

CHINESE-AMERICAN  
JOINT COMMISSION ON RURAL RECONSTRUCTION

Plant Industry Series: No. 11

CROP IMPROVEMENT AND SEED DISTRIBUTION  
OF UPLAND FOOD CROPS IN TAIWAN

By

Chung-Fu Cheng



TAIPEI, TAIWAN, CHINA

JUNE, 1956

CHINESE-AMERICAN  
JOINT COMMISSION ON RURAL RECONSTRUCTION

Plant Industry Series: No. 11

CROP IMPROVEMENT AND SEED DISTRIBUTION  
OF UPLAND FOOD CROPS IN TAIWAN

By  
Chung-Fu Cheng  
Sr. Specialist  
Plant Industry Division



TAIPEI, TAIWAN, CHINA

JUNE, 1956

Copyright, 1956, by the Chinese—American  
Joint Commission on Rural Reconstruction,  
Taipei, Taiwan, China. All rights reserved.  
This book, or parts thereof, may not be  
reproduced in any form without written  
permission of the Joint Commission.

The Joint Commission on Rural Reconstruction  
25 Nanhai Road, Taipei, Taiwan, China.

# CONTENTS

	Page
Foreword	
1. Sweet Potato.....	1
I. Background information .....	1
II. Variety improvement .....	4
III. Production and distribution of sweet potato seed material.....	10
2. Wheat .....	14
I. Background information .....	14
II. Variety improvement .....	17
III. Production and distribution of pure wheat seed .....	19
3. Peanuts .....	23
I. Background information .....	23
II. Variety improvement .....	25
III. Production and distribution of better seed .....	28
4. Soybean .....	31
I. Background information .....	31
II. Variety improvement .....	32
III. Seed production and distribution .....	34

## Foreword

In Taiwan, sweet potato, peanut and soybean have one economic aspect in common. They are all important both as human food and as hog feed. With the steady growth of population and the number of hogs raised, the demand for these three crops has been continuously on the increase in the postwar years. The acreage of sweet potato, around 230,000 hectares, is second only to rice, and that of peanut has reached nearly 100,000 hectares and has edged out sugarcane (93,000 hectares) to become the crop with the third largest acreage in 1955. The soybean, with a humble prewar acreage of 7,000 hectares (1934-1938 average), has now over 30,000 hectares and is next in acreage only to rice, sweet potato, peanut and sugarcane among the farm crops. The acreage expansion of these crops will perhaps slow down due to the limitation of arable land and the growing competition for land among crops. The future hope of further increasing the production of these crops lies in the elevation of their yield per hectare and reduction of loss in the field and after harvest.

The improvement work done on these three crops before the War was much less extensive than that on such crops as rice and sugarcane. Neither was much attention given to these crops in the early postwar years. Only during the last two or three years have the local agricultural research institutes and stations seriously resumed and intensified the improvement work on sweet potato, peanut and soybean.

Wheat is a winter crop in Taiwan, planted after the harvest of the second rice crop and harvested before the transplanting of the first rice crop. It is a useful supplementary food crop and is in much demand by the local flour mills. When the price is low, its acreage may be shifted to other winter crops such as flax, field peas, and vegetables.

The present paper reports on the progress of the work on variety improvement and seed multiplication of these four crops, with special emphasis on results obtained in recent years.

H. T. Chang, Chief

Plant Industry Division

# Crop Improvement and Seed Distribution of Upland Food Crops in Taiwan

The food crops included in this paper are sweet potato, wheat, peanuts and soybeans. They are especially adapted to upland cultivation and their economic importance is second only to rice and sugarcane. The acreages of peanuts and soybeans have increased considerably during the past few years because of increasing demand for oil and protein feed for local consumption.

No significant progress is being made, however, on the increase in unit yield of these four crops. One of the primary reasons for the low unit yield is that most of the varieties used are those that have been propagated for many years. For this reason, the Joint Commission on Rural Reconstruction (JCRR) has contributed considerable financial and technical assistance since its establishment in Taiwan in 1948 to local agricultural research institutions and the Provincial Department of Agriculture and Forestry (PDAF) in strengthening the work on crop improvement and on seed multiplication and distribution.

Much of this work still involves experimentation and demonstration or development of a better system of seed distribution. This report gives the present status of seed improvement and distribution work in Taiwan on sweet potato, wheat, peanuts and soybeans with a brief description of the production of these crops.

## 1. Sweet Potato

### I. Background information

#### A. Acreage and production:

Sweet potato, a common staple food for Chinese as well as for thousands of people living at the southeastern Asia, is known to have been grown in Taiwan even before the Dutch took the island in 1624. History also tells us that many sweet potato varieties were brought by the settlers from Fukien and Kwangtung after the occupation of Taiwan by Koxinja in 1662. At the time of the Japanese occupation in 1896, the acreage of sweet potato had been expanded to some 39,000 hectares.

The first improved variety was selected and released for island-wide planting in 1912. It was White Holland, introduced originally from Japan, and is still one of the commonly grown sweet potatoes in Taiwan. With development of local agriculture since then, the acreage of sweet potato has been increased steadily and in 1954 its acreage reached a peak of 247,551 hectares. This area was second only

to rice and almost six times that in 1900.

Because of greater demand for land for other crops, especially peanuts, the sweet potato acreage decreased slightly in 1955. To offset the loss in acreage, effort is being made to reduce losses in the fields and in storage. These losses are estimated at as high as 20 percent of total production, or the equivalent of 48,000 hectares a year. Improved drying facilities and better control of insect pests in the fields as well as in the granaries are expected to reduce these losses. Acreage and production during recent years compared with some years in the past are shown in the following tables:

<u>Year</u>	<u>Acreage</u> (Ha.)	<u>Production</u> (M.T.)	<u>Unit yield</u> (Kg./Ha.)
1900	39,855	205,996	5,169
1935	138,225	1,624,101	11,750
1945	134,715	1,165,263	8,650
1951	231,389	2,021,719	8,737
1952	233,502	2,090,463	8,953
1953	237,788	2,276,942	9,576
1954	247,551	2,556,823	10,328
1955	245,513	2,437,443	9,928
1956 (goal)	215,000	2,580,000	12,000

#### **B. Producing area:**

Since more than 200,000 hectares of sweet potatoes are planted every year, they are seen almost everywhere in Taiwan from north to south and from west to east. They may be planted on hilly slopes, upland, lowland, paddy fields and sometimes along the roadsides and river banks. The major areas of sweet potatoes, however, are in Tainan, Yunlin and Changhwa in the south and central parts of Taiwan. These three prefectures alone have almost 35 percent of the total acreage. The geographical distribution of the sweet potato acreage in the crop year 1956 follows:

<u>Northern Taiwan</u>	<u>Acreage (Ha.)</u>	<u>Percentage</u>
Keelung City	689	0.32
Taipei City	211	0.10
Ilan Prefecture	4,738	2.20
Taipei Prefecture	9,199	4.28
Yangmingshan District	499	0.23
Taoyuan Prefecture	7,137	3.32
Hsinchu Prefecture	9,323	4.34
Miaoli Prefecture	10,836	5.04

	<u>Acreage(Ha.)</u>	<u>Percentage</u>
<u>Central Taiwan</u>		
Taichung City	918	0.43
Taichung Prefecture	7,802	3.63
Changhwa Prefecture	22,249	10.35
Nantou Prefecture	8,439	3.92
<u>Southern Taiwan</u>		
Tainan City	3,912	1.82
Yunlin Prefecture	27,096	12.60
Chiayi Prefecture	17,351	8.07
Tainan Prefecture	32,553	15.14
Kaohsiung City	1,343	0.63
Kaohsiung Prefecture	16,647	7.74
Pingtung Prefecture	16,640	7.74
<u>Eastern Taiwan</u>		
Taitung Prefecture	4,863	2.26
Hwalien Prefecture	9,174	4.27
<u>Penghu District</u>		
Penghu Prefecture	3,381	1.57
<hr/>		
Total:	215,000	100.00

### C. Planting and harvesting seasons:

Sweet potatoes are planted primarily as the autumn crop with only small acreage in the spring. Of the 215,000 hectares planned for the 1956 crop year, 182,698 hectares or 85 percent will be planted in the autumn. The percentage of spring planting is much higher in northern Taiwan than in the southern part. In Tainan Prefecture, for example, none of 32,553 ha. of sweet potatoes is planted in the spring. Only in Penghu Prefecture (Pescadores Islands), are all sweet potatoes planted in spring season because of the climatic condition.

