 but during the Summer Institute of that year he held special conferences with the representatives of these stations as well as 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.

Dr. Myers, knowing he was the last Cornell representative to participate in the program, used his time to the greatest possible advantage. He knew that plans for the future needed careful consideration and he discussed a number of these during his many conferences with the staff members at Nanking and those in charge of the crop improvement work at the cooperating stations who were to be responsible for the program in the future. He revised the projects as noted earlier as well as the Memorandum of Agreement. Dr. Myers felt the great responsibility he had for doing everything possible to leave complete plans, recommendations and directives covering all the many details that would arise as the Crop Improvement Program continued to grow and expand. IT DID JUST THAT. This fact will be demonstrated by the data presented in Table 11 pages 44-45 and the discussion of this table in the accompanying pages. Dr. Myers had made the plans and details for carrying them out so clear that the Chinese associates had no difficulty in following them and the results they obtained are proof of their outstanding efforts.

**Results from Experimental Work**

Some results obtained from the various experiments will now be presented. It is not proposed to present all the data, but to present enough from several crops to show that the methods being used were leading to worthwhile results. Some of the gains made by the new strains or varieties may appear somewhat high, but this is not surprising as it will be remembered that this work was being done in a new agricultural area from the standpoint of crop improvement and no extensive experiments to improve crops, in addition to those made by Dean Reisner and his associates, had been conducted.

Data on the several different crops upon which work was being conducted and the number of stations where the work was being done are presented in Tables 1 and 2. In these tables are used the words head and plant rows, which are those planted from the various selections that were made from farmers’ fields. The words rod rows also are used. These are really small plots and the kind of plots that are used by most plant breeders in conducting tests like these. It will be noted in Table 1 that material from eight different crops was grown at eight different stations, including Nanking and the cooperating stations. The total plantings for all the different tests in 1927-1928 is 46,229. Similar data for 1929-1930 are presented in Table 2, which indicates the increases made in the number of stations, which now number 13, and the total number of planting, 96,799—more than double that of 1927-1928.

The results of yield comparisons for several crops will now be presented. The yields of the Nanking No. 2905 wheat compared with Nanking No. 26 are presented in Table 3. Using the data for the years in which the comparisons may fairly be made, it is seen that the actual yield for five years is 30 bushels per acre and the gain over the check averages six bushels per acre or 25 percent. Since it is known by numerous tests that Nanking No. 26 yields about seven percent more than the farmers’ varieties, it is apparent that the new selection No. 2905 wheat, under similar conditions, would yield about 32 percent more than the farmers’ varieties.

There are some other interesting results from yield tests of wheat presented in Table 4. These results are presented in bushels per acre and cover yields for five years, from 1927 to 1931. The results show the yields and the gain or loss, compared with the standard variety used as check. This standard is Nanking No. 26. All but one of these varieties were selected from Chinese wheat. The Red Rock variety was brought in from the United States. In this table, Red Rock gives a good yield but another sort was developed at the Nanhsuchow station which was better as will be shown in Table 6.

Among these different strains is Nanking No. 2905, and it will be noted that this variety gave a gain of over 50 percent as a result of the five-years’ tests. The variety from the United States, Red Rock, outyielded Nanking No. 2905.
slightly in this series of tests, but the results of a number of different comparisons proved that Nanking No. 2905 would be better adapted in a number of Chinese wheat growing areas. When comparing these gains represented by percent in the last column, it is well to remember that the standard variety used for comparing the different varieties was Nanking No. 26, which yields seven percent better than the farmers’ varieties. It is evident that all of the different sorts tested were superior to the Chinese wheat as commonly grown at that time.

According to the information available, the strain numbers 2902, 2903, 2905, 2915, and 2919 came from heads all selected from the same field. While these all gave good increases over the standard variety, it is evident that No. 2905 exceeds the performance of the others. It becomes evident, upon looking over tables such as these, that the differences in yielding ability in varieties of crops is shown by conducting some sort of adequately designed experiments as these were. One cannot depend upon the evidence of tests of one year only. He must have the results of several years’ tests because environment may change from season to season, and this may also influence the performance of varieties in the field.

Wheat selection was conducted at the Kaifeng station in northern Honan and some of the results are presented in Table 5. One of the selections, Kaifeng No. 124, showed up well in comparative tests, and this selection also produced grain of good quality. This selection was tested for quality by the Shanghai Food Association, and the following statement was made by the staff of this association, relative to Kaifeng No. 124: “Hard wheat, good, glutinous, 30 percent can be used at Shanghai. Suitable for making flour noodles in the North.”

The results from the seven-years’ tests, as shown in Table 5, indicate that with the exception of the years 1926 and 1931, that this new selection gave an important increase over the check or standard variety. Even including these years, the average gain in percent for the seven years’ tests is 12.4 percent. On account of the high quality and good yield of this wheat, it was decided to multiply seed and distribute it to the farmers as rapidly as possible. It was given the name of Bailee Wheat in memory of Dr. W. Eugene Bailee of the Southern Baptist Mission, who started the Agricultural Experiment Station in Kaifeng.

Wheat improvement work was also conducted at the Hanhsuchow station and some of the results obtained from a new selection, known as Hanhsuchow No. 61, are presented in Table 6. Wheat No. 6 was one of several varieties brought to China by Dean J. H. Reisner when he came to China the first time. The records show that it was a selection made from the Fulcaster variety. Number 6 was put under test for several years and, after the Hanhsuchow Agricultural Department found it to be promising, the seed was also multiplied for distribution to farmers. Since 1925 it has been used by the Hanhsuchow station as a check variety for tests of wheat. It is resistant to rust, smut, and especially to nematodes.

While Nanhsuchow No. 61 did not yield better in all years than did Nanhsuchow No. 6 wheat, it gave an average increase of 11.75 percent for the seven-years’ tests. When compared with two farmers’ varieties, for three years, it shows an increase of 27.83 percent. The result of this experience encouraged the staff members of the Nanhsuchow station to multiply and distribute thousands of pounds of the seed of this wheat in the general area of Nanhsuchow and even farther away.

Some results from the barley improvement work at the Kaifeng station are presented in Table 7. This shows the comparison in yield for five years of Kaifeng No. 313 with the check variety. In the upper part of the table the results show that the new barley gave an average increase of over seven percent for the five-years’ tests. In the lower part of the table is shown the comparison between this new selection and farmers’ varieties. Here a gain of over 21 percent is obtained.
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<td>1,936</td>
<td>1,060</td>
<td>480</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5,043</td>
</tr>
<tr>
<td></td>
<td>Blank Test</td>
<td></td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Multiplication</td>
<td></td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>405</td>
<td>78</td>
<td>2,824</td>
<td>3,006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,060</td>
<td>480</td>
<td></td>
<td>7,853</td>
</tr>
<tr>
<td>Wheat</td>
<td>Head Rows</td>
<td></td>
<td>4,723</td>
<td>2,255</td>
<td>1,632</td>
<td>1,403</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,013</td>
</tr>
<tr>
<td></td>
<td>Rod Rows</td>
<td></td>
<td>2,825</td>
<td>200</td>
<td>1,875</td>
<td>330</td>
<td>9,068</td>
<td></td>
<td></td>
<td></td>
<td>637</td>
<td>595</td>
<td>740</td>
<td>953</td>
</tr>
<tr>
<td></td>
<td>Genetic Study</td>
<td></td>
<td>2,697</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,697</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>2,825</td>
<td>200</td>
<td>6,598</td>
<td>330</td>
<td>3,315</td>
<td>14,020</td>
<td></td>
<td></td>
<td>2,040</td>
<td>595</td>
<td>740</td>
<td>953</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>21,608</td>
<td>4,835</td>
<td>10,538</td>
<td>839</td>
<td>11,749</td>
<td>33,216</td>
<td>1,632</td>
<td>688</td>
<td>3,807</td>
<td>2,415</td>
<td>1,389</td>
<td>3,883</td>
<td>96,799</td>
</tr>
</tbody>
</table>

Note 1: The numbers in the above table show the exact number of rows planted as the omitted after each series are not counted.

Note 2: The number of rows in the above table includes both strains or varieties, and check rows.
Table 3. The Yield Comparison of Nanking No. 2905 Wheat With Nanking No. 26 In Bushels Per Acre

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual yield+</th>
<th>Gain over No. 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927*</td>
<td>(40.8)</td>
<td>(19.8)</td>
</tr>
<tr>
<td>1928</td>
<td>29.4</td>
<td>8.8</td>
</tr>
<tr>
<td>1929*</td>
<td>(53.3)</td>
<td>(26.9)</td>
</tr>
<tr>
<td>1930</td>
<td>40.8</td>
<td>9.7</td>
</tr>
<tr>
<td>1931</td>
<td>23.4</td>
<td>-.5</td>
</tr>
<tr>
<td>1932</td>
<td>28.1</td>
<td>7.7</td>
</tr>
<tr>
<td>1933</td>
<td>28.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Average</td>
<td>30.3</td>
<td>6.0 = 25.0%</td>
</tr>
</tbody>
</table>

*The average yield for Nanking No. 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 No. 26 was unusually low, owing to a poor stand and should not be compared with Nanking No. 2905 for that year. Excluding these two highest yields for No. 2905, the average yield is 30 bushels per acre, which is a gain of six bushels or 25 percent over Nanking No. 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 and high amounts of fertilizer were not used.
Table 4. Yield in Bushels Per Acre of Eight New Strains of Wheat, Compared With a Standard Variety, Nanking No. 26, 1927-1931 (from T. H. Shen)

