

RESEARCH ACHIEVEMENT

Introduction

Agricultural Environment in Taichung District

Taichung district including the areas of Taichung, Changhua and Nantou prefectures and Taichung city covers a total area of 738,700 hectares. Of which 197,922 hectares are crop lands. The ratio of paddy field to upland field is approximately 6:4. However, this ratio is changing yearly because of the recent governmental policy to increase the acreage of upland crops and reduce the acreage of paddy field.

The favorable climate in this district is suitable to grow different crops the year round. The mean annual temperature of this district is 22.4°C, July and August are the hottest months with a mean temperature of 28°C, while February is the coldest month with mean temperature of 16°C. The mean annual rainfall of this district in the past ten years was 1,740 mm. The distribution of rainfall is rather uneven around the year.

There are five major groups of soils in this district. Slate alluvial soils cover the whole Changhua prefecture where rice yield is the highest in Taichung district. Sandstone and shale alluvial soils are found mostly in Taichung and Nantou prefectures. Soil reaction in these areas ranges from slightly to strongly acid, and hence the yield of rice is usually lower than that in

Changhua prefecture. Latritic soils which are very strongly acid and very poor in fertility are scattered in the highland areas. Mixed alluvial soils of sandstone, shale and slate are located in the west coast of Taichung prefecture. Because of its high sulfur content and poor drainage condition, rice yield in this type of soil is generally low. Red-yellow podzolic soils are mainly distributed in the mountainous areas where the soils are generally strongly acid.

History

Taichung, Changhua and Nantou Farmers' Associations established their own respective experimental stations in 1920. In 1924, all three stations were merged into one station and renamed as "Taichung Agricultural Experiment Station". The status of the station had been changed several times since then. It was given the present name and was placed under the Department of Agriculture and Forestry, Taiwan Provincial Government in 1960.

This station was formerly located in Taichung city. However, the experimental field was no longer suitable for the purposes of agricultural research due to the rapid urbanization of the city. A plan to move the station to rural area was therefore laid out in 1979. After 5 years of planning and construction, the movement was finally completed in March, 1984 at a total cost of NT\$ 500,000,000. The new site of the station, located at Tatsuen, Changhua,

covers approximately fifty hectares of land. The construction of the branch station at Puli, Nantou with an acreage of 17 hectares of slopeland was also completed at the same time.

Equipment and Facilities

The experimental farm of the station is properly equipped with irrigation and drainage systems. The main building consists of laboratories, offices, auditorium, and some conference rooms, etc. The agricultural extension building consists of an exhibition hall, offices, mass communication room and a training center.

The training center may accommodate 50 trainees at the same time. It includes an audio-visual classroom, teaching material room, home economics classroom, dining room, recreation room and bedrooms.