Spring planting is usually in April and May. Autumn planting is between August and September. Harvest is five to six months after planting. Early maturing varieties usually are needed in the north because of the shorter growing season. Ordinarily, sweet potato is rotated with paddy rice, sugarcane, peanuts, upland rice or green legumes in the local cropping system. Little land is devoted to sweet potatoes as a single-crop. In fact, in southern Taiwan, sweet potatoes are often intercropped with sugarcane in the autumn while in Taichung and Changhwa Prefectures, they may be interplanted in rice fields about 20 to 30 days before the second rice crop is harvested.



Intercropping is a common practice in Taiwan. It enables farmers to grow more crops on their limited land, although it does reduce yields to certain extent.

#### **D. Economic Importance:**

Production of more than two million tons of potato tubers annually is worth more than six hundred million New Taiwan dollars without considering the value of green vines and leaves which could be used for feeding and planting. Sweet potato tubers are used primarily for food and feed, and a small portion is used in manufacturing starch powders. However, with more rice being produced in recent years, coupled with the improvement of economic conditions in the rural districts, sweet potatoes are being used more for hog feed than for human food. This also indicates that a greater number of hogs are being raised in recent years to meet the need of Taiwan's growing population. The following unpublished data supplied unofficially by the Provincial Food Bureau show the trend in use of sweet potatoes.

<u>Used for</u>	<u>Percentage in 1942</u>	<u>Percentage in 1954</u>
Food	47.6	9.1
Feed	42.3	89.5
Starch	6.7	0.4
Seed	3.4	1.0
<hr/>		
Total:	100.00	100.0

A greater portion of sweet potatoes is made into dry chips and only a small percentage is used in fresh form.

## **II. Variety improvement**

### **A. Varieties grown at present:**

More than 200 varieties of sweet potatoes are grown commercially in Taiwan, but, of this number, less than 30 of them occupy an acreage above 1,000 hectares. Native varieties were obtained from the selection of those which had been introduced to Taiwan in early days. They still occupy well above half of the present total commercial acreage. The improved varieties, occupying the other half, are those formerly bred by the Chiayi Agricultural Experiment Station of the Taiwan Agricultural Research Institute. They were obtained from the crosses made between the native or Japanese varieties or with other varieties introduced from other countries. Some popular improved and native varieties and the origin of some improved varieties are shown in the following tables.

### Some Popular Sweet Potato Varieties in Taiwan

<u>Improved varieties</u>	<u>Native varieties</u>
Tainung 31	70-day Early
Tainung 17	Green-tuber-tail
Tainung 10	Red-tuber-tail
Tainung 9	Iron-wire Variety
Tainung 3	5-catty Variety
Tainung 44	Chiayi Variety
Tainung 45	Yu-pien
White Holland (Introduced from Japan)	Foreign Variety Deep Red Variety

#### Origin of Some Tainung Varieties

Variety	Percentage	Crosses made	Year selected
Tainung 3	Chan × American Yellow Skin	1922	1928
Tainung 9	Chieh-yu × Nancy Hall	1922	1928
Tainung 10	American Yellow Skin × Red Skin	1922	1928
Tainung 17	Red Meat × Cake Potato	1924	1930
Tainung 31	White Holland × Yuan-ti	1929	1937
Tainung 44	Foreign Variety × Tainung 14	1936	1944
Tainung 45	Ying-chai-yeh × Tainung 14	1936	1944

As a general characteristic, the native varieties are relatively early maturing, do better under adverse conditions, and grow fairly well on poor land. For those reasons, they still are the leading commercial varieties in the northern and central parts of the Island. Their quality is generally poorer, however, for they contain more water and produce a smaller percentage of dry chips than the improved varieties. On the other hand, the improved varieties prefer better soil and usually give higher yields in the south than do the native varieties. Their quality is superior to the native varieties. Tainung 31 and 17 have become dominant varieties in Tainan, Yunlin and Chiayi Prefectures which are part of the major producing area.

Distribution of improved and native varieties in different districts in Taiwan is shown as follows:

<u>District</u>	<u>Varieties</u>
All parts of Taiwan:	White Holland
Northern Taiwan:	Iron-wire Variety
North Central Taiwan:	70-Day Early, 5-catty Variety, Red-tuber-tail, Hai-wu Variety.
Central Taiwan:	Green-tuber-tail, Pai-sha Variety, Changhwa Variety, Red-tuber-tail, Tainung 31
South Central Taiwan:	Tainung 3, 17, 31; Green-tuber-tail.
Southern Taiwan:	Tainung 10, 17, 31; Chiayi Variety, Yu-pien, Foreign Variety, Deep Red, Ying-chai-yeh, etc.

Tainung 44 and 45 are newer varieties. They were selected in 1944 and were put into regional tests by the Chiayi Agricultural Experiment Station after the World War II. Results from these tests show that these varieties yield more tubers and dry chip than Tainung 31 or 17. A small acreage is being grown in Tainan and Chiayi Prefectures and a trial planting will be made in other regions with other new selections in 1956.

The Yield of Tainung 44 and 45 from Regional Tests as Summarized by the Chiayi Station

Variety	Tuber yield (Kg./Ha.)	Chip %	Chip yield (Kg./Ha.)	Green-top yield (Kg./Ha.)
Tainung 44	28,003	36.20	10,210	9,523
Tainung 45	34,073	31.40	10,738	8,253
Tainung 17	23,143	36.44	8,432	6,578
Tainung 31	25,396	33.55	8,562	11,551

#### B. Variety improvement work in progress:

Sweet potato varieties now generally grown in Taiwan are either the native varieties or the varieties that have been propagated for many years. For that reason, the Taiwan Agricultural Research Institute (TARI), its Agricultural Experiment Station at Chiayi, and the District Agricultural Improvement Stations at Tainan and Hsinchu of the Provincial Department of Agriculture and Forestry are carrying out rather extensive cross-breeding programs for sweet potato variety improvement. This work, started in 1945, has the following three objectives:

(a) To produce some varieties which will retain at least the quality of Tainung varieties but will mature early enough to replace the native varieties in northern and central northern Taiwan. For this purpose, crosses were made between the Tainung varieties and native varieties.

(b) To produce some high quality and high yielding varieties which will supersede the present Tainung varieties under cultivation. To this end, crosses were made within the Tainung varieties and with the varieties introduced from foreign countries.

(c) To produce some colored varieties which possess higher nutritional value for table use. For this purpose, attempts have been made to cross the Tainung varieties with Nancy Hall, Porto Rico, Oklahoma and other colored varieties. Nancy Hall and Porto Rico have been found to yield considerably less under Taiwan conditions.

Many new seedlings have been produced since 1945. A great majority of them are still in different stages of testing. A few promising ones which have been tested for a number of years and are being put into trial planting or in a province-wide regional test in 1956 are mentioned below.

1. P-30 was produced by the Taiwan Agricultural Research Institute (TARI). This new variety was obtained in 1948 from a cross made between Tainung 47 and Iron-wire native variety. It is comparable in time of maturity and soil adaptability to native varieties grown in northern and northcentral Taiwan, but yields more tubers and dry chips and has a higher quality. Regional trials for three years (1951-53 inclusive) in Taipei, Taoyuan, Hsinchu and Miaoli show that P-30 averaged 30 per cent higher tuber yields and one per cent higher chip percentage than Iron-wire, 70-day Early and 5-catty native varieties. Trial plantings in 1954 and 1955 in different localities north of Taichung Prefecture showed promising results.

2. Light-colored varieties K 2, C 137 and C 162 were produced by the Chiayi Agricultural Experiment Station of TARI. These three varieties, except K 2, were obtained from the crosses made in 1946. Their origins are:

- |       |                 |   |            |  |
|-------|-----------------|---|------------|--|
| K 2   | Foreign Variety | × | Tainung 14 | Cross made sometime between<br>1937 and 1941 |
| C 137 | Tainung 17      | × | Tainung 45 | Cross made in 1946                           |
| C 162 | Tainung 31      | × | Tainung 45 | Cross made in 1946                           |

After being selected, these three varieties were put into advanced yield tests. For three years they were better than Tainung 31 in tuber yield by an average of

7 to 26 per cent. The average yield may be shown in the following table:

Variety	Tuber yield (Kg./Ha.)	Index yield
K 2	28,590	112.9
C 137	34,826	137.5
C 162	31,897	126.0
Tainung 31	25,313	100.0

Regional tests in seven other District Agricultural Improvement Stations between 1951 and 1954 also give encouraging results.