<table>
<thead>
<tr>
<th>Strain</th>
<th>Source</th>
<th>1927</th>
<th>Gain over Standard</th>
<th>Yield</th>
<th>Gain over Standard</th>
<th>1928</th>
<th>1929</th>
<th>1930</th>
<th>Gain over Standard</th>
<th>1931</th>
<th>Yield</th>
<th>Gain over Standard</th>
<th>Average</th>
<th>Gain over Standard in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2902</td>
<td>Selected from Chinese Wheat</td>
<td>27.5</td>
<td>9.9</td>
<td>23.2</td>
<td>3.9</td>
<td>41.9</td>
<td>19.7</td>
<td>31.5</td>
<td>5.0</td>
<td>21.9</td>
<td>-0.2</td>
<td>29.2</td>
<td>7.7</td>
<td>35.8</td>
</tr>
<tr>
<td>2903</td>
<td>&quot;</td>
<td>25.4</td>
<td>7.8</td>
<td>24.7</td>
<td>7.3</td>
<td>39.5</td>
<td>17.4</td>
<td>33.9</td>
<td>7.4</td>
<td>20.6</td>
<td>0.5</td>
<td>29.0</td>
<td>8.1</td>
<td>38.7</td>
</tr>
<tr>
<td>2905</td>
<td>&quot;</td>
<td>35.8</td>
<td>16.6</td>
<td>24.6</td>
<td>7.3</td>
<td>44.6</td>
<td>22.5</td>
<td>34.1</td>
<td>8.1</td>
<td>19.6</td>
<td>-0.5</td>
<td>31.7</td>
<td>10.8</td>
<td>51.7</td>
</tr>
<tr>
<td>2915</td>
<td>&quot;</td>
<td>26.8</td>
<td>7.0</td>
<td>22.4</td>
<td>6.2</td>
<td>42.9</td>
<td>20.6</td>
<td>31.8</td>
<td>5.8</td>
<td>20.0</td>
<td>1.8</td>
<td>28.8</td>
<td>8.3</td>
<td>40.5</td>
</tr>
<tr>
<td>2941</td>
<td>&quot;</td>
<td>33.9</td>
<td>10.0</td>
<td>25.4</td>
<td>5.1</td>
<td>46.2</td>
<td>23.4</td>
<td>34.4</td>
<td>5.9</td>
<td>20.5</td>
<td>1.6</td>
<td>32.1</td>
<td>9.2</td>
<td>40.2</td>
</tr>
<tr>
<td>516</td>
<td>Red Rock</td>
<td>23.2</td>
<td>11.6</td>
<td>26.8</td>
<td>9.6</td>
<td>35.8</td>
<td>15.4</td>
<td>33.4</td>
<td>8.0</td>
<td>24.9</td>
<td>5.4</td>
<td>28.8</td>
<td>10.0</td>
<td>53.2</td>
</tr>
<tr>
<td>2899</td>
<td>Selected from Chinese Wheat</td>
<td>29.7</td>
<td>8.8</td>
<td>27.1</td>
<td>7.0</td>
<td>44.1</td>
<td>22.3</td>
<td>33.6</td>
<td>8.1</td>
<td>21.7</td>
<td>-0.4</td>
<td>31.2</td>
<td>9.2</td>
<td>41.8</td>
</tr>
<tr>
<td>2919</td>
<td>&quot;</td>
<td>32.7</td>
<td>7.0</td>
<td>26.0</td>
<td>8.6</td>
<td>39.3</td>
<td>16.7</td>
<td>37.1</td>
<td>8.6</td>
<td>20.7</td>
<td>1.8</td>
<td>31.2</td>
<td>8.5</td>
<td>37.4</td>
</tr>
</tbody>
</table>

Standard variety is Nanking No. 26 which yields seven percent better than the farmers’ varieties.
No. 3 Harvesting test plots of wheat used for comparing yields of varieties and selections.

No. 4 Carrying the bundles of wheat to the storage building.
No. 5 The bundles are hung up for drying and after drying the grain is threshed out by hand and placed in paper bags shown in the picture, that are properly labeled for storage until needed to prepare the seed for the next crop.

No. 6 Wheat of one of the good varieties that has been grown on a field to increase the amount of seed for distribution to growers now spread out on a large concrete floor for good sunning. This helps prevent mold and also helps control insects.
### Table 5. Results of the Tests of Kaifeng No. 124 Wheat

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Yield</th>
<th>Check Yield</th>
<th>Gain Over Check</th>
<th>Gain in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>25.7</td>
<td>27.3</td>
<td>-1.6</td>
<td>-5.9</td>
</tr>
<tr>
<td>1927</td>
<td>50.0</td>
<td>35.3</td>
<td>14.7</td>
<td>41.6</td>
</tr>
<tr>
<td>1928</td>
<td>23.5</td>
<td>20.5</td>
<td>3.0</td>
<td>14.6</td>
</tr>
<tr>
<td>1929</td>
<td>17.5</td>
<td>15.7</td>
<td>1.8</td>
<td>11.5</td>
</tr>
<tr>
<td>1930</td>
<td>28.0</td>
<td>26.6</td>
<td>1.4</td>
<td>5.3</td>
</tr>
<tr>
<td>1931</td>
<td>37.8</td>
<td>37.7</td>
<td>.1</td>
<td>.3</td>
</tr>
<tr>
<td>1932</td>
<td>39.6</td>
<td>34.5</td>
<td>5.1</td>
<td>14.8</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>31.7</strong></td>
<td><strong>28.2</strong></td>
<td><strong>3.5</strong></td>
<td><strong>12.4</strong></td>
</tr>
</tbody>
</table>

### Table 6. Yield Data Of Nanhsuchow No. 61 Wheat As Compared With Nahnsuchow No. 6 Wheat, The Variety Formerly Distributed

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

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

### Yield Data Of Nanhsuchow No. 61 Wheat In Comparison With Farmers’ Varieties

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield of No. 61 (Bu. per acre)</th>
<th>Yield of Farmers’ Variety (Bu. per acre)</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929-30</td>
<td>29.1</td>
<td>20.6</td>
<td>8.5</td>
</tr>
<tr>
<td>1931-32</td>
<td>26.5</td>
<td>18.9</td>
<td>7.6</td>
</tr>
<tr>
<td>1932-33</td>
<td>25.7</td>
<td>24.1</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>27.1</strong></td>
<td><strong>21.2</strong></td>
<td><strong>5.9</strong></td>
</tr>
</tbody>
</table>
Some selection work with soybeans was begun at the Nanking station in 1924 when a Chinese associate made some individual plant selections from the university farm and farmers’ fields around Nanking. Among these selections was one named Nanksoy No. 332, which proved to be a most valuable type, as its performance in yield indicates. The results for five-years’ tests are presented in the upper part of Table 8. It will be seen that as a result of the five-years’ tests, the average gain over the check is 5.46 bushels per acre. Subtracting this from the average yield of Nanksoy No. 332, 17.68, the average yield of the check is 12.22 bushels. Using this as a basis it is seen that Nanksoy No. 332 shows a gain of 44.7 percent. The results obtained when comparing Nanksoy No. 332 with the farmers’ varieties are presented in the lower part of Table 8. The gain of the new variety over the farmers’ sort in the first test is about 83 percent and in the second one it is over 90 percent. Thus is seen the value of selection for improvement of crop yields.

Some results of rice selection are presented in Table 9. All of the strains reported on here are selections made from rice fields in China. There is only one yield reported for 1927 which is not included in the totals, and the results for 1928 are also not included in the totals due to the fact that the yields of the check variety were unusually low. At the bottom of the table, it states that the standard variety used for comparison for 1927 and 1928 was a variety commonly grown by the farmers. A better variety, White Round, was used for a standard in 1929 and 1930. The average yields and gains are shown for these two years. While the gains over this standard made by the different selections are not as high as those obtained in 1928 they do show that the selections yield appreciably more than the varieties that had been available to the rice growers. The gains of these selections for the two years range from 14.6 to 29.6 percent and yield increases as large as these are of real importance to the farmer for the better yields are the result of having made some selections that have the heredity to produce high yields under the conditions where the experiments were conducted and would be expected to continue to do so tinder a similar environment.

### Table 7. Results of the Test of Kaifeng No. 313 Barley

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Yield</th>
<th>Check Yield</th>
<th>Gain Over Check</th>
<th>Gain in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>29.82</td>
<td>28.81</td>
<td>1.01</td>
<td>3.51</td>
</tr>
<tr>
<td>1927</td>
<td>50.77</td>
<td>41.58</td>
<td>9.19</td>
<td>22.10</td>
</tr>
<tr>
<td>1928</td>
<td>51.24</td>
<td>50.43</td>
<td>.81</td>
<td>1.61</td>
</tr>
<tr>
<td>1930</td>
<td>38.87</td>
<td>38.44</td>
<td>.43</td>
<td>1.12</td>
</tr>
<tr>
<td>1931</td>
<td>50.56</td>
<td>46.98</td>
<td>3.58</td>
<td>7.62</td>
</tr>
<tr>
<td>Average</td>
<td>44.25</td>
<td>41.25</td>
<td>3.00</td>
<td>7.27</td>
</tr>
</tbody>
</table>

### Results of Comparison With Farmers’ Varieties, 1932*

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield in Bushels Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 313</td>
<td>51.23</td>
</tr>
<tr>
<td>Farmers’ Varieties</td>
<td>42.24</td>
</tr>
</tbody>
</table>

* In the test of 1932 Barley No. 313 was used as the check.
**Table 8. Yield of Nanksoy No. 332 Compared with the Check Variety**

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Yield of Nanksoy No. 332</th>
<th>Gain Over Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>20.3</td>
<td>9.6</td>
</tr>
<tr>
<td>1927</td>
<td>24.3</td>
<td>6.7</td>
</tr>
<tr>
<td>1928</td>
<td>15.4</td>
<td>4.1</td>
</tr>
<tr>
<td>1930</td>
<td>13.8</td>
<td>5.0</td>
</tr>
<tr>
<td>1931</td>
<td>14.6</td>
<td>1.9</td>
</tr>
<tr>
<td>Average</td>
<td>17.68</td>
<td>5.46</td>
</tr>
</tbody>
</table>

**Variety**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield in Bushels Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers’</td>
<td>Seeds</td>
</tr>
<tr>
<td>Nanksoy No. 332</td>
<td>37.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield in Bushels Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers’</td>
<td>12.1</td>
</tr>
<tr>
<td>Nanksoy No. 332</td>
<td>23.1</td>
</tr>
</tbody>
</table>
## Table 9. Comparison of Selected Strains of Rice with a Standard Variety at Nanking 1927-1930