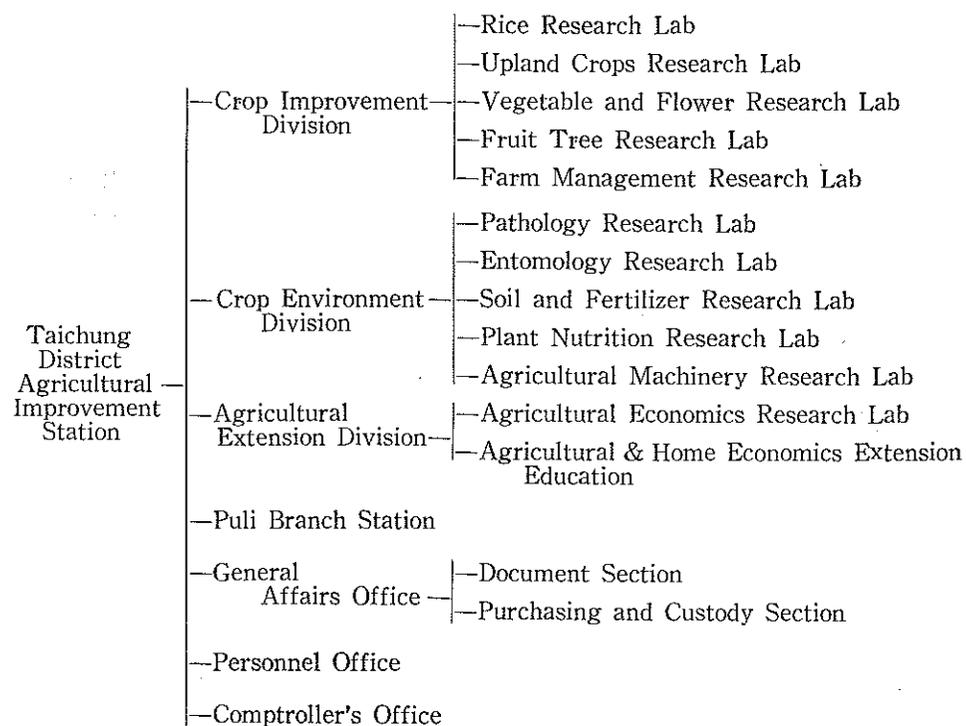
The main facilities of the station are

insectary, agricultural engineering workshop, cold storage room, agricultural weather observatory, greenhouses, warehouses, etc. Dormitories are also available for single and married staff members.

Main laboratory equipments include scanning electron microscope, atomic absorption spectrophotometer, automatic analyzer, gas chromatographer, liquid chromatographer, UV spectrophotometer, microprocessors, ion analyzer, flame photometer, growth chambers, incubators, mini-computer and others.

Organization

This station consists of 1 branch station (located at Puli, Nantou prefecture), 3 technical divisions and 3 administrative offices. Each technical division is subdivided into several research labs as shown in the following scheme:



Staff Members

There are 82 staff members, including 68 technical (13 senior and associate research fellows, 25 assistant research fellows and 30 research assistants) and 14 administrative personnels in this Station. In addition, the Station has 28 project employees, 69 skilled labors and 85 temporary field labors.

Functions

1. To conduct plant breeding work for the major crops of economic importance.
2. To improve the cultural methods of various crops.
3. To propagate and maintain the improved varieties of crops and other germplasms.
4. To study the problems of soils, fertilizers and plant nutrition.
5. To solve the problems of pest control, including forecasting the insect and disease epidemics.
6. To improve and design the farm machinery and implements.
7. To study the economy of farming systems in rural areas.
8. To carry out agricultural extension education, through providing technical service, training classes, field demonstrations and other measures to the farmers.
9. To carry out home economics education through training courses and other measures.

稻米 Rice

臺中地區雙期作水田耕作制度之探討

本試驗為利用臺中地區一般雙期作水田進行

轉作雜糧等其他作物之研究，其主要目的在探討臺中地區一般雙期作水田適宜之轉作作物及其耕作方式。根據試驗結果，七種耕作制度中除春作薏苡——第二期作水稻之淨收益與一年兩期水稻之淨收益與一年兩期水稻之對照方式相若外，其餘六種耕作方式之淨收益均明顯地高於對照方式，其增加率為 25.3~60.6%，其中以春作高粱——宿根高粱——秋裡作玉米之耕作方式較佳。由於其淨收益比對照增加 60.6%，且其機械化程度與水稻相似，又可行省工之宿根栽培，故為一較為可行之轉作耕作方式。此外，一期水稻——夏作綠肥——秋作玉米及一期早熟稻——夏作甜瓜——秋作玉米等兩種耕作方式由於淨收益較高，亦值得推薦給農民採用。春作玉米——秋作落花生及一期水稻——秋作落花生之耕作方式在沿海地區亦頗易為農民接受。

Experiment of Cropping Pattern for Growing Substitution Crops in Paddy Field

In order to develop an optimum rotation system for growing upland crops in paddy field, a series of experiment were carried out to study the yield performance and net profits of those crops under seven cropping patterns.

The results showed that the pattern (job's tears-rice) gained the same profit as the check (rice-rice), and the net profits from the other six cropping patterns were 25.3 to 60.6% higher than that of check. Among of them, the cropping pattern (sorghum-ratooned sorghum-corn) may be the most easily accepted by the farmers because its net profit was 60.6% higher than that of the check; its mechanization level was the same as that of rice; and the ratooning may save the labor. Besides the other two patterns (corn-peanut; rice-peanut) may be popularly accepted by the farmers in the coastal areas.