Among other light-colored varieties, the Chiayi Agricultural Experiment Station also recommends C 169 (Tainung 31 × Tainung 45), C 347 (selected from open-pollinated seeds) and C 424 for regional tests this year.

3. Dark colored varieties have been produced by the Chiayi Agricultural Experiment Station in addition to the light-colored varieties, by crossing Tainung varieties with Nancy Hall, Porto Rico and Oklahoma. Those which yield better than their colored parents are shown in the following table:

Yield of Some Dark-colored Varieties Produced  
by the Chiayi Agricultural Experiment Station

Variety	Parentage	Av. tuber yield (Kg./Ha.)	Chip %	Meat color
C 381	Tainung 44 × Porto Rico	23,962	33.8	Orange yellow
C 382	Tainung 44 × Porto Rico	24,305	30.3	Orange red
C 430	Tainung 27 × Oklahoma	22,305	36.5	Light orange
C 454	Tainung 27 × Nancy Hall	21,960	34.9	Orange yellow
C 456	Tainung 27 × Nancy Hall	20,020	41.9	Orange yellow
Nancy Hall		18,000	39.6	Orange yellow
Porto Rico		15,260	35.4	Orange red
Chu-san (a native variety)		14,520	23.9	Dark orange red

4. Varieties Hsin-yu 24, 25, 30 and 34 were produced by the Hsinchu District Agricultural Improvement Station. These varieties were selected primarily for the northern districts where native varieties are still dominant. Results from regional

trials in 1953-54 in Hsinchu, Chung-li, Kwang-si and Hou-lung of Hsinchu Prefecture show that they are better than the native varieties. The results follow:

Yield of Hsin-yu Varieties as Compared with the Native Varieties in Northern Districts 1953-54

Variety	Hsinchu		Chung-li		Kwangsi		Hou-lung	
	Kg./Ha.	%	Kg./Ha.	%	Kg./Ha.	%	Kg./Ha.	%
Hsing-yu 24	33,120	151.2	21,300	168.0	35,250	87.3	26,675	146.7
Hsin-yu 25	37,080	169.3	23,601	185.1	38,407	95.1	20,725	114.1
Hsin-yu 30	36,960	168.8	25,100	197.9	44,475	110.1	17,125	94.2
Hsin-yu 34	33,350	152.3	18,900	149.1	34,619	85.7	19,951	109.7
Native * variety	21,900	100.0	12,630	100.0	40,400	100.0	18,180	100.0

\*Hsinchu: 70-day Early; Chung-li: Fukien Variety; Kwang si: Kwanghsi Hu tzu; Hou lung: Iron wire.

The chip percentage of the Hsin-yu varieties is approximately 3 to 4 per cent higher than the native varieties.

5. Other new sweet potato varieties are produced by the Taichung and Tainan District Agricultural Improvement Stations. At least two new varieties reported by Taichung District Station are promising. They are Taichung-yu 5 and 6. The Tainan District Station also reports two varieties Nan-hsien 2 (Tainung 31 × Hwa-kuei) and Nan-hsien 4 (Tainung 31 × Chiayi Variety), both of which were selected in 1951.

Since a number of new sweet potato varieties have been found to grow better than the old varieties in the regions where tests were made, these varieties will be put into demonstration fields in order to encourage wider use by farmers. Varieties selected for demonstration in 1956 include the following:

<u>Variety</u>	<u>Demonstration location</u>
P-30	Taipei, Hsinchu and Taichung Prefectures
Hsin-yu 25 & 30	Hsinchu Prefecture
K 2	Taipei and Tainan Prefectures.
C 137	Taipei, Tainan, Kaohsiung, Taitung and Hwalien Prefectures.
C 162	Tainan and Kaohsiung Prefectures
Taichung 5 and 6	Taichung Prefecture
Tainung 44	Taitung and Hwalien Prefectures
Tainung 45	Tainan, Kaohsiung, Taitung and Hwalien Prefectures.

With the financial assistance of JCRR, a province-wide regional test of sweet potato is being started in 1956 in which all new varieties produced by different agricultural experiment stations will be compared under the same field plan. In addition to varieties being demonstrated in 1956, the varieties include: P-6 and P-46 from TARI; C 169, C 347, C 424 and colored varieties C 381, C 382, C 430, C 454 and C 456 from Chiayi Agricultural Experiment Station of TARI; Hsin-yu 24 and 34 from Hsinchu District Agricultural Improvement Station; and Tainan 9, Nan-hsien 2 and 4 from Tainan District Agricultural Improvement Station. Results from this province-wide test will give a better understanding of the performance of these new varieties in regions other than those in which they have been previously tested.

### **C. Problems confronting the plant breeders in Taiwan:**

While Taiwan is a small island, sweet potatoes are grown under rather diversified climatic conditions and planting systems. The plant breeders need to produce varieties which will fit the conditions in different localities. With the increasing demand for good sweet potatoes for table use, the need for dark-colored varieties for commercial planting has become urgent. This complicates the procedure in making selections and in planning a sound breeding program.

Although sweet potato diseases are not a serious problem in Taiwan, the damage caused by the vine borers and potato weevils is sometimes tremendous. Breeding for insect resistant varieties may help reduce these losses.

Introduction of more genetically diversified material to our breeding stock is a step which probably should be taken in order to produce high yielding varieties. It has been demonstrated in other crops, such as in corn, that crossing between two genetically distant parents usually produces more hybrid vigor than that between two closely related ones. Hybrid vigor has been found to be positively correlated with the yielding ability of the plant. Since sweet potato is vegetatively propagated, this hybrid vigor can be well utilized in its direct first filial hybrids. Sweet potato breeders in Taiwan need to introduce more foreign varieties to be used not only as trial varieties but also as parent material. In 1955, a Hawaiian variety Onolena was introduced by JCRR from Hawaiian Agricultural Improvement Station. This is being propagated in TARI as well as in its Chiayi Agricultural Experiment Station.

## **III. Production and distribution of sweet potato seed material**

### **A. Production and distribution:**

A system of potato seed production and distribution was established in Pre-War days. It was renewed again in 1950. The system used since then until 1955 may be outlined as follows:

1. The foundation seed potato farms in the first year

These farms were operated by the District Agricultural Improvement Stations. Seed potatoes produced there were distributed free of charge to the different prefectures for establishing stock seed potato farms the next year.

2. The stock seed potato farms in the second year

These stock farms were established in different prefectures throughout Taiwan under the operation of the prefectural farmers' associations or farmers contracted by them. Since each prefecture received only a small quantity of seed potatoes from the foundation seed farms, it was generally necessary for the prefectural farmers' associations or the contracted farmers to multiply the stock seed potatoes several times in a year before there were enough seed potatoes to be distributed for establishing the extension seed potato farms in different townships of the prefectures. The stock seed growers received only a small subsidy from Provincial Department of Agriculture and Forestry (PDAF) through the prefectural farmers' associations.

3. The extension seed potato farms in the third year.

These farms scattered throughout different townships were operated by the township farmers' associations or contract farmers. Each farm received only a small quantity of seed potatoes at the beginning and had to multiply them several times before there were enough seed potatoes for general distribution to the farmers. No special subsidy was given to the extension farm growers except the initial seed supply. Sale of seed potatoes from the extension farm growers to the farmers was totally at the will of the first party.

**B. Difficulties encountered in the then existing seed production and distribution system:**

1. It was necessary to multiply the seed potatoes several times in each of the stock and extension seed farms in order to get substantial amounts of seed potatoes for subsequent distribution. For this reason, seed potatoes from the foundation seed farms would take at least two years of multiplication work before they could be distributed for general planting.

2. Since seed potatoes were distributed and only about 12,000 kg. were produced in every hectare of land, the acreage required for establishing the stock seed farms



usually ran to several hundred hectares and the extension seed farms several thousand every year. The prefectural and the township farmers' associations always met considerable difficulties in getting enough enthusiastic and dependable farmers who would be interested in running these multiplication farms.