<table>
<thead>
<tr>
<th>Strain</th>
<th>Source</th>
<th>1927 Yield</th>
<th>Gain over Standard</th>
<th>1928 Yield</th>
<th>Gain over Standard</th>
<th>1929 Yield</th>
<th>Gain over Standard</th>
<th>1930 Yield</th>
<th>Gain over Standard</th>
<th>Average for 1929-1930</th>
<th>Gain over Standard in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>7094a</td>
<td>Selection from Native Variety</td>
<td>9.2</td>
<td>8.5</td>
<td>31.4</td>
<td>19.0</td>
<td>43.0</td>
<td>3.8</td>
<td>51.3</td>
<td>8.3</td>
<td>47.1</td>
<td>6.0</td>
</tr>
<tr>
<td>1-7-35</td>
<td>&quot;</td>
<td>...</td>
<td>...</td>
<td>51.0</td>
<td>37.9</td>
<td>38.4</td>
<td>10.1</td>
<td>54.3</td>
<td>11.2</td>
<td>46.3</td>
<td>10.6</td>
</tr>
<tr>
<td>1-3-86</td>
<td>&quot;</td>
<td>...</td>
<td>...</td>
<td>43.8</td>
<td>37.4</td>
<td>40.1</td>
<td>9.0</td>
<td>48.0</td>
<td>5.3</td>
<td>44.0</td>
<td>7.1</td>
</tr>
<tr>
<td>1-6-70</td>
<td>&quot;</td>
<td>...</td>
<td>...</td>
<td>54.7</td>
<td>47.5</td>
<td>36.9</td>
<td>9.4</td>
<td>45.5</td>
<td>2.8</td>
<td>41.2</td>
<td>6.1</td>
</tr>
<tr>
<td>1-9-54</td>
<td>&quot;</td>
<td>...</td>
<td>...</td>
<td>45.3</td>
<td>35.3</td>
<td>34.3</td>
<td>9.3</td>
<td>49.1</td>
<td>3.1</td>
<td>41.7</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Note 1: Yields are given in bushels per acre

Note 2: Standard variety was a common farmers' variety used for 1927 and 1928; a better variety, White Round, was used in 1929-1930

## Table 10. Comparison of New Strains of Kaoliang with Farmers' Variety at Nanhsuchow (from T.H. Shen)

<table>
<thead>
<tr>
<th>Strain</th>
<th>Source</th>
<th>1927 Yield</th>
<th>Gain over Standard</th>
<th>1928 Yield</th>
<th>Gain over Standard</th>
<th>1929 Yield</th>
<th>Gain over Standard</th>
<th>1930 Yield</th>
<th>Gain over Standard</th>
<th>Average for 1929-1930</th>
<th>Gain over Standard in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A7-9c-2d-4</td>
<td>Selection from Native Variety</td>
<td>32.6</td>
<td>7.8</td>
<td>33.8</td>
<td>5.7</td>
<td>52.1</td>
<td>26.9</td>
<td>47.3</td>
<td>4.3</td>
<td>41.5</td>
<td>11.2</td>
</tr>
<tr>
<td>1A7-9c-2a-3</td>
<td>&quot;</td>
<td>32.6</td>
<td>7.8</td>
<td>33.8</td>
<td>5.7</td>
<td>42.1</td>
<td>22.5</td>
<td>36.3</td>
<td>6.1</td>
<td>36.2</td>
<td>10.5</td>
</tr>
<tr>
<td>1A7-9c-2b-4</td>
<td>&quot;</td>
<td>32.6</td>
<td>7.8</td>
<td>33.8</td>
<td>5.7</td>
<td>46.7</td>
<td>25.2</td>
<td>37.2</td>
<td>1.5</td>
<td>37.6</td>
<td>10.1</td>
</tr>
<tr>
<td>1A7-47c-3b-4</td>
<td>&quot;</td>
<td>38.2</td>
<td>4.3</td>
<td>28.7</td>
<td>5.5</td>
<td>49.6</td>
<td>16.6</td>
<td>50.2</td>
<td>10.4</td>
<td>41.7</td>
<td>9.2</td>
</tr>
<tr>
<td>1C1-11b-1a-4</td>
<td>&quot;</td>
<td>44.9</td>
<td>12.2</td>
<td>38.1</td>
<td>16.5</td>
<td>41.0</td>
<td>7.5</td>
<td>47.1</td>
<td>19.1</td>
<td>42.8</td>
<td>13.8</td>
</tr>
<tr>
<td>1C1-11b-1b-2</td>
<td>&quot;</td>
<td>44.9</td>
<td>12.2</td>
<td>38.1</td>
<td>16.5</td>
<td>45.7</td>
<td>10.8</td>
<td>49.2</td>
<td>17.3</td>
<td>44.5</td>
<td>14.2</td>
</tr>
</tbody>
</table>

Note 1: Yields are given in bushels per acre
The comparison of a number of selections from kaoliang fields, when compared with a farmers’ variety as a standard, are presented in Table 10. It will be noted that all of the new selections yielded better than the standard in all of the tests conducted during the four years. The gains in yield, as an average of the four-years’ tests, ranged from 28 to 48 percent. Three of the selections show increases of over 40 percent, and two of them gave increases of over 35 percent. The lowest yielder gave a gain of 28 percent. All of these strains are definitely much better yielders than the standard used.

The experimental work on cotton was begun by Mr. J. B. Griffing when he made selections from Chinese cotton. This was before the expanded Crop Improvement Program was undertaken. In his studies Mr. Griffing made over 50,000 selections. One of these seemed to be superior to others from the standpoint of yielding ability and quality of lint. This was named the Million Dollar and was accepted by a large number of farmers as being an improvement over the common variety they had been growing.

Seeds of this variety were multiplied and distributed to a good many growers, especially along the sea coast from Shanghai, south to Ningpo, as well as for some distance in from the sea coast. It was also grown north of the Yangtze River above Shanghai. Its quality, measured by spinning tests, was judged to be equal to the American cotton. Some seed of the Acala variety from the United States was tried out in China, and in some places this variety was also giving satisfactory results.

Later the cotton work was included as part of the Crop Improvement Program, and some variety trials were made in the northern part of China, where it was found that some of the varieties from the United States gave good results. Trice cotton was one that was doing fairly well, but Stoneville No. 4 seemed to be more popular in the general area around Peking and an area southwest of Peking. More extensive variety tests were planned in order to determine what varieties were best for the different important cotton producing areas of China. These experiments indicated in what areas the Chinese type of cotton would be expected to be more satisfactory than the foreign varieties, mainly American. The latter are better adapted to the north central and northern cotton growing regions.

A new selection program was begun and studies on the disease resistance of the different types was taken up seriously toward the end of the program. Toward the later years of the program, more consideration was being given to the multiplication and distribution of pure seeds of the varieties that carefully conducted field experiments had demonstrated were capable of producing superior yields in a large number of different areas.

The data which have been presented demonstrate that under the conditions existing in China when the program began, selection conducted on a large scale does make it possible to obtain new strains of plants that will produce greater yields than the varieties commonly grown by the farmers and these results were obtained in a relatively short time.
Seed Multiplication and Distribution

Some distribution of good strains of wheat, cotton and corn began in China before 1925. As already mentioned, Dean Reisner had produced the Nanking No. 26 wheat and a variety of corn, which was named Nanking Yellow Corn. Both of these were superior to the native varieties the farmers were in the habit of growing and resulted from selections from local varieties. Selected strains of cotton were also distributed. Mr. J. B. Griffing made many selections from Chinese cotton and one of these named Million Dollar gave an increase in yield and produced high quality lint. Selections were made from the American cotton varieties, Trice and Acala, and the seed was later distributed.

It is appropriate at this point to discuss a matter that has been brought up on numerous occasions when discussing the work in China. The question is raised whether the Chinese farmer might be so conservative that he would not want to cooperate with the program and try out seed of some new variety, or a method for seed treatment. The answer to this is that he is not any more conservative by nature than were the farmers of the United States 50-60 years ago. The chief difference is one of economy. Since many of the Chinese farmers had farms less than an acre in size and the average size of farm was about 3-5 acres, the farmer was not willing to set aside a small part of his field to try something new for if no good result was obtained he would have less food than would have been the case if he had used all his land for his own crops. With the American farmer it was different since his farm was larger he could usually spare a strip of land for some experiment without affecting his income seriously. When the Chinese farmer could see the experiment demonstrated in his neighborhood then he was eager to have it on his own farm. An experience that occurred near the farm of the College of Agriculture at Nanking will illustrate this fact. A special festival day was being celebrated near the farm and some of the extension men from the College knew this would be a good time for some extension work. This affair was held in the spring so they took with them a quantity of seed of the Nanking Yellow Corn to distribute to the farmers. Most of them lived close enough to the farm to see the crops that had been grown and they had seen fields of this corn. Many requests for some seed were made and by midday the supply was exhausted. But the crowd had not all arrived and people kept coming. The farmers among them had heard about the seed corn and came to request seed but were told there was no more. This made them most unhappy and they began to talk with each other. The more they talked the more unhappy they were and finally they decided the extension men had some seed but for some reason were not willing to give them their share. This idea made the farmers even more unhappy and the extension men feared they might start trouble so they invited the farmers into the booth to see for themselves. They showed them the empty bags and finally convinced the farmers that the extension men were not holding out on them, but were sorry the farmers had not arrived earlier so they might have received their share, and the extension men told the farmers that they regretted that more seed was not available. This little story does not indicate the farmers are conservative, but does show they are willing to grow the new varieties developed in the program, when they have seen them growing in their neighborhood.

In the early days of seed multiplication and distribution, no definite program had been worked out for handling the various details. The seed of these different sorts was distributed generally in the neighborhood of Nanking, and the Million Dollar cotton was distributed to farmers in the cotton growing region around Shanghai and along the Yangtze River. This early distribution was the result primarily of the work done by the extension staff members of the College, other interested parties and some of the Agricultural Missionaries who were to participate later in the Crop Improvement Program. It was evident, however, that before a seed distribution system could be developed, it would be more satisfactory to those growing the seed of improved varieties and others helping to produce the special varieties to conduct regional tests. These tests are variety trials in which all of the sorts to be compared are grown in small plots, each variety being replicated several times in each trial. When possible it is of value to have these tests grown on the farmers’ fields and there should be enough of these regional tests so that the new varieties will be tested over a large area.