水稻早熟新品種臺中 190 之育成

根據農林廳編印水稻品種別種植面積統計，近五年來本省早熟稻栽培面積每年約為 4~5 萬公頃，約佔全省水稻總栽培面積之 8~9%，早熟稻主要為裡作栽培地區以配合耕作制度上之需要而種植，就臺中地區而言，由於農業條件優異，裡作栽培甚為發達，秋冬裡作豌豆蔬菜及菸葉高達一萬多公頃，其他裡作雜糧瓜果類之面積亦不小，這些裡作栽培地區，一般須種植早熟稻品種。本場自 1979 年起即加強早熟稻品種之選育工作，以臺農 67 號與臺中早育 229 號雜交，於 1981 年選出臺中早育 287 號並開始進行各級產量試驗及特性檢定，於 1986 年申請登記命名為臺中 190 號。本品種具有早熟、強稈及抗稻熱病等特性，株高約 88~95 公分，產量每公頃約 5~5.5 公噸，生育日數一期作約 105 天，二期作約 82 天，適合裡作地區栽培種植，目前臺中 190 號栽培面積約近 1000 公頃，且有繼續增加之趨勢。

The Development of a New Early Maturing Variety of Rice-Taichung 190

In Taichung district, many farmers are always looking for the early maturing varieties of rice for being able to combine with some catch crops in their rotational cropping system to increase the multiple cropping index. Many important catch crops such as pea in Changhua, tobacco in Nantou, and potato in Taichung are grown in the fall to winter season usually from September to next February or May. In order to meet the above requirement, our breeding objective of rice has been pointed to shorten the growing duration of rice since 1979. A medium maturing variety with some favorable characters, Tainung 67, and an early maturing variety Taichung yu 229 were used as parents and crossed in 1979.

Through a series of selection in the progeny of their succeeding generations, Taichung early yu 287 was selected from F_6 in 1982. The line had entered yield trials from the following year and showed better performance than the other early maturing entries. It was therefore registered and named as "Taichung 190" in 1986.

This variety is a semidwarf japonica type of rice with a plant height of 88-95 cm, erect leaves, blast resistance, and a grain yield of 5-5.5 t/ha. Its growth duration is about 105 days in the first crop and 82 days in the second crop. The current cultivated area is about 1000 hectares and may be further expanded in the future.

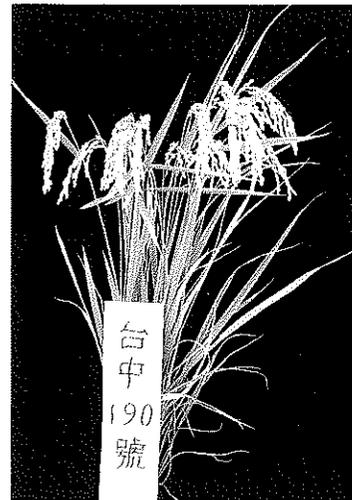


Fig. 1. The early maturing rice variety "Taichung 190".

籼稻品種糯性之遺傳育種

在分離後代研究糯稻與非糯稻胚乳特性遺傳及食味性，其結果摘要如下：

1. 在非糯稻品種臺中秈糯 1 號之第一代的直鏈性澱粉含量為 18.7%，而上述反雜交組合之第一代為 17.1%。顯示以糯稻為母本之第一代的直鏈性澱粉含量低於以非糯稻為母本者。

2. 在非糯稻臺中秈 10 號與糯稻臺中秈糯 1 號及其反雜交組合之第二代之分離比符合 3:1 比例，在反雜交之回交第一代符合 1:1 比例，顯示糯稻基因為一對隱性基因所控制。