3. Furthermore, as these seed farms were distributed almost in every important township, adequate supervision either by prefectural or township farmers' association was oftentimes found impossible.

4. Whereas the extension seed growers received no special subsidy to compensate their labor except the initial seed supply, they were generally reluctant to sell out the seed potatoes produced. On the other hand, most of the local farmers in Taiwan today still think that they did not need to renew their seed material so frequently. As a result, not all the seed potatoes produced from the extension seed farms had actually been sent out for general distribution.

#### **C. Revision of seed production and distribution system for sweet potatoes:**

As the then existing seed production and distribution system for sweet potato was proved too complicated and not effective, a thorough revision was made in the fall of 1955. The revised system differs from the original one in the following major points:

1. Potato cuttings and not seed potatoes are distributed from the stock to the extension seed farms and from the latter to local farmers. Thus, time required for seed multiplication, from the initial foundation seed farms to the time of the distribution of cuttings to ordinary farmers, has been shortened to one year instead of the original three.

2. The acreage for the stock and extension seed farms is considerably less every year, but the output of planting material is far greater with the use of cuttings.

3. The extension seed farm in the revised system is designated as the cutting multiplication farm. The name of the stock seed farm is retained in order to distinguish it from the former.

4. In each prefecture, the stock and cutting multiplication farms are concentrated in a few places every year and, after the renewal work is completed, they are rotated to other places. Such a centralized plan facilitates adequate supervision.

5. More multiplication work is devoted to the new varieties rather than the common commercial varieties. Farmers will be taught to renew the seed material of the existing varieties by themselves.

6. The farm growers will receive besides the subsidy from the government

cash returns from the selling of cuttings. This gives the growers more incentive to operate the farms.

**D. Revised system of sweet potato seed production and distribution:**

The system as revised in the fall of 1955 and being put into practice in 1956 may be outlined as follows:

1. Foundation seed potato farms are operated by the District Agricultural Improvement Stations with the running expenses paid by the Taiwan Provincial Department of Agriculture and Forestry (PDAF). Seed potatoes produced on them are distributed free of charge to the stock seed farms in different prefectures.

2. Stock seed potato farms are operated by the prefectural farmers' associations or the farmers contracted by them. There will be only one to three stock seed farms in each prefecture at each crop season in order to facilitate supervision. Foundation seed potatoes are planted on these farms. Potato cuttings produced therefrom are distributed to the first cutting multiplication farm growers in townships without charge, but prefectural farmers' associations or the contract farmers will receive compensation from PDAF based on the number of cuttings distributed.

3. First potato cutting multiplication farms are operated by township farmers' associations or contract farmers. One to three farms in each township produce potato cuttings for sale to the second cutting multiplication farms at a nominal price. The township farmers' associations or the contract farmers who operate these farms will receive a small subsidy from PDAF.

4. Second potato cutting multiplication farms are operated by contract farmers for the township farmers' associations. Potato cuttings produced from the second cutting multiplication farms are sold to farmers for a reasonable price set by township farmers' associations with approval of PDAF.

The establishment of the second multiplication farms is necessary, because potato cuttings supplied from stock seed potato farms from the prefectural level are not enough to supply all townships.

**E. Plans for seed multiplication in 1956.**

The amount of seed potatoes and cuttings to be multiplied for the 1956 crop year is shown in the following table:

	Quantity of seed potatoes to be multiplied		Quantity of cuttings to be multiplied	
	Acreage (Ha.)	Quantity (Kg.)	Acreage (Ha.)	Number of cuttings
Foundation seed potato farms	5.0	60,000		
Stock seed potato farms			5.0	3,750,00
First cutting multiplication farms			62.5	30,000,000
Second cutting multiplication farms			500.0	180,000,000

The potato cuttings produced from the second multiplication farms in 1956 will be enough to plant 6,000 hectares of sweet potatoes in 1957 at the rate of 30,000 cuttings per hectare.

## 2. Wheat

### 1. Background information

#### A. Acreage and production:

Wheat is a comparatively minor food crop in Taiwan. It is grown principally as an intercrop between the 2nd and 1st crops of rice on the paddy fields or as a winter crop after the harvesting of peanuts or sweet potatoes on upland. It was introduced to Taiwan when the settlers from south China brought in their native varieties. Its production had never become stabilized until the development of the early maturing rice varieties of Taichung No. 65 and No. 150 and after the introduction of improved varieties of wheat Saitama No. 27, Showa wase and Egima shinriki from Japan after 1935. These varieties fit crop rotation systems in paddy fields. Further stabilization was made after the release of the early maturing wheat variety Taichung 31 in 1941. Since then, the wheat acreage has been increased considerably but is still under 15,000 hectares except in 1950 when 18,333 hectares were planted. The production during the past few years and the goal set for 1956 is shown in the following table:

<u>Year</u>	<u>Acreage</u> (Ha.)	<u>Production</u> (M.T.)	<u>Unit Yield</u> (Kg./Ha.)
1950(highest)	18,333	19,100	1,042
1951	14,335	15,165	1,058
1952	14,582	16,604	1,139
1953	13,506	14,288	1,058
1954	11,089	15,493	1,397
1955	12,837	19,297	1,503
1956(goal)	16,500	21,450	1,300

Wheat production in Taiwan can be increased further if necessary since its acreage at one time had been expanded to 18,333 hectares. With American surplus aid available, however, no effort is being made to increase it because the land is needed for other crops such as soybean and flax which also are planted during the winter season. Instead, more attention is being given to increasing the unit yield by using better seeds, better varieties and better cultural practice.

#### B. Producing area:

Wheat producing area in Taiwan is confined to a few prefectural districts around the central part of the Island. Of 16,500 hectares projected for 1956, about

80 per cent is found in Taichung and Changhwa. The following shows the geographical distribution of wheat acreage in 1956:

Taoyuan Prefecture	70 ha.		
Hsinchu Prefecture	50 ha.		
Miaoli Prefecture	700 ha.		
	<hr/>	820 ha.	or 5%
Taichung City	2,050 ha.		
Taichung Prefecture	4,700 ha.		
Changhwa Prefecture	6,660 ha.		
Nantou Prefecture	235 ha.		
	<hr/>	13,645 ha.	or 82.7%
Yunlin Prefecture	100 ha.		
Chiayi Prefecture	550 ha.		
Tainan Prefecture & City	805 ha.		
	<hr/>	1,455 ha.	or 8.8%
Taitung Prefecture	500 ha.		
Hwalien Prefecture	80 ha.		
	<hr/>	580 ha.	or 3.5%
<b>Total:</b>		<hr/>	16,500 ha. or 100.0%

#### C. Planting and harvesting seasons:

Wheat is grown as a winter crop, which is planted principally in paddy rice fields just before or after the harvesting of the second rice crop. Planting is done on the upland area following the harvesting of sweet potatoes or peanuts. In either cases, seeds are sown in late October or early November. Late plantings sometimes may be found in southern areas. Harvesting is done in March before the first rice crop or other upland crops are planted.

Yields during the past few years have been excellent because of no disease epidemic, the average being well above 1,000 kilograms per hectare. The yield for crop year 1955 is 1,503 kilograms per hectare which will be a record per-hectare yield. The highest record in the past was 1,396 kilograms per hectare in 1903. Wheat is grown in Taiwan under a condition considerably different from that in other wheat growing countries. It is grown in winter when the temperature is low, rainfall is short and length of the day is short. Success can be attained only when methods of planting and the varieties can meet these requirements.

#### D. Economic Importance:

Wheat production gives not only additional food for the increasing population

but also an extra cash crop to the farmer in addition to his two regular rice crops. Although the local production of 20,000 metric tons of wheat constitutes only one-eighth to one-tenth of the total amount consumed every year, it means over 30 million New Taiwan dollars to the Chinese Government as well as to the farmers of Taiwan.