In these regional tests one would use some of the local varieties that are judged by the farmers to be best for that locality. The results from these tests will indicate whether the new sort or sorts are adapted to the local conditions.
and exceed the farmers’ varieties in yield and possess other qualities desired for the crop, such as good quality of the grain and a satisfactory lint for the cotton. These tests were recommended to precede any large scale distribution of seed of a new sort.

Dr. C. H. Myers, in presenting lectures to the Slimmer Institute in 1931, outlined a program for seed multiplication and distribution. He stated that it is not necessary nor desirable to have a large number of new varieties to be put into multiplication and distribution at the same time. That is, it would not be necessary to have several different strains of wheat or other crops put into distribution for use in a certain general area.

He also recommended that rather than distribute small amounts of seed over a large area, that it would be better at first to select certain areas where the farmers had indicated a willingness to cooperate in a good seed program and where the users of the product would be interested in taking part in this movement. Seed would be distributed to a large number of farmers, if there was a sufficient amount of the new seed. If the results were satisfactory, the plan would be to move out in a more-or-less general circle, surrounding the area where the seed was first distributed, and to continue on in this way until an entire area, or at least the majority of the farmers, were growing the new variety. This plan was generally followed as the program continued and expanded during the years, even the war years, with the result that many farmers benefited by the use of good seed.

This was better than to follow the practice of distributing seed to individual farmers in scattered areas, since it was possible to select good farmers who could become specialists in growing and multiplying pure seed. These growers needed to be instructed on the value of keeping seed of the new variety pure and free from mixtures. The fields grown by these farmers were inspected by men qualified for this work, and those farmers who were willing to multiply the seed were asked to make the seed from their farms available to their neighbors through a cash sale or some sort of barter system. The extension staff members and others from the College or from the different stations helped the farmers become better acquainted with the methods for inspection and other details required for the production of pure seed.

For an improved seed program to be complete, it is desirable to have a system for the registration of new varieties. Registration of varieties is important since it often helps prevent the introduction and use of untried and unworthy sorts. Upon registering a variety, there are certain data that are required, such as the name of the variety, a complete description of the plant, its origin and characters, as well as its production, and a summary of the performance record relative to yield and other characteristics, after several years of testing. It was not possible to develop all of these details during the period devoted to this Crop Improvement Program, but sufficient information was made available so that seed multiplication and distribution continued to expand rapidly in many different parts of China and continued during the war years.

The Japanese invasion of the China mainland in 1937 made it impossible for the University to remain at Nanking, but the officials of the West China Union University in Chengtu, Szechwan, maintained headquarters at their campus, and extended an invitation to the University of Nanking to join them. This was a most generous offer and was gladly accepted by the University of Nanking. Naturally, when a move was made from Nanking, the College of Agriculture staff arranged to have a large amount of material and equipment shipped to Chengtu. They took with them supplies of the new wheat varieties and other crops to try them out in the West China area. Some seed of Nanking No. 2905 wheat had reached this area for testing before the College had to move there in the fall of 1937. This wheat was found by many comparisons to yield 20 percent higher than the local varieties the farmers were growing, and the grain produced 11 percent more flour than the local varieties. The staff of the Department of Agronomy arranged to have a number of demonstration plots planted to this variety, which served to show the farmers the value of this new wheat. In 1938, they had a fair amount of improved seed for distribution to the farmers.

It is important to insert here a statement which shows that the Plant Breeding staff of the Department of Agronomy were not discouraged since they had to change their location, but went out looking at the wheat in 34 different counties in west China and brought back 7,000 individual heads for further selection work. Four different groups
of staff members went out in September to make rice head selections. They worked over 48 counties and returned with 50,000 selected heads.

While the Agronomy experiment stations of the University of Nanking were mostly located in the war area after 1937, they were still making considerable progress with their experimental work and the multiplication of seed. These stations at Nanking —Chengtu, Nanhsuchow, Tsinan, Yenching, and Sian—reported a distribution of a large amount of improved wheat seed to the farmers. The Sian station also distributed enough good seed of Stoneville No. 4 cotton in one year to plant 5,000 acres. This shows how the work was being continued by the faithful staff members of Nanking and those from many other places who had been so helpful in connection with the program.

Some interesting information on the program is presented in the Agriculture and Forestry Notes of the College of Agriculture and Forestry, University of Nanking, under date of May, 1939. This was over seven years after the last Cornell representative had returned from China. One statement reads: “Since 1924 the crop improvement program on a large scale has been well underway. Considering the population and area of China, and the fact that 85 percent of the population is rural and hence directly connected with agricultural production, crop improvement may well be considered of the utmost importance to the economic and physical well-being of the people.” The names of the improved varieties of crops and some of their characteristics are presented in Table 11.

There are 37 strains or varieties listed in this table and 27 of these, as indicated in the table, were already being distributed to farmers and some were grown on a fairly large acreage. The above number should be 28 rather than 27 because, although this table does not indicate that any seed of Stoneville No. 4 was being distributed, other available records, as noted above, indicate that a large amount of seed of this variety was being distributed. The other nine varieties were being multiplied for distribution. All of the selections were made from Chinese crops except those made from Trice, Acala and Delfos cotton. These varieties were grown in China and the selections were made from these fields.

There are more varieties of wheat than any other crop. This is to be expected since wheat is widely grown and with the differences in soils and climate different types are needed for best results. Some experiments as conducted show that the different areas of central and north China require special types of this crop. It is important to have the notes on disease resistance for use in future work.

All the sorts that would be available to farmers for the program are not listed in Table 11, since crop improvement is a continuing program, and new lines developed from time to time. When found worthy, the seed was multiplied and made available to the farmers. For example, Table 11 was completed early in 1939 and by November a new variety of barley was ready for distribution.
Table 11. Improved Crop Varieties (cont’d next page)
From the University of Nanking and Cooperating Agricultural Experiment Stations

<table>
<thead>
<tr>
<th>Improved Varieties</th>
<th>Yield in Catties Per Mow(^{(1)})</th>
<th>Gain Over Check (%)</th>
<th>Gain Over Farmers’ Varieties (%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHEAT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. 2905*</td>
<td>226.0</td>
<td>25.0</td>
<td>32.0</td>
<td>Early, stiff straw, smut resistant</td>
</tr>
<tr>
<td>U.N. 26*</td>
<td>208.1</td>
<td>7.0</td>
<td>7.0</td>
<td>Early, good stooling power</td>
</tr>
<tr>
<td>U.N. Kaifeng*</td>
<td>238.6</td>
<td>12.5</td>
<td>17.7</td>
<td>Stiff straw, good quality</td>
</tr>
<tr>
<td>U.N. Nanhsuchow 61*</td>
<td>284.0</td>
<td>33.9</td>
<td>34.0</td>
<td>Early, resistant to nematode</td>
</tr>
<tr>
<td>U.N. Nanhsuchow 1419**</td>
<td>264.0</td>
<td>23.0</td>
<td>56.9</td>
<td>Stiff straw, good quality</td>
</tr>
<tr>
<td>U.N. Yenching Standard*</td>
<td>19.0</td>
<td></td>
<td>19.0</td>
<td>White kernel, resistant to cold</td>
</tr>
<tr>
<td>U.N. N-W Blue-awn*</td>
<td>185.0</td>
<td></td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>Oberlin 169* - dry land</td>
<td>370.0</td>
<td>13.5</td>
<td></td>
<td>White kernel</td>
</tr>
<tr>
<td>“                    ” - irrigated</td>
<td>226.0</td>
<td>9.2</td>
<td></td>
<td>White kernel</td>
</tr>
<tr>
<td>Tinghsien 72*</td>
<td>267.5</td>
<td>15.0</td>
<td></td>
<td>White kernel</td>
</tr>
<tr>
<td>Tinghsien 73914*</td>
<td>255.8</td>
<td>18.3</td>
<td></td>
<td>Good quality</td>
</tr>
<tr>
<td>Hsuchow 1438*</td>
<td>245.9</td>
<td>16.5</td>
<td>22.5</td>
<td>Resistant to cold and drought</td>
</tr>
<tr>
<td>Hsuchow 1405*</td>
<td>251.9</td>
<td>21.2</td>
<td>27.2</td>
<td>Resistant to cold and drought</td>
</tr>
<tr>
<td>Tsinan 1195**</td>
<td>303.5</td>
<td>32.4</td>
<td></td>
<td>Resistant to flag smut</td>
</tr>
<tr>
<td><strong>COTTON</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>U.N. Trice*</td>
<td>180.0</td>
<td></td>
<td></td>
<td>Wide adaptation</td>
</tr>
<tr>
<td>U.N. Acala*</td>
<td>180.0</td>
<td></td>
<td></td>
<td>Fine fiber</td>
</tr>
<tr>
<td>U.N. Million Dollar*</td>
<td>150.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. Acala 481**</td>
<td>187.0</td>
<td>8.5</td>
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</tr>
<tr>
<td>U.N. Acala 949**</td>
<td>220.0</td>
<td>18.5</td>
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<td></td>
</tr>
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<td>Stoneville 4(^{(2)})</td>
<td>200.0</td>
<td></td>
<td></td>
<td>Early maturity</td>
</tr>
<tr>
<td>Delfos 531*</td>
<td>200.0</td>
<td>35.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RICE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. 1386** - direct planting</td>
<td>361.2</td>
<td>9.0</td>
<td></td>
<td>Stem borer resistance</td>
</tr>
<tr>
<td>U.N. 1386** - transplanting</td>
<td>394.8</td>
<td>12.9</td>
<td></td>
<td>Stem borer resistance</td>
</tr>
<tr>
<td><strong>SOYBEAN</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>U.N. 332*</td>
<td>133.0</td>
<td>44.9</td>
<td>82.7</td>
<td>High yield</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>90.8</td>
<td>High yield</td>
</tr>
<tr>
<td><strong>MILLET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. Yenching 811*</td>
<td>303.0</td>
<td>26.8</td>
<td>1.8</td>
<td>Resistant to covered smut</td>
</tr>
<tr>
<td>U.N. Nanhsuchow 373*</td>
<td>353.0</td>
<td>13.0</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>U.N. Kaifeng 48*</td>
<td>370.5</td>
<td>31.0</td>
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</tr>
<tr>
<td>U.N. C.H. Millet*</td>
<td>424.3</td>
<td>34.9</td>
<td></td>
<td>Somewhat resistant to kernel smut and downy mildew</td>
</tr>
<tr>
<td>Tinghsein-Yenching 22*</td>
<td>417.0</td>
<td>7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved Varieties</td>
<td>Yield in Catties Per Mow(1)</td>
<td>Gain Over Check (%)</td>
<td>Gain Over Farmers' Varieties (%)</td>
<td>Remarks</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------</td>
<td>---------------------</td>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Tsinan U.N.** Path. 8</td>
<td>479.7</td>
<td>53.4</td>
<td></td>
<td>Resistant to kernel smut</td>
</tr>
<tr>
<td>KAOLIANG</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. Kaifeng 2612*</td>
<td>284.1</td>
<td>21.2</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>U.N. Nanhsuchow 2624*</td>
<td>328.0</td>
<td>18.0</td>
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<td></td>
</tr>
<tr>
<td>Tinghsien 33*</td>
<td>250.9</td>
<td>28.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARLEY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. 99*</td>
<td>211.8</td>
<td>17.9</td>
<td>17.9</td>
<td>Resistant to covered smut</td>
</tr>
<tr>
<td>U.N. Kaifeng 313**</td>
<td>266.6</td>
<td>7.3</td>
<td>21.9</td>
<td></td>
</tr>
<tr>
<td>U.N. Nanhsuchow 1963**</td>
<td>358.0</td>
<td>18.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.N. Nanhsuchow 718**</td>
<td>224.0</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nanking Yellow*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oberlin Golden Queen*</td>
<td>554.0</td>
<td>21.0</td>
<td></td>
<td>Fairly resistant to corn borer</td>
</tr>
</tbody>
</table>