Wheat varieties grown in Taiwan seem to contain more gluten than imported wheat. Gluten is an essential material for the manufacture of the gourmet powder (sodium monoglutamate) which is used extensively by the Chinese for seasoning. Importing dry gluten or extracting gluten from the imported wheat flour at high cost is uneconomical. The average composition of crude protein (which contains about 85 per cent gluten) and starch of the American wheat as determined by Shollenberger and Curtis in 1949 compared with that of the Taiwan varieties as determined by Taiwan Agricultural Research Institute in 1954 is shown in the following table:

Average Composition of Crude Protein and Starch  
of American and Taiwan Wheats

	Crude protein	Starch
	(N x 5.7) (%)	(%)
<u>American wheats</u>		
Hard red spring	16.5	61.2
Durum	16.0	63.0
Red durum	16.8	61.3
Hard red winter	15.3	63.5
Soft red winter	12.4	66.5
White	11.2	66.6
<u>Taiwan wheats</u>		
Taichung 2	17.1	68.6
Taichung 23	18.6	64.3
Taichung 29	17.9	66.1
Taichung 31	17.2	70.5
Taichung 32	16.3	71.0

Variation in environmental conditions will induce substantial variations in the protein content of wheat. Varieties of the American wheats grown under Taiwan climatic conditions may show higher protein content than the local varieties. For this reason, several high gluten varieties of hard red spring and durum wheats were introduced from Minnesota and North Dakota by JCRR last year for trial plantings.

## II. Variety improvement

### A. Varieties grown at present:

Wheat culture in Taiwan was successful only after the development of early maturing rice varieties of Taichung No. 65 and No. 150 and after the introduction of comparatively short growing improved varieties of wheat of Saitama No. 27 and Showa wase from Japan in 1935. This made it possible for wheat to be grown between the first and second crops of rice.

A number of new wheat varieties were then obtained through hybridization under local conditions. Those which have been released for commercial planting and are still grown today include Taichung 2, 23, 27, 29, 31 and 32. These varieties are now the dominant varieties in all wheat growing districts except in Tainan, Chiayi and Yunlin where only native varieties are grown. Of the improved varieties, Taichung 31 is most popular and accounts for about 60 per cent of the total wheat acreage. The variety census for the last few years is approximately as follows:

<u>Variety</u>	<u>Acreage %</u> <u>(approximate)</u>
Taichung 2	17
Taichung 23	1
Taichung 29	7
Taichung 31	60
Taichung 32	10
Saitama 27	3
Others	2
	100

The origin and the characteristics of the Taiwan wheat varieties are indicated in the following table:

<u>Variety</u>	<u>Parentage</u>	<u>Length of growth</u> <u>(days)</u>	<u>Degree of resistance to rust</u>
Taichung 2	Saitama 27 x	114	Moderately resistant
	Showa wase		
Taichung 23	Florence x	101	Susceptible
	Saitama 27		

	Saitama 27		
Taichung 29	x	100	Susceptible
	Showa wase		
	Showa wase		
Taichung 31	x	107	Average
	Saitama 27		
	Florence		
Taichung 32	x	113	Moderately resistant
	Saitama 27		
Saitama 27	From Japan	114	Susceptible

None of the improved varieties listed above are adapted to the Tainan area. This is because they are not tolerant enough under the drought condition and yield lower than the native varieties.

### B. Variety improvement work:

Wheat breeding work in Taiwan is carried out principally by the Taichung District Agricultural Improvement Station and to a lesser extent by the Tainan District Agricultural Improvement Station.

#### 1. Development of disease resistance.

Since all commercial varieties, both improved and native now under cultivation, are more or less susceptible to leaf and stem rusts, breeding for disease resistance has become the main objective in the present Taiwan wheat variety improvement program. During the past few years, the Taichung District Station has made a number of crosses using known rust resistant varieties such as Newthatch, Timstein with the local commercial varieties Taichung 31 and 32. A few backcrossed progenies also were made. Some of these new backcrossed seedlings under testing show greater degree of resistance to rusts than the original Taichung 31 or 32. Recently, a new rust resistant variety called Selkirk was introduced from the United States by JCRR and will be put into use and trial planting this year.

#### 2. Work on higher yielding varieties.

The Taichung District Station also made several crosses after the War with the varieties that have been found to be high yielders including the local commercial varieties. Ten new varieties selected from those crosses and two varieties introduced from abroad were put into regional tests in 1953 and 1954 at Taipei, Taichung and Taitung. The results showed only "Motigo wheat" from India yielding somewhat better than local commercial varieties. Another eight new varieties were tested at eight localities in the Taichung area, but only Taichung-yu Nos. 133, 134, 136 and 137 looked promising. None of the new varieties mentioned above, however, have been released for commercial planting.

### 3. Search for varieties for Tainan area.

The following few varieties of wheat which may be adapted to the Tainan area have been selected by the Tainan District Station:

<u>Variety</u>	<u>Origin</u>	<u>Length of growth(day)</u>	<u>Yield (Kg/O.1 Ha.)</u>	<u>Yield index</u>
Tainan Improved No. 48	Native variety	138	221.2	110
Nan-yu No. 2	Egima Shinriki			
	x	95	227.0	111
	Florence			
Nan-yu No. 26	Florence	117	247.2	120
Nan-yu No. 33	Florence	130	230.2	114
Tainan No. 1	Florence	118	241.5	118
Saitama 27(ck)		110	205.4	100

These varieties are still being tested and the best ones will be put into trial plantings.

More than 245 varieties, including those formerly introduced from the U. S. and Argentina are under observation at Tainan District Station at present.

### 4. Working for high gluten varieties.

Although the local wheat varieties seem to have higher gluten content than the imported flour, an effort has been made to introduce high gluten varieties from outside. In January 1956, JCRR introduced six varieties of durum wheat from the U. S. They are Mindum, Penrad, Longdon, Ramsey, Townier and Yuma. These varieties will be put into trial planting this year.

### 5. Introduction of foreign wheat varieties.

Aside from the varieties mentioned above, JCRR also introduced some other varieties of wheat from the U. S. in the spring of 1956. These include the famous wheat varieties Ceres, Marquis, Merit, Pilot, Early Premium, Renown, Rwal, Thatcher, Newthatch and Selkirk. Most of these varieties are now grown commercially in the United States.

## III. Production and distribution of pure wheat seed

### A. Wheat seed multiplication system:

Seeds of improved and native varieties are multiplied and produced in the following manner:

#### 1. Improved varieties.

Seeds of the improved varieties such as Taichung Nos. 2, 23, 29, 31 and 32,



which are commercial varieties in Taichung, Changhwa, Miaoli and Taitung Prefectures, are multiplied according to the following system:

a. Foundation seed farms.

These farms are operated by the District Agricultural Improvement Stations in Taichung and Taitung with labor expenses subsidized by PDAF and JCRR.

b. Stock seed farms

These farms are operated by the prefectural farmers' associations in Miaoli, Taichung, Changhwa, Nantou and Taitung or by farmers contracted by the associations.

c. Extension seed farms

These farms are operated by township farmers' associations or by contract farmers.

Acreage and amount of improved wheat seed produced each year since the resumption of wheat seed multiplication system in 1950 are shown below:

Year	Foundation seed farms		Stock seed farms		Extension seed farms	
	Acreage (Ha.)	Production (Kg.)	Acreage (Ha.)	Production (Kg.)	Acreage (Ha.)	Production (Kg.)
1950	10.00	7,587	-	-	-	-
1951	10.00	10,336	100.00	80,496	-	-
1952	10.00	14,857	96.65	66,807	852.14	616,462
1953	6.40	4,920	71.45	71,823	724.12	555,805
1954	6.00	4,200	49.07	52,993	563.36	575,353
1955	5.30	6,250	51.50	87,083	504.40	711,615

For each hectare of wheat, 60 kilograms of seed ordinarily is needed. Seeds produced on the extension seed farms will seed about 9,000 to 12,000 hectares, almost the total acreage covered by the improved varieties each year.

2. Native varieties

Since improved wheat varieties are not adapted to the Tainan area including Tainan, Chiayi and Yunlin Prefectures, selection and multiplication of seeds of better native varieties are necessary. The multiplication of seeds is carried out as follows:

a. Mass selection from farmers' fields

Better native seed is selected from farmers' fields each year by the Tainan District Agricultural Improvement Station with the help of prefectural governments, township offices, and prefectural or township farmers' associations.

b. Primary seed farms

These farms are operated by prefectural farmers' associations and contracted farmers.

c. Secondary seed farms are operated by the township farmers' associations and contracted farms.

Acreage and amount of better native wheat seed produced by the above procedure started in 1952 are shown below.