** Seeds being multiplied, not yet extension
* Seeds under extension
(1) One catty equals 1.33 pounds
(2) See text, page 43

The University of Nanking moved back from Chengtu in 1946. Seed multiplication was continued but the records
are not available to furnish information on whether the seed distribution was stopped when the Communists took
over the Chinese Government. Likewise, the records showing the amount of seed distributed to the farmers during
the years just previous to the changeover of the Government are not available. It is fair to state that seed of the
various improved crops has been made available in quantities to thousands of farmers in various parts of China,
who have grown many thousands of acres of the crops listed in this table.

What better evidence can be had to show the importance of the training of staff members which was stressed all
during the time spent in China than to review the results presented in this table. No one can doubt the importance
of this training when it is realized that over seven years after the end of the trips of the staff from Cornell, and with
the troubled times for China, that the program of crop improvement was going forward on an ever widening scale.
This fact is of the greatest importance.

It is worthwhile at this point to relate an experience that a friend of the University of Nanking had at New Delhi
while attending the Industrial Fair in 1960. While looking over the exhibit from Communist China he came
across a bottle of wheat seed labeled “Nanking 2905”. It is likely that this sample was from the crop of 1959, indicating
that 28 years after the close of the formal cooperation on the Crop Improvement Program that this variety was still being used by the Chinese farmers.
No. 7 Showing method of threshing by flailing. These flails are made with a long bamboo handle with several short pieces of bamboo or other wood. When the flail is lifted and given a forward push it falls on the grain with considerable force. The grain is placed on a threshing floor made by tamping down a part of the area near the house or farm buildings. Sometimes the soil may be wet down before the tamping begins. These floors are prepared sometime before needed and may be wet down and worked over several times.

No. 8 Another method of threshing is by use of a corrugated roller pulled by a water buffalo or other animal. These rollers are made by taking a large stone and cutting out grooves lengthwise and then constructing the necessary frame work so that as the animal pulls it along the roller revolves. This same type of roller may be used by the farmers when preparing their soil for planting by breaking up large clods of soil. The corrugated type works better than the roller that is smooth all around.
No. 9 Another method for threshing is that of making a slatted frame. The frame is made from any kind of wood available and the slats are often made from bamboo. The bundle of grain is then beaten over this by a workman and the grain and chaff fall to the ground. With all these three methods the grain is separated from the chaff by tossing it into the air when a breeze is blowing and a good separation is obtained.

No. 10 This picture does not show the threshing machine very well, but it is a small type of modern (for those days) machine made for small farm operations in the United States. It was used at Nanking for threshing grain from fields where a good variety was being multiplied for distribution to farmers, and when time permitted to thresh grain for the farmers living near the Tai-Ping Men Experimental Farm. Another reason for using this picture is to show the large number of experimental fields at the Tai-Ping Men farm used in the program.
The Training Program

The training of men proved to be the most important element in the entire program. The evidence for this lies in the fact that the crop improvement work continued to expand in every way even during the war years when the College was in Chengtu.

The training was carried out through a series of Summer Institutes of three weeks’ duration, formal lectures in the College, field observation trips and informal discussions and conferences which were almost continuous and always helpful.

The purpose of the Summer Institutes was to provide intensive courses of instruction in Genetics and Plant Breeding and related subjects for those who had little or no training in them. Although the instruction was intended primarily for the staff of the cooperating stations, representatives from government institutions and experiment stations were invited to attend and by 1931 made up the majority of those registered. A second purpose was to bring the Nanking cooperators together to discuss problems arising at their stations and to check on methods being used and results obtained.

On Dr. Love’s first trip to Nanking in 1925, reorganization of the plant breeding program at the College and the cooperating stations was accompanied by detailed instructions covering every aspect of the work, such as preparation of planting plans, weighing of seeds, planting, observations to be made during growing season, selection of strains for further trials, harvesting, threshing, weighing, storage, keeping of records and interpretations of data. Detailed instructions for making head and plant selections and for rod row testing were prepared and translated into Chinese. For members of the staff, Dr. Love gave a series of evening lectures on Biological Statistics and during the summer a course on Experimental Methods. For advanced students and the younger staff members he gave a course in Plant Breeding.

In 1926, a Summer Institute of Crop Improvement was held at Nanking under the direction of Professor Myers. Twenty-three students and experiment station men were registered, with 16 visitors — representing the major crop improvement organizations in central and east China. Lectures and laboratory practice were given in Genetics, Plant Breeding and Plant Pathology. Field observations were also arranged. In addition, Dr. Myers gave a course of 20 lectures on Plant Breeding attended by about 50 upperclassmen and members of the faculty.

In 1929, after an interruption of two years due to political disturbances, the second Summer Institute of Crop Improvement was held at Nanking under the direction of Dr. Love, with 52 registered students, an average attendance of 65, with similar representation as in 1926, and with the same general program of instruction. Dr. Love also gave a course on Biometrical Methods to advanced students and members of the faculty.

The third Institute was held from July 18 to August 5, 1930, at Yenching University, Peiping, under the direction of Dr. Wiggans with the University acting as host. Twenty-five persons attended, made up of directors of provincial experiment stations, representatives from provincial governments and plant breeders from the cooperative stations in north China. This Institute differed from those previously held in that emphasis was placed on the improvement of open-fertilized crops and that it was held in north China and was of special help to those who had been unable to make the long trip to Nanking in previous years. Dr. Wiggans offered a course on Breeding Methods with emphasis on open-fertilized crops. Dr. Shen gave a course on Genetic Principles as applied to crop improvement. A member of the division of Plant Pathology at Nanking gave a course on Crop Diseases and other relationships to a crop improvement program. Laboratory exercises, field trips and conferences completed the program. At Nanking, Dr. Wiggans gave a series of lectures for advanced students and staff members of the College and National Central University; attendance varied from 33 to 50.

The fourth and final Institute was held at Nanking, July 6-24, 1931, with Dr. Myers and reflected the progress that had been made in the years since the cooperative program began. The following is taken from the announcement of the Institute:
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 methods of controlling diseases, as a part of the Crop Improvement Program of the Agronomy Department of the University of Nanking, for those primarily interested in the improvement of crops for China:

◊ As cooperators with the department in its crop improvement program.
◊ As staff members of other institutions or organizations who are making efforts along the same line.
◊ 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 crop 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.

Ninety-one persons were registered for the Institute, with 20 regular visitors from the staff of the College of Agriculture and Forestry, mostly from the plant science departments. There were 32 institutions represented, of which 17 were governmental and 15 private from nine provinces mostly in north central and east China. The private institutions were for the most part the cooperating stations listed on page 5. The government institutions were as follows:

◊ - Kao-yu District, Experiment Station, Kiangsu.
◊ - Chekiang University, Hangchow.
◊ - Kiangsu Provincial Wheat Experiment Station, Hsouchowfu, Kiangsu.
◊ - Second Provincial Vocational School, Runan, Honan.
◊ - Kiangsu Board of Agriculture and Mines, Chinkiang, Kiangsu.
◊ - Kiangsu Provincial School, Wush, Kiangsu.
◊ - Honan Water Conservation School, Kaifeng, Honan.
◊ - Hupeh Provincial Rural Normal School, Wuchang, Hupeh.
◊ - Chiating Agricultural Experiment Station, Chiating, Kiangsu.
◊ - Changshu Agricultural Experiment Station, Changshu, Kiangsu.
◊ - National Bureau of Inspection and Testing, Tsingtao, Shantung.
◊ - Kiangsu Provincial Rice Experiment Station, Soochow, Kiangsu.
◊ - Honan Provincial Horticultural Experiment Station, Kaifeng, Honan.
◊ - Chekiang Provincial Agricultural Experiment Station, Hangchow, Chekiang.
◊ - Chekiang Provincial Cotton Experiment Station, Siao-shan, Chekiang.
◊ - Honan University, Kaifeng, Honan.

The courses offered in the Fourth Summer Institute were as follows:

“A. Elementary Plant Breeding was given by Dr. T. H. Shen. This course consisted of five one-hour lecture periods and three 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 six visitors.

“B. The course in Plant Pathology was given by a member of that division. It consisted of five lecture periods of one hour each and two 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 six visitors who attended all the lectures.
“C. A course in Advanced Plant Breeding was given by Dr. C. H. Myers. It consisted of five lecture and two 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, who had returned to Nanking in March, 1931, as Agricultural Advisor to the National Agricultural Research Bureau. The course given in English consisted of three two-hour periods each week and dealt with methods of calculations and application of the more important statistics and with the experimental error concept. There were 40 students regularly registered for the course with six visitors attending the lectures.