<u>Year</u>	<u>Amount obtained by</u>	<u>Primary seed farms</u>		<u>Secondary seed farms</u>	
	<u>mass selection</u>	<u>Acreage</u>	<u>Production</u>	<u>Acreage</u>	<u>Production</u>
	(Kg.)	(Ha.)	(Kg.)	(Ha.)	(Kg.)
1952	2,210	-	-	-	-
1953	2,100	20.00	11,260	-	-
1954	670	8.70	3,317	79.29	56,770
1955	837	8.00	7,339	57.19	50,751

During the past three years, 1953-55, JCRR has given subsidies to 600 extension seed farm growers in Miaoli, Taichung and Changhwa Prefectures to construct 600 cement drying grounds for wheat seed drying purposes. In addition, JCRR has contributed to the farmers' associations in these three prefectures part of the money to construct 16 wheat seed granaries for seed storage, 11 of which have a floor area of 121.3 M<sup>2</sup> with a capacity of 64,000 kilograms of seed and 5 of which have a floor area of 95.7 M<sup>2</sup> with a capacity of 48,000 kilograms. These granaries facilitate the seed multiplication work in these prefectures.

**B. Distribution of wheat seed:**

1. Seeds produced from the foundation seed farms and those selected from native varieties are distributed to the stock seed growers free of charge.

2. Seeds produced on the stock seed farms as well as on the primary seed farms are purchased by township farmers' associations at the market price immediately after they are harvested and dried. The seeds are kept in tight bins or stored in the wheat seed granaries. If the farmers' associations are not able to purchase seed due to lack of funds, the Provincial Food Bureau (PFB) will be asked to buy and preserve the seeds for them. Prior to planting time, these seeds will be sold or loaned to the extension seed growers.

3. Seeds produced by the extension seed farms and the secondary seed farms are distributed to farmers in exchange for wheat grain or cash. Farmers will pay, either in kind or in cash, 10 per cent premium for the extension seeds.

4. In case farmers do not want to exchange their seed until wheat planting

time, the Provincial Department of Agriculture and Forestry will make special arrangement so that the seeds would be bought either by PFB or by township farmers' associations with 10 per cent premium and kept in good condition. These seeds will then be sold or loaned to the ordinary farmers at the planting time.

### C. Difficulties in present system

The present wheat seed production and distribution system has run rather smoothly because wheat planting in Taiwan is confined to one crop a year in a few prefectures. Furthermore, the quantity of seed multiplied and produced every year from the multiplication farms is small compared with those of other food crops. It has often been found, however, that many of the township farmers' associations who are in charge of these multiplication farms are not able to appropriate enough funds at harvest time to purchase the seeds from the stock and extension farm growers unless the Provincial Food Bureau provides the funds. It would be far better therefore for the Provincial Department of Agriculture and Forestry to appropriate a capital fund and keep it in the township farmers' associations to be used every year for this purpose.

### D. Seed multiplication plans for 1956.

The acreage and amount of wheat seeds to be multiplied for the crop year of 1956 follows:

	<u>Seed selected</u> (Kg.)	<u>Acreage</u> (Ha.)	<u>Seed production</u> (Kg.)
a) Improved varieties:			
Foundation seed farms		5.0	3,500
Stock seed farms		50.0	35,000
Extension seed farms		500.0	350,000
b) Native varieties:			
Seeds from farmers' fields	840	-	-
Primary seed farms		8.0	5,600
Secondary seed farms		80.0	56,000

### 3. Peanuts

#### I. Background information

##### A. Acreage and production:

Peanuts have been grown in Taiwan since the late 15th century. It is one of the main crops on the upland area, for it can be in rotation or interplanted with other field crops such as sugarcane, sweet potatoes or upland rice. The acreage of peanuts in 1900 was about 11,600 hectares with an production of little more than 6,000 tons. However, because of the increasing demand for more peanuts for food, feed and oil in recent years, the acreage has been increased almost tenfold. Planned area for the crop year 1956 is 105,000 hectares with an expected yield of 90,000 metric tons. The trend in production may be seen in the following data:

<u>Year</u>	<u>Acreage</u> (Ha.)	<u>Production</u> (M. T.)	<u>Unit yield</u> (Kg./Ha.)
1900	11,598	6,103	526
1920	22,835	14,793	648
1940	30,617	28,671	936
1950	83,387	57,110	685
1951	84,889	61,158	720
1952	80,975	60,037	741
1953	82,580	60,104	728
1954	94,025	65,868	701
1955	96,034	66,572	693
1956(goal)	105,000	89,250	850

##### B. Producing area:

Although peanuts are seen almost everywhere in Taiwan, about one-third of the total acreage is in Yunlin Prefecture, where over 37,000 hectares of peanuts are planted every year. Next to Yunlin are Tainan and Chiayi Prefectures, each having about 9,000 hectares. These three main peanut producing centers are in the southern part of Taiwan. The geographical distribution of the peanuts based on the acreage projected for the crop year 1956 is as follows:

<u>Locality</u>	<u>Acreage</u> (Ha.)	<u>Percentage</u> (%)
Northern Taiwan	3,468	3.3
Hsinchu crop district	5,650	5.4
Taichung crop district	13,584	12.9
Tainan crop district	57,484	54.8
Yunlin Prefecture	(36,928)	(36.1)
Tainan Prefecture	( 9,614)	( 9.2)
Chiayi Prefecture	( 9,026)	( 9.6)
Tainan City	( 916)	( 0.9)
Kaohsiung crop district	7,962	7.6
Eastern Taiwan	13,530	12.8
Penghu Prefecture	3,322	3.2
<b>Total:</b>	<b>105,000</b>	<b>100.0</b>

### C. Planting and harvesting seasons:

About 60 per cent of the peanuts in Taiwan is planted in spring and 40 per cent in the fall. Planting season for the spring crop may start as early as the middle of December or as late as the middle of May, varying in different parts of the island. The majority of spring planting is done, however, between February and March. The fall crop may be planted in June or as late as November, the main planting period being in July and August.

Peanuts are mature and ready for harvest when leaves turn yellow. The small seeded varieties will be mature in 4 to 5 months while large seeded varieties may take 6 to 7 months to reach maturity. Generally, the spring crop is harvested in June and July and autumn crop in November and December. Harvesting may be one or two months earlier or later depending upon the time of planting in different localities.

In Penghu, no fall planting is made because of heavy winds prevailing during the winter season. Spring crop is planted in March or April and harvested in August or September. Only varieties of the Virginia or runner type of peanuts are planted.

### D. Economic importance:

Due to the shortage of edible oils in Taiwan, the price of peanuts has increased continuously in postwar years. Although no estimate is available for 1955, the cash returns from 65,868 metric tons of peanuts produced in 1953 was almost 200 million New Taiwan dollars according to the statistics of the Provincial Department of Agriculture and Forestry. Of the peanuts produced every year, about 50 percent is used as food, 30 per cent is crushed for oil and 20 per cent is used as seed. Percentage for food should be reduced so that more peanuts can be used for oil extraction, thus saving foreign exchange used to import edible oils.

## II. Variety improvement.

Variety improvement in peanuts was started in 1902 by the Taiwan Agricultural Research Institute. Since that time, a number of foreign varieties had been introduced from Japan, Java, United States and Spain. Except small seeded varieties from Java which were released for commercial planting, none of the introduced varieties showed better yields than the native ones.

In 1927, the Tainan District Agricultural Improvement Station started to work on the peanut variety improvement. Single plant selections were made from the native varieties grown in the farmers' fields in the Tainan area. From these selections, Tainan Pei-yu-tou Nos. 1, 2 and 5 were produced. These locally bred varieties were put into regional tests after World War II. Tainan Pei-yu-tou Nos. 1 and 2, in 1950, became the first improved varieties to be released for commercial planting.

Although other new seedlings are now under different stages of testing, peanut variety improvement in Taiwan was not attempted intensively until a breeding program was established in 1954. The varieties grown at present and those under trial planting and testing will be described briefly.

### A. Present varieties:

#### 1. Native varieties

Native varieties occupy about 85 per cent of the total acreage. About 90 per cent of them are the Spanish or erect type and 10 per cent are the Virginia or runner type. Peanuts of the Spanish type are generally erect in growth habit, small seeded, thin shelled, and mature in 4 or 5 months. Those of the Virginia type are characterized by their prostrate growth habit, dark leaf color, large seeds and thick shells. The prostrate or runner type is planted primarily in Penghu and in the area along the west sea coast of Changhwa, Yunlin and Tainan Prefectures where heavy winds prevail. They mature about one or two months later and seem to stand up better under drought conditions than the Spanish type. The common native varieties of the Spanish and Virginia types are:

#### Spanish type

Native pei-yu-tou

Lao-kung-tzu-tou

Lung-yen-tou

Liu-tzu-tou

Red and white kernel yu-tou

#### Virginia type

Ta-pon

Fan-tzu-tou

Yuan-yang-tou (small seeded)

Chu-chih-tzu-tou (erect)

## 2. Improved varieties

Improved varieties, primarily the Tainan Pei-yu-tou Nos. 1 and 2, constitute at present only 15 per cent of Taiwan's peanut acreage. They are planted mostly in the area around the Peikang district of the Yunlin Prefecture, the main peanut producing center of Taiwan. Small quantities are also found in other districts in Tainan and Chiayi Prefectures. With JCRR financial support, the Land Bank in Taitung had in 1955 procured seeds of these improved varieties to Taitung, where at present more than 800 hectares of Tainan Pei-yu-tou No. 1 and No. 2 are planted. More acreage will be devoted to these varieties through the peanut seed multiplication system.

Tainan Pei-yu-tou No. 1, No. 2 and No. 5 are Spanish-type peanuts but with slightly larger seeds and thicker hull than the native varieties. They yield 10 to 20 per cent better than the native varieties and also contain a higher oil percentage. These varieties were obtained from pure line selection of the native Pei-yu-tou. Their origin and yielding ability is indicated below:

<u>Variety</u>	<u>Origin</u>	<u>Yielding ability</u> (Kg./Ha.)		<u>Oil</u> (%)
		<u>Spring</u> <u>Crop</u>	<u>Autumn</u> <u>Crop</u>	
Tainan Pei-yu-tou No. 1	From native Pei-yu-tou grown in Peikang	1,589	1,657	57.60
Tainan Pei-yu-tou No. 2	From native Pei-yu-tou grown in Changhwa	1,586	1,707	53.81
Tainan Pei-yu-tou No. 5	From native Pei-yu-tou grown in Tung-shih near Chiayi	1,532	1,467	54.57
Native Pei-yu-tou (check)		1,272	1,444	52.36

## B. Variety improvement work:

### 1. Pure line selection

In 1954, JCRR gave subsidies to the Taiwan Agricultural Research Institute and the Tainan District Agricultural Improvement Station to make single plant selections from the farmers' fields throughout the Island. Altogether, 2,616 single plants and 1,975 seed groups of peanuts were collected. They were planted in the fall of 1954 at the Tainan District Station. From these materials, 126 lines were

advanced to preliminary yield tests and 1,008 to 2-row plot trial in 1955. Strains selected from these trials will be given further tests this year.

## 2. Regional Variety tests

Besides the work on pure line selection, a Province-wide regional test of peanut varieties has been conducted since 1951 by the Taiwan Agricultural Research Institute (TARI) and Tainan District Station. Varieties whose past records are promising include Tsingtao, Lungtung Yu-tou and P-49B-146. These varieties, mostly selected from the native varieties formerly collected by TARI, are being put into trial plantings this year. Varieties which are now in the regional test include the following:

Tainan Improved No. 1	P-49B-3
Tainan Improved No. 4	P-49B-51
Tainan Improved No. 7	P-49B-52
Tainan Improved No. 10	H-51B-166
Tainan Improved No. 13	H-51B-284
Tainan Improved No. 14	

While P-49B-3, 51, 52 and H-51-166 and 284 were selected from introduced and native varieties through pure line selection, the Tainan improved varieties were obtained from the cross of the varieties of the Spanish type made in 1950. Their origin and past experimental records follow:

<u>Variety</u>	<u>Origin</u>	<u>Kernel Yield</u>		<u>Oil Content</u>
		<u>Kg./Ha</u>	<u>%</u>	<u>(%)</u>
Tainan Improved 1	Tainan Pei-yu-tou No. 2 X Tainan Pei-yu-tou No. 1	1,162.5	109	47.06
Tainan Improved 4	Lungtung Yu-tou x Tainan Pei-yu-tou No. 1	1,137.5	107	51.68
Tainan Improved 7	Java No. 1 x Tianan Pei-yu-tou No. 2	1,140.5	107	48.90
Tainan Improved 10	Pei-kang Pei-yu-tou x Tainan Pei-yu-tou No. 1	1,398.0	131	51.86
Tainan Improved 13	Java Small Seeded No. 12 X Tainan Pei-yu-tou No. 1	1,207.0	113	50.21
Tainan Improved 14	Java Small seeded No. 12 X Tainan Pei-yu-tou No. 1	1,222.5	115	52.11
Tainan Pei-yu-tou No. 1 (ck)		1,065.5	100	49.08



### 3. Breeding for disease resistance

In Taiwan, *Cercospora* leaf spot and *Sclerotium* wilt diseases are the most serious peanut diseases. None of the commercial varieties and new seedlings under test have proved satisfactorily resistant. Effort is being made in the peanut breeding program to develop varieties with more disease resistance. It is known that the Virginia type is relatively more resistant to these diseases than the Spanish type, although the former is of the prostrating growth habit. An attempt is being made to cross the varieties of the Spanish type with those of the Virginia type and then to select for resistant varieties with the erect or semi-erect characteristic. Introduction of good Virginia parents from U. S. also has been undertaken.

### 4. Introduction of varieties from abroad.

Many peanut varieties have been introduced to Taiwan. Most recent introductions include Dixie Spanish, Spanish 18-38-42, Florispan Runner, Kinorales, Dixie Giant, Virginia Bunch 46-2, and Holland Station Runner. Many of these new varieties belong to the Virginia type which will be used for breeding disease resistant varieties. Dixie Giant is known to be one of the best parents, from which many commercial varieties have been produced in the U. S. Attempts also are being made to acquire resistant varieties recently produced by North Carolina State College from atom-irradiated material.

## III. Production and distribution of better seed.

### A. Past seed multiplication system

The peanut seed multiplication system was established by the Provincial Department of Agriculture and Forestry in 1949. It followed the same pattern as used in other grain crops such as rice and wheat. Foundation seed peanuts were multiplied by the district agricultural improvement stations. The stock seed farms were operated by the prefectural or township governments or contract farmers and the extension seed farms by contract farmers in various townships. There seems to be nothing wrong with the seed multiplication system itself. However, it was found that the operation of the system was unsatisfactory because of the following conditions:

1. The individual stock and extension seed farms, averaging less than 0.1 hectare, were too small.

2. Too many stock and extension seed farms in each prefecture scattered in many small isolated spots in the villages made it impossible for the prefectural or township governments to give adequate supervision.

3. Management of the farms generally was poor. This probably was due to

contract farmers receiving no compensation except a small subsidy amounting to only NT\$200 per hectare.

4. No special price was fixed for the multiplication seeds and the contract farmers were given a free hand to dispose of their seeds. As a result, only a small portion of seeds produced from the extension seed farms were actually acquired by other farmers. The rest were sold to the market for food or oil extraction.

In view of these facts, a revision in the system was made in the fall of 1955. The revised system differs from the original one in the following essential points:

1. The stock seed farms will be established and concentrated in one township in each prefecture each crop season.

2. The extension seed farms, each being at least 0.5 hectare, will be concentrated in not more than one fourth of the townships in a prefecture in each crop season. After the peanut seeds of those townships are all renewed, the extension farms will be moved to other townships. Therefore, a rotating plan for the extension seed farms will be adopted.

3. All stock and extension farm growers will be carefully selected and registered. Seeds produced will be bought by the Provincial Department of Agriculture and Forestry through the prefectural or township farmers' associations at a price 5 per cent higher than the prevailing market price. Following the direction of PDAF, the farmers' associations will then distribute the stock seeds to the extension seed farm growers, and extension seeds to ordinary farmers at the next crop season. These seeds are to be sold to the contract or other farmers either on cash or on seed loan basis according to the market price.

#### **B. Revised seed production and distribution system:**

The revised system as amended in the fall of 1955 is outlined as follows:

1. Foundation seed farms are operated by District Agricultural Improvement Stations with the labor expenses subsidized by the PDAF. Seed peanuts produced from these farms are distributed free of charge to establish the stock seed farms in next crop season.