Of special significance was the academic standing of the student group, 66 were graduates of recognized colleges, 24 were upperclassmen in the College of Agriculture and Forestry, and 21 were graduates of its short course in Agriculture. With the exception of the upperclassmen, all were engaged in experimental work or teaching. As Dr. Myers pointed out in his final report, the instruction given was of the same grade and covered the same ground as that offered by the three Cornell professors in their teaching at Cornell.

Again, many individual conferences were held during the Institute on special problems being faced at the institutions represented. The Institute also provided opportunity for a general conference of the representatives of all the cooperating stations.

Of more than passing interest, but of considerable value, were the three social functions at which the entire Institute, including faculty, were present. To those familiar with Chinese courtesy and hospitality, no explanation is necessary. It is included in this history because it reflects so very well the friendly atmosphere which characterized the entire cooperative effort.

By the end of the formal cooperation between Cornell and Nanking, it was estimated that well over 125 men, who had little or no previous experience, had been trained to the point where they were independently able to conduct crop improvement experiments.

The close of the formal cooperation also marked the beginning of another training program, when the College of Agriculture and Forestry was designated as the center for Plant Breeding training in connection with the Government-organized Crop Improvement Program at Nanking, in which Dr. Love was to play an important part. (See Government Cooperation, page 51.)

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**Chinese Graduate Students in Plant Breeding at Cornell**

Between 1909 and 1961, according to the records of the Department of Plant Breeding, a total of 82 Chinese graduate students have studied Plant Breeding and Genetics at Cornell. A total of 17 Ph.D. degrees, and 19 M.S. degrees and five M.S.A. degrees have been granted. Between 1926, the second year of the cooperative program, and 1946, 62 Chinese graduate students were registered for work in the Department.

Personal contacts with the visiting Cornell professors at Nanking stimulated the desire on the part of many Chinese students for additional professional training in plant breeding and genetics. Beginning with Dr. T. H. Shen, who had received his Ph.D. degree in 1928, and succeeding students at Cornell, the influences in favor of study at Cornell increased. This influence carried over into the early years after the Government of the Republic of China had moved to Taiwan. It is not suggested that the direct and indirect influence of Cornell accounted for all the 62 students who studied there between 1926 and 1946, but it was certainly the major factor.
A very interesting and human insight into this influence was provided at a dinner tendered to Dr. Love on his visit to Taiwan in 1954. One of the speakers referred to him as the “grandfather” of plant breeding in China, Dr. T. H. Shen as the “father,” and the present generation of plant breeders as their “offspring.” That Cornell has played the dominant role in plant breeding work in China and later on in Taiwan, is not open to question.

**Government Cooperation**

Reference has already been made to local government experiment stations that were cooperating with the College in the Crop Improvement Program. In 1930, conferences were held by a few prominent Government officials, representatives of the College of Agriculture of Central University and representatives from the University of Nanking, including Dr. R. G. Wiggans. As a result, the Ministry of Agriculture and Mining of the Central Government at Nanking, the Kiangsu Provincial Government, through its Bureau of Agriculture, and the Chekiang Provincial Government, through its Bureau of Agriculture and Forestry, decided to establish a Crop Improvement Program that would serve both provinces. An invitation was extended to Dr. Love to become its first Advisor. With the approval of Cornell University and the necessary leave of absence, Dr. Love accepted. He arrived in Nanking in April, 1931, and served for three and one-half years.

The several governments concerned with this new development made certain agencies responsible for the program and among themselves developed a working plan agreeable to all. The official statement and agreement was as follows:

“The Ministry of Agriculture and Mining of the Central Government, Nanking, and the Provincial Governments of Kiangsu and Chekiang, jointly having employed Professor H. H. Love, of Cornell University, as advisor to the Ministry and Director of the respective Provincial Crop Improvement Programs for a period of three years, beginning January 1, 1931, the College of Agriculture of Central University, the Bureau of Agriculture and Forestry, Hangchow, and the College of Agriculture and Forestry, Nanking University, as functioning organizations in Crop Improvement work, do hereby enter into a cooperative agreement in order that the efforts of Professor H. H. Love during his stay in China may accomplish the greatest results for the advancement of crop improvement in China:

“1. The Provincial Government of Kiangsu and Central University assume the responsibility for the budget for crop improvement in Kiangsu.

“2. The Provincial Bureau of Agriculture and Forestry assumes the responsibility for the budget for crop improvement in Chekiang.

“3. The College of Agriculture and Forestry, University of Nanking, agrees to provide necessary equipment for long periods of training and the Provincial Bureau of Agriculture and Forestry and College of Agriculture, Central University, agrees to provide necessary equipment for short periods of training for students in crop improvement.

“4. The training of students in crop improvement is to be an important part of the duties of Professor H. H. Love.

“5. Office and laboratory space is to be provided by the University of Nanking for general headquarters, clerk, and training of graduate students.

“6. The Provincial Government of Kiangsu and the College of Agriculture, Central University are to provide office, laboratory, and experimental farm equipment for crop improvement work in Kiangsu.”

Although entirely a governmental project, Nanking University profited by the close cooperation with the Govern-
ment and with the Specialist in training Chinese for crop improvement work. The fact that the Central Government was making Nanking University headquarters for Dr. Love more than proved the good will of the Government toward the University and the value the Government placed on the crop improvement work of the College.

In anticipation of this development much preliminary work had been done especially in Chekiang Province in choosing suitable branch stations, making selections from fields and retaining some staff members, and getting possession of a central experimental farm at Hangchow. Dr. Wiggans had the pleasure of visiting, in company with Mr. T. H. Chien, the proposed area for the central station.

After some of the general plans had been settled and Dr. Love had agreed to go to China to serve as advisor he received word from the Ministry of Industries stating that the Government was interested in the organization of a unit that would lay plans for a general agricultural program of research and development for the whole of China in so far as possible. It was understood by those interested that such an extensive program could not be developed at once since it would be necessary to have land, buildings, equipment and especially a large staff of well-trained men to man the program. Such things as land, buildings and equipment would be of little value unless a large number of properly trained staff members could be available. Not only would these staff members need to be well trained but they would need to have a sincere desire to engage in some phase of scientific agriculture for the purpose of helping their country. The Ministry sent Dr. Love this word so he would be thinking about the development of such a program while he was getting ready to go to China. Dr. Love was glad to know of the Government’s interest in such plans and gave much thought to methods of procedure that would aid in furthering the plan.

Soon after arriving in China and having completed the necessary arrangements for the crop improvement work that needed to be handled at that time, Dr. Love and some of the interested Chinese talked over the necessity of making a beginning on the Government’s plan for a research program. It was agreed that a call would be made on the Minister of Industries to present the need for a committee to study the entire matter and make recommendations to the Minister for his consideration. This was done and the Committee chosen by the Minister consisted of men well informed as to the efforts that had been made to improve the agriculture of China.

This Committee lost no time in getting started and began holding frequent meetings. There was much interest shown by the members and many useful ideas and suggestions were made. It was decided that the name would be the National Agricultural Research Bureau, and that it would be best to locate it at Nanking. Its program was to develop research in all the important phases of Chinese agriculture just as rapidly as a trained staff and facilities would permit. Three divisions were established for the different lines of work. These were—Crop Production, Animal Production and Agricultural Economics and Marketing.

The Committee completed its work in the early fall of 1931 and plans were made to implement its recommendations. One of the first moves was to start the work of obtaining sufficient land for buildings and experimental fields. Next came plans for buildings, greenhouses, and other construction work. The first large building was begun early in 1934 which showed good progress since it took a long time to buy up the large number of small farms needed for the 384 acres that were required for buildings and experimental work. When it is recognized that many farms contained only a few acres, sometimes only one or two or even less, and seldom more than five, it is clear that many parcels of land would have to be bought to make up the total acres needed.

By November 1937, only six years after the first committee meetings were held to discuss the need for a Research Bureau, the land area had increased to 428 acres, and five laboratory buildings, one administration building, more than 10 staff dormitories, greenhouses, wire cages (to protect plants from birds), cold storage rooms and a high temperature room had been constructed. The technical staff included over 100 in addition to the farm laborers and servants needed. The research was expanding rapidly and aid was made available to many of the provinces. Some extension was also added to carry the facts of some of the research out to the farmers for their benefit. But about that time it was necessary for the Bureau to move to west China where it functioned as long as possible before the Communists moved in to take control of the Government.
China Foundation Cooperation

As a result of the progress made in the Crop Improvement Program, Nanking University was granted aid for the first time in 1930 by the “China Foundation for the Promotion of Education and Culture.” Upon presentation of well-outlined projects on breeding and disease resistance work by the Departments of Agronomy and Pathology, the University was granted $10,000 a year for a period of three years. This very material aid made it possible to inaugurate and carry to completion some phases of the crop improvement work which could not otherwise have been done. Available records indicate that the China Foundation continued its support of this work for at least 10 years and after the College had moved to Chengtu because of the Japanese invasion.

The International Education Board

The International Education Board, founded in 1923 by Mr. John D. Rockefeller, Jr., contributed greatly to the success of the program by providing funds to cover the salaries of the Cornell professors not covered by Cornell University. In addition, a grant was made in 1925 to cover the expenses of Mr. T. H. Shen to travel and work with Dr. Myers on his first trip to Nanking in 1926. A further appropriation provided Mr. Shen with a fellowship to complete work for a Ph.D. degree in Plant Breeding and to provide return travel to Nanking, where he had been appointed to a professorship in the College of Agriculture and Forestry. The total appropriations by the International Education Board for the purposes above indicated amounted to $14,000 for the entire period of cooperation.

A history of the International Education Board has been written by Mr. George W. Gray and published by Harcourt, Brace and Company of New York City. This covers the period from 1923 to 1938 and in this history (pages 51) is presented an evaluation of the Crop Improvement Program. The author points out that by following approved methods of crop improvement the staff of the College of Agriculture at Nanking cooperating with a number of staff members of several Mission stations and from other stations developed a number of improved varieties of the important crops of China. These new sorts produced higher yields than the farmers’ varieties and some of them were more resistant to diseases. The plans made for seed multiplication and distribution were also mentioned.