2. Stock seed farms are operated by the township offices or by farmers contracted by the township offices. Only one township in each prefecture is selected to establish these farms in each crop season. Seeds produced are used to establish the extension seed farms the next crop season.

3. Extension seed farms are operated by contract farmers. In every crop season, not more than one-fourth of the townships in a prefecture will operate such farms. Seeds produced therefrom are distributed for general planting.

4. Seeds multiplied from stock and extension seed farms will be bought at a price

5 per cent higher than the market price. Farmers buying the seed will pay the ordinary market price and the organization concerned (at present, JCRR) will pay the price differential.

5. Procurement, storage and distribution of multiplied seeds is handled by township farmers' associations, who receive at present revolving funds from the Provincial Supply Bureau (last season from the Provincial Food Bureau) and handling commission from PDAF and JCRR.

### C. Seed Production in 1954 and 1955 and Projected Production for 1956

Amounts of seeds produced in 1954 and 1955 from these multiplication seed farms and that projected for 1956 are shown as follows:

<u>Year</u>	<u>Foundation seed farms</u>		<u>Stock seed farms</u>		<u>Extension seed farms</u>	
	<u>Acreage</u> (Ha.)	<u>Production</u> (Kg.)	<u>Acreage</u> (Ha.)	<u>Production</u> (Kg.)	<u>Acreage</u> (Ha.)	<u>Production</u> (Kg.)
1954	10.00	6,600	79.30	77,700	-	-
1955	11.05	9,286	47.03	45,020	644.30	640,300
1956(planned)	10.55	10,550	77.63	77,630	438.60	438,600

## 4. Soybeans

### I. Background information

#### A. Acreage and production:

Soybeans formerly were a minor crop but have become important in Taiwan in recent years because of increasing local demand for oil and beancakes. Annual consumption is estimated at 170,000 metric tons, of which local production provides less than one-eighth. In order to meet the need and at the same time to cut down the amount imported from outside, the acreage of soybeans has been increased steadily during the last few years. The acreage and production projected for the crop year 1956 and those of previous years follow:

<u>Year</u>	<u>Acreage</u> (Ha.)	<u>Production</u> (M.T.)	<u>Unit yield</u> (Kg./Ha.)
1950	20,300	12,543	618
1951	23,251	13,412	577
1952	24,315	14,627	602
1953	28,225	17,426	617
1954	30,048	20,310	676
1955	34,510	24,151	700
1956(goal)	36,000	28,080	780

#### B. Producing area:

Soybeans are grown mostly in the southern part of this Island around Pingtung and Kaohsiung Prefectures. Of 36,000 hectares planned for 1956, about 20,000 hectares will be found in these two localities. Other prefectures which lead in soybean production are Tainan, Chiayi and Yunlin, each constituting about 3,000 ha. Starting in 1955, a small acreage of soybeans will also be found in Miaoli Prefecture, which will be the first time that yellow soybeans have been grown commercially so far north in Taiwan. The distribution of soybean acreage in 1956 based on localities follows:

<u>Locality</u>	<u>Acreage</u> (Ha.)	<u>Percentage</u> (%)
Miaoli Prefecture	200	0.6
Changhwa "	2,500	7.0
Yunlin "	2,300	6.4

Chiayi Prefecture	3,460	9.6
Tainan "	3,400	9.5
Kaohsiung "	5,560	15.4
Pingtung "	14,431	40.0
Taitung "	1,588	4.4
Hwalien "	1,479	4.1
Others "	652	3.0
<hr/>		
Total:	36,000	100.0

### C. Planting and harvesting season.

Soybeans are planted in Taiwan in spring (February–March), summer (June–July) and also in late Autumn (October–November). However, in Pingtung and Kaohsiung area and recently in Changhwa Prefecture, soybeans are grown primarily as a catch crop between two crops of Ponlai rice. In this case, soybean seeds are sown in the rice fields in late October about 10 days before or just after the second rice crop is harvested and the soybeans are harvested before the first rice crop is planted in late January. In Tainan, Chiayi and Yunlin area, soybeans are planted in both the spring and autumn seasons, whereas in eastern Taiwan, it is grown principally as an autumn crop. Soybeans are harvested about four or five months after planting, depending upon the district in which they are grown.

### D. Economic importance

As may be seen in a previous table, the annual soybean production in Taiwan is little over 20,000 metric tons during the past 2 years, having a value of almost 70 million New Taiwan dollars. The amount is still too small, especially of the yellow beans. Taiwan has to import more than 100,000 tons of bean and peas annually in order to meet its needs. If the local production of yellow beans can be increased, about 14 million U. S. dollars can be saved every year.

## II. Variety Improvement

### A. Varieties grown at present:

Variety improvement work in soybeans was not started in Taiwan until 1953. The varieties grown at present are all native ones and are badly mixed. The commercially grown varieties may be grouped under the following few categories:

<u>Types</u>	<u>Acreage %</u> (approximate)	<u>Remarks</u>
Green beans	41	Used primarily for making bean curd.

Black beans	40	70% of soybeans grown in Pingtung area is of this type; used for seed, soybean sauce and animal feed.
Yellow beans	17	For bean curd and some for oil extraction
White beans	2	For bean curd and oil extraction

## B. Variety improvement work in progress.

### 1. Single plant selection from farmers' fields:

In 1953 and 1954, with JCRR financial assistance, the Kaohsiung District Agricultural Improvement Station of PDAF made single plant selections from the farmers' fields in Pingtung and Kaohsiung area. Sixty-five new strains selected from the material collected in 1953 are now advanced to 3-row-plot test. About 700 others collected in the spring and summer of 1954 are in 2-row-plot tests.

In 1955, another project was underway under direction of the Provincial College of Agriculture in Taichung. In this project, single plant selections from the farmers' fields around Tainan, Chiayi and Changhwa area also will be made. To date, seeds from 2,000 single plants have been collected. They will be put into plant row test this year.

### 2. Regional variety trial:

Starting in the spring of 1956, a Province-wide regional variety trial of soybeans was started, in which all promising varieties recorded in the past will be tested to show their regional adaptability. Most of these varieties are those formerly introduced from U. S., Japan, and northern China. Those which seem promising in some areas in Taiwan follow:

<u>Variety</u>	<u>Origin</u>	<u>Remarks</u>
"San-kuo"	Japan	Grow very well in Miaoli and quite hopeful in Hwalien.
"Mei-yu"	Japan	Quite promising in Miaoli
Yellow Autumn	Japan	Quite hopeful in Pingtung
Acadian	U.S.A.	Quite hopeful in Pingtung
Improved Pelican	U.S.A.	Quite hopeful in Pingtung
Seminole	U.S.A.	Quite hopeful in Pingtung

### 3. Preliminary extension of "San-kuo" soybean variety in Miaoli:

Since the "San-kuo" variety has been found to grow well in the Miaoli area, an initial expansion of 200 hectares is planned for the fall of 1956. Seed will be sown in July and the crop will be harvested sometimes in late October. A seed multiplication

system also will be started to facilitate future distribution.

4. Recent introduction of new soybean varieties from U.S.A.

As some foreign soybean varieties have proved to be adapted to Taiwan, JCRR has undertaken to introduce some more from U.S.A. In February 1956, the following seven varieties were introduced from U.S. Soybean Regional Laboratory: Perry, Wabash, Lincoln, Harosoy, Adams, Clark and Hawkeye. Late in May, another two varieties, Kim and Kanrich, were introduced. Efforts will be made to introduce some other varieties from Japan and Philippines.

III. Seed production and distribution.

A. No Province-wide soybean seed production and distribution system is in existence at present.

B. However, after the soybean variety "San-kuo" was found adapted to the Miaoli area in late 1955, a seed multiplication plan was formulated to provide seed for 4,800 hectares in 1959. The plan is as follows:

<u>Type of seed farms</u>	<u>Acreage planned (Ha.)</u>			
	1956	1957	1958	1959
Foundation seed farms	0.5	0.5	0.5	0.5
Stock seed farms	1.0	2.0	2.0	2.0
Extension seed farms	20.0	40.0	0.0	0.0
Hectares to be planted	200.0	1,200.0	2,400.0	4,800.0

Seed distribution will be carried out in the future following the same pattern as that used for peanuts.

行政院農委會圖書室



0010998