The author stresses the value of the training of men which from the beginning of the program was considered of great importance. He also mentions the influence the program had on some of the government agencies which resulted in the National Government working with the provincial governments of Kiangsu and Chekiang established a similar plan for continuing crop improvement studies. It may be added that this program eventually spread over most of China.

It is also pointed out in this history that when, in 1935, the Rockefeller Foundation began a rural reconstruction program for China, the earlier work of the Crop Improvement Program served as a basis for this work.

Reasons for the Success of the Program

Many factors entered into the success of this program, and it is difficult to assign priorities to them.

First, most likely is the factor of people, in this case, Chinese and Americans. The specialists were Americans. They had knowledge, techniques and experience greatly needed in China and for the most part, lacking. Their job was to transfer these qualities to their Chinese associates, if their efforts were to be successful. Moreover, they had to be accepted personally by their new associates and in the community as well, as indeed they were. They were under
the necessity of identifying themselves, not only with a particular program, but with the personalities of those with whom they worked. It was not a situation where impersonal relationships were effective nor in order. It was a situation where personal relationships to a large degree determined the atmosphere and spirit of the cooperative effort and, therefore, its results. It was a “learning” situation, both for the Cornell professors and the Chinese staff, and while the Chinese may have had more to learn, the quest for new knowledge was at least mutual. On all these points, the Cornell representatives scored well.

On the Chinese side, it must be remembered that scientific agricultural education and agricultural improvement were in a pioneer stage of development. There was a heavy national deficit in terms of trained men, institutions and governmental interest and support. To these pioneer Chinese, the improvement of agriculture was not only a pressing necessity, but a patriotic cause.

The Chinese staff with whom the Cornell representatives were associated all had a sense of the importance of the work in which they were engaged, and of pride in their share in it. Admittedly, their training had been limited. Had it been otherwise, there would have been no reason for this cooperative program. What they lacked in training was made up by their eagerness to learn and their desire to cooperate. Finally, and we hope without bias, it would be difficult to find anywhere in the world a finer group of people with which to work. They embodied in themselves the best traditions of China and of Chinese character. Ten-hour work days in the field or in the office were not unusual.

The second major factor in the success of the program was the emphasis on training. This was both formal and informal, and with the staff at Nanking almost a continuous process, whether in the office or in the field. A question by a staff member to the Cornell representative was an opportunity to broaden the questioner’s knowledge. The informal training that took place when visits were made to the cooperating stations was of like value, perhaps of even greater significance because these station staff members were cut off from the constant give and take characteristic of what took place within the Department at Nanking. Had the program failed to make opportunities for formal training, or had not persisted in its opportunities for informal training, the total results of the program would have been seriously vitiated.

Another factor in the success and influence of the program was that of cooperation with both missionary and government agencies. Before this program came to an end, formal cooperative relationships had been developed at 14 stations in the Yangtze Valley and the provinces north of Nanking. This provided opportunity to deal with crops important to the area concerned. Uniform methods were used throughout, making possible comparable results.

There was much informal cooperation—particularly in making available to government institutions and experiment stations plant breeding material. From 1925 to 1930, 69 orders for wheat, 60 orders for cotton, 33 orders for corn were received from government institutions. In addition hundreds of strains for experimental purposes were supplied. Members of the Department of Agronomy of the College served on many governmental committees. Formal cooperation in the Crop Improvement Program was in operation with three government institutions. A considerable number of government employees took advantage of the special training courses instituted as a regular feature of the program.

The fact that the Department of Agronomy was one of the strongest in the College, that it was fairly well staffed, that it had a field program in operation, which had already produced practical results and that it was fairly well financed, had an important bearing on the results achieved. The Department was in a position to make maximum use of the contributions which the Cornell professors were able to provide.

Another factor of success was continuity. This is, of course, especially necessary in crop improvement work. As has already been pointed out, no experiment was destroyed, no seeds lost because of the serious military disorders during these years. The only outright losses that occurred were due to the disastrous Yangtze River flood of 1931, when the work at the Wuchang station and the rice work at the Nanking station were completely lost for that year. A reserve seed supply made possible a continuation of the program the following year.
Still another factor of success of the program was that those responsible for it knew exactly the kind of results they were seeking and knew how to attain them. The broad outline of the program had been established at the beginning. Enough time had been allotted to secure results, adequately trained men had been developed to carry on into the future when the Cornell representatives were no longer available. To a large extent, they had worked themselves out of the job and left it in efficient hands.

**Significance of the Program**

I. In the field of Crop Improvement.

◊ Higher yielding strains of wheat, barley, rice, kaoliang and soybeans, cotton and millet—all of them important crops in east and north China—were developed and put into distribution to farmers.

◊ Crop improvement methods were standardized throughout the area and later adopted throughout most of China. Detailed plans for small grain breeding and testing were prepared and made available in the Chinese language.

◊ The plant breeding work at the University of Nanking was reorganized and cooperative relationships established with 14 private and government stations throughout this area.

◊ Government activities in this field were greatly stimulated. (For details see p. 51.)

II. In the field of training in China.

◊ All the Cornell representatives taught courses to the undergraduate students in the Department of Agronomy of the College of Agriculture and Forestry. Special courses were arranged for staff members. There were numerous conferences with the College staff and the representatives from government and other institutions.

◊ Four special summer short courses were held for all those participating at the cooperative stations and were also attended by staff members from government institutions and experiment stations.

◊ Field work and observations were important parts of the training,

◊ It is safe to say that no branch of agriculture in China had available to it as many well-trained men as did plant breeding.

III. In the field of training at Cornell.

◊ Resulting chiefly from the contacts made with the Cornell representatives in China, many Chinese students took graduate work in Plant Breeding and Genetics at Cornell. (See p. 50.)

IV. In the field of International Education.

◊ As an experiment in International Education, the results were highly significant and satisfactory. Expert professional competence, for the most part lacking, was successfully transferred to those participating in the program in China. Professional advice and instruction in the plant breeding field had been made available to a large number of students and experiment station workers. Out of this background of experience in China, a significant group went to Cornell for further specialized training.

◊ The Cornell professors were agreed that their work in China had broadened their own training and experience, and added to their knowledge in the field of plant breeding.

◊ The general experience of the Cornell professors in agricultural education, administration and research work resulted in incidental but very important contributions to other departments of the College at Nanking.
Dr. W. I. Myers, former Dean of the College of Agriculture at Cornell has stated that, “the success of the Cornell-Nanking program was one of the factors leading to a decision on the part of the New York State College of Agriculture at Cornell to undertake an extensive program in cooperation with the College of Agriculture at Los Banos, in the Philippine Islands, under contract with the United States Foreign Aid Program.”

V. In stimulating Governmental Activities.

The extent and success of the Crop Improvement Program in which government experiment stations were invited to and did participate, undoubtedly stimulated further governmental efforts. In this, they were always aided and supported by the Cornell representatives, as well as by members of the College faculty at Nanking.

In 1930, the Ministry of Agriculture and Mining of the Central Government at Nanking, the Provincial Government of Kiangsu Province, through its Bureau of Agriculture, and the Provincial Government of Chekiang Province, through its Bureau of Agriculture and Forestry, established a Cooperative Crop Improvement Program, similar to that of the College of Agriculture and Forestry, and invited Dr. H. H. Love to become its Advisor. This program later developed into the National Agricultural Research Bureau. Dr. Love entered into his duties in April, 1931. (See page 52 for further details.)

VI. A Continuing Program.

The Crop Improvement Program continued to expand after 1931 when the formal cooperation with Cornell came to an end. All experimental material at Nanking was moved to Chengtu in 1937 after the Japanese invasion of the mainland—grown there and was returned to Nanking in 1946. A successful Crop Improvement Program was launched immediately in west China. During these war years the stations at Nanking and some of the cooperating stations continued to function and to produce seed of the superior varieties for local distribution. Too much praise cannot be given for the wisdom and courage of the Chinese in maintaining the experimental material.

VII. Of benefit to the Agriculture of New York and several neighboring states.

In practical terms, this program was not a one-way street. The introduction of four heads of barley from the experimental fields of the College of Agriculture and Forestry into the breeding program of the New York State College of Agriculture added much to winter barley growing in New York State, as well as to Pennsylvania, Ohio, New Jersey, Maryland, Delaware and Virginia. (See the Wong Barley Story, page 59.)

VIII. In Modern Terms.

At the time of this program, the term “Technical Assistance” had not yet come into the prominence it has now attained. Looked at from almost any angle the development of international understanding and good will; the transfer of technical knowledge to a host country; the establishment of an on-going program definitely related to a pressing national need; the creation of a reservoir of well-trained nationals capable of carrying on when the “technicians” departed, this program must be rated as a technical assistance at its best. With the results obtained and in terms of its low cost, it probably set some kind of a record.
The Influence on Taiwan and Other Countries

The following statement was prepared by Dr. T. H. Shen:

“The influence is indirect and through the 12 men of the National Agricultural Research Bureau who formed an important part of the Joint Commission of Rural Reconstruction staff. They include three commissioners: T. H. Chien in 1952-61; Y. S. Tsiang since 1961; and T. H. Shen since 1948. Dr. Love served as consultant of JCRR in 1949. An important part of the program of JCRR is to assist cooperating agencies in training and developing leaders and developing better varieties, which are much the same as the objectives of the Nanking-Cornell International Education Board Program.

“I should also like to express my gratitude and pleasure in having been privileged to take part in the Program. The International Education Board granted a research fellowship to me in 1926-1927 on the recommendation of Professors H. H. Love and C. H. Myers. While on the faculty of the University of Nanking in 1927-1937, I had the rare opportunity to acquire valuable experience from the Cornell University professors, Drs. H. H. Love, C. H. Myers, and R. G. Wiggans.

“With confidence in the international cooperation built up from my early association with this triangular cooperative program, I have enjoyed working, since 1948, in my present position with the China-United States Joint Commission on Rural Reconstruction in China.

“As a trustee of the International Rice Research Institute, Manila, I met Mr. John D. Rockefeller, III at the opening ceremonies of the Institute on February 7, 1962. I expressed my gratitude to him for my research fellowship from his father’s foundation, the International Education Board, and commented on this triangular cooperative program as the earliest and also the best example of technical assistance by American institutions to foreign countries.”

The Influence on Other Countries

It is of interest to mention how the experience of those Chinese who had been associated with the Crop Improvement Program, or had heard much about it, encouraged them to be ready to help other countries which indicated a need for such aid. A number of Chinese specialists in the field of crop improvement who had moved to Taiwan were called upon to render this kind of service. So Free China is making its contribution to world agriculture.

Dr. T. H. Shen was invited to take several agricultural specialists from Taiwan to Thailand to study the problems of that country. After spending some time studying the agriculture of that country they made a report and recommendations relative to certain improvements which they concluded would be of benefit to Thai agriculture.

Recognizing the importance of improving their agricultural production, the Government of Vietnam approached the officials of Taiwan with a request for aid in this effort. Several specialists were needed for the work the Vietnam officials hoped to see developed. A Chinese Technical Mission was formed under the direction of Dean P. C. Ma of the College of Agriculture, University of Taiwan. A total of 11 men made up the Mission. They arrived in Vietnam in time to begin work in July 1960. Two interesting reports have been printed covering the work of 1960-1961 and 1961-1962. Many tables are included giving results of numerous different experiments and it is evident that the staff members of the Mission were working hard to accomplish the purpose of the program. Dean Ma was called to other duties early in the second year and Chu Hai-fan was appointed to head the Mission.

It is stated above that Dean Ma was asked to undertake another assignment early in the second year of the Vietnam program. The Government of Liberia, West Africa, became interested in expanding its College of Agriculture and had requested the cooperation of the Food and Agriculture Organization of the United Nations to aid in this effort. The latter realizing that an experienced agricultural administrator was needed asked Dean Ma if he would be willing to accept this responsibility. He agreed to do so after consulting with the Vietnam officials and certain
administrative officers of Taiwan. At present he is busy with all the various problems that need to be considered in developing a college of agriculture that will be prepared to train students in the fundamentals of agriculture and especially those peculiar to Liberia and that part of Africa. A research program needs to be developed to study the problems of Liberian Agriculture and an extension division to carry the latest agricultural information to the growers.

These activities of Chinese technical experts well illustrate how far the methods and ideals developed during the early years of the Cornell-University of Nanking-International Education Board Program of Crop Improvement are being extended to different countries. And who would be willing to say that these efforts will be the last? No, it is more likely that other areas in the world will benefit from similar programs, and it is possible that from the work in Liberia, Vietnam and Taiwan other new projects will be developed. Such worthwhile programs as these reported here have a way of continuing to grow and serve to stimulate others of a similar nature.

The Wong Barley Story

Many people are inclined to think that when a staff member of one of the Colleges or Universities in the United States is invited to go to some foreign country to participate in a program in that country, that the staff member gives out information and helps the local institution and country but does not gain any information that will be of value to him or to his institution when he returns. Dr. Love was asked by one of the administrative officers at Cornell when he returned from China the first time whether it was not a situation of all give and no return. He answered definitely “that it was not.” Often new experiences gained from spending time with college men in another country add much to the information the visiting staff member needs for his own program at home. Then if one is interested in some phase of plant life he may find some plants that would be most “useful to his own investigations when he returns to his special work after completing his service abroad.

Dr. Love states that he gained much from the new experiences, and especially from some new plant types. He had been conducting genetic studies with oats and there was one type of plant he had been seeking for some time but never could find. When he was looking over a field of wheat at Nanking he was suddenly surprised to see this type “looking right at him.” It was a mixture that had become mixed with the wheat. Another time he was observing a large field of hybrid barley plants and was happily surprised to see some bearing their heads erect even when the plants were nearly ripe. This was most unusual as practically all of the United States varieties have a weak straw. These new plants stood so erect that there was not a bend in the stem. These are the basis of the Wong Barley Story.

Dr. Love asked the Chinese investigator, who was a member of the staff of the College of Agriculture, Nanking University, and a member of the team working on the Crop Improvement Program, if it would be possible to have a few seeds of some of these special plants. Only a few seeds were needed at the time. Four heads were obtained. Dr. Love had in mind using these to cross with spring barley to obtain stiffer straw. When he returned to Cornell he found that spring barley was not grown as much as formerly, but some interest was developing in winter barley. The seeds he had obtained in China were from winter types but the winters where these were growing are less severe than those in New York State. Seeds from each of the four heads were grown in the Plant Breeding garden to see if the plants produced could stand the winter here in New York. Some plants from each head did survive the winter, but those from two heads made much better growth. These were grown in other winters and finally the plants from one line did much better and this line was kept, the seed was multiplied further and the variety named Wong. This new sort was grown by a number of farmers of New York, and was the stiffest strawed type then available to United States growers. It yielded well compared with the other varieties then grown in New York. The average yields in bushels per acre for four varieties grown in 14 yield tests for 1939-1942 in New York are shown here.
Prof. N. F. Jensen, of the Plant Breeding Department at Cornell, who is in charge of the Small Grain Breeding Program, has assembled some facts and figures on Wong barley and we thank him for making these available for this story. Prof. Jensen has also made a number of crosses between Wong and other winter barley varieties and three of these, Hudson, Dutchess, and Catskill, have replaced Wong in New York State due to higher yields, greater winter hardiness and scald resistance. In a number of adjacent states Wong is still grown on a large number of acres.

Seven or eight states produce certified seed of Wong for the farmers’ use. The larger producers of certified seed are Virginia for 14 years which has an average acreage of 1,404 acres, and Pennsylvania, 1,522. Maryland for 13 years has produced an average of 769 acres and New Jersey 349 acres. Certified seed of Wong barley has been offered to the farmers for 21 years which is an unusual record for a grain variety to be popular so long.

Quoting from Prof. Jensen’s statement we have, “Wong must be almost unique in the history of crop varieties. After more than 20 years of production there is more Wong grown today than in any previous year (last year of complete data: 1960). Certified seed production of this variety in 1960 was 15 percent greater than the highest previous figure. Furthermore, for the 14 years for which data are available Wong production (total bushels) averaged 40.9 percent of all certified winter barley seed production in the United States (and 41.5 percent of all acreage). In 1960 Wong produced 40.3 percent of total certified bushels on 34.4 percent of the total certified acreage so it appears that the trend is not going downwards. New varieties do not seem to offer competitions. A total of 28 winter barley varieties were involved in 1960 production of certified seed in the United States. Dayton with a production of 102,700 bushels was second to Wong (241,700 bushels). (Hudson was grown on 991 acres to produce 32,500 bushels.) For 14 years the average production of certified Wong seed was 150,885 bushels.

Taking into account the usage of certified seed it is assumed that certified Wong seed planted 25 percent of the total acreage of Wong, therefore, 603,540 bushels of Wong would be needed to plant all Wong acreage each year. At a 2 bushels-per-acre seeding rate this would indicate 301,770 acres annually. Roughly 300,000 acres at 35 bushels-per-acre yield would amount to 10,500,000 bushels per year. At $1.00 per bushel this gives an estimated value of $10,500,000. per year.”

It is interesting to note that a large handler of certified seeds made an independent estimate, based on knowledge of seed sales and related information, of the value of Wong. This estimate was $200,000,000 over a period of 21 years, or $9,500,000 annually. From these two estimates it seems reasonable to conclude that Wong has been worth ten million dollars a year to eastern United States agriculture. This is an important gain coming from one little barley head, or back one generation, just one seed.

“Wong apparently has extraordinarily good parental qualities. In the 1961 U.S.D.A. Uniform Winter Barley Nursery test of about 30 varieties, the first seven, and nine of the top ten in yield rank had Wong as a parent.”

The result obtained from the Wong barley is definite proof that when staff members go from their institutions in the United States to some institution abroad it is not always “a give, no take effort”, especially if the visiting staff member is a keen observer and he usually is or he would not have been chosen for the job.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Bushels per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wong</td>
<td>50.0</td>
</tr>
<tr>
<td>Kentucky No. 1</td>
<td>47.8</td>
</tr>
<tr>
<td>Michigan Wonder</td>
<td>46.0</td>
</tr>
<tr>
<td>Poland</td>
<td>45.6</td>
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</tbody>
</table>
Evaluations of the Program

The following evaluation is by one who had observed the progress of the Crop Improvement Program and one who was in a position to give a fair estimate of the program.

“(1) This project was a forerunner of the present technical assistance program of the United Nations, and for the present University contract arrangement by the AID of the U. S. Department of State.

“(2) The project was located at a training institution, where a large number of people could be trained. We, the counterpart, were not just one person, but a group of people working with the visiting professors.

“(3) There was a real desire to learn from the expert on the part of the recipient institution.

“(4) There was an element of continuity and stability, which helped to carry the project to a successful result.”

Statement by Dr. T. H. Shen

Dr. T. H. Shen played an important part in this program. He broke into his studies at Cornell to accompany Dr. C. H. Myers during his tour of duty at Nanking in 1926. On his return to Cornell late in 1926, he completed his work for the Ph.D. degree in Plant Breeding receiving his degree in February 1928. He then returned to Nanking as Professor of Plant Breeding in the College of Agriculture and Forestry. He later became associated with the National Agricultural Research Bureau in China. In 1948 he was appointed a Commissioner of the Joint Commission on Rural Reconstruction, where he is still serving. Dr. Shen was the first Chinese Ph.D. in Plant Breeding and has given meritorious service at all times. The following statement was written by him at Taipei, Taiwan on October 12, 1962.

“The most significant results of the Nanking-Cornell-International Education Board Program for Crop Improvement in China were: (1) training a group of Chinese plant breeders for carrying on a national program of crop improvement; (2) developing better varieties of wheat, barley, rice, kaoliang, millet and soybeans showing increased yields from 10 to 20 percent more than the native varieties; (3) stimulating the Chinese government to establish the National Agricultural Research Bureau of the Ministry of Industry in 1931 which made great improvements in agricultural production in China up to 1949 through scientific research and agricultural extension services. Dr. H. H. Love, of Cornell, served as Advisor to the Bureau in 1931-1934.”