3. 上述雜交後代選出進一步試驗，有 108 品系抗葉稻熱病，18 品系中抗白葉枯病，67 品系抗褐飛虱，從這些選拔品系期望選出抗多種病害蟲。

4. 所選出糯稻 11 品系比親本臺中秈糯 1 號高產 3~17%。

5. 所選出 11 品系之糯稻穀粒比臺中秈糯 1 號之食味品質佳，如外觀及黏彈性。

Genetic Studies and Breeding for Indica Varieties of Glutinous Rice

Glutinous and non-glutinous endosperm characters were studied together with the eating quality of the segregated progenies from the crosses of *indica* rice. The results are summarized in the followings:

1. Amylose content of F_1 plant between non-glutinous variety Taichung Sen 10 and glutinous variety Taichung Sen waxy 1 was 18.7%, while that in the F_1 of the reciprocal cross was 17.1%. It showed that the F_1 amylose content of the glutinous variety as female parent was lower than that of non-glutinous variety as female parent.

2. The segregation ratio of non-glutinous vs. glutinous plants in F_2 generation of Taichung Sen 10 and Taichung Sen waxy 1 as well as their reciprocal cross was fitted to a 3:1 ratio and that in BCF_1 was fitted to a 1:1 ratio indicating that glutinous gene is controlled by a single recessive gene.

3. Among the 115 progenies of above mentioned crosses, 108 lines showed "R" reaction to leaf blast disease, 18 lines showed "MR" reaction to bacterial leaf blight disease and 67 lines showed "R" reaction to brown planthopper. The promising lines

of multiresistance to diseases and insect pests are expected to be selected from those selected lines through the further trials.

4. Eleven glutinous lines showed 3-17% higher grain yield as compared with that of the parental variety Taichung Sen waxy 1.

5. Eleven lines showed better eating quality than Taichung Sen waxy 1 in term of glossiness of rice grain, cohesiveness and tenderness.

胚芽米之規格研訂及品種間之變異

本試驗之主要目的在尋求適合碾製胚芽米之品種，及在臺灣目前之生產技術與設備下，研討國內合理之胚芽米規格。由試驗獲悉，碾製胚芽米時，品種間之含芽率呈顯著差異，其中以豐錦最好，其次為臺農 67 號和臺中 189 號，但是秈稻品種皆不適合碾製胚芽。一般粒形愈短、愈寬且厚之品種較適合碾製胚芽米。由試驗結果建議，國內胚芽米標準規格應定為含胚芽率在 70% 以上，碾白度至少應比原料糙米提高 8 度為宜。

The Genotypic Variation and the Standardization of Embryo Rice

The study for setting up the standard of embryo rice indicated that there were significant differences between varieties in the percentage of residual embryo of milling rice. Toyonisiki was the best for embryo rice processing followed by Tainung 67 and Taichung 189, *indica* varieties are adversely. Generally, a variety with shorter, wider and thicker grain is more suitable for embryo rice processing. It suggested that the standard of embryo rice should have more than eight degrees in milling whiteness than its brown rice and at least 70% of embryo left in the milling rice.

新舊米檢定方法

為辨別新米與舊米，本研究利用三種方法測試。首先由新米或舊米之透明度加以辨識，新米較舊米清晰明亮。其次利用 BTB 與 PR 溶於 NaOH 中，新米溶液及米粒呈濃紫色，舊米溶液及米粒呈黃色。第三法為利用 BTB 與 MR 溶於乙基乙醇中，新米溶液為濃綠色，而舊米溶液為濃綠色，而舊米溶液則轉黃趨橙色；測定此法溶液之 pH，發現隨儲存時期之增加，pH 值有下降的現象。

Identification of New and Old Milled Rice

Three methods were used to distinguish

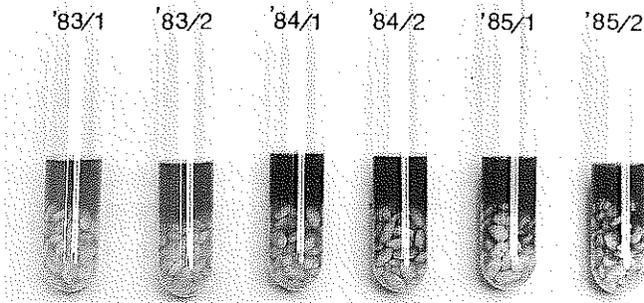


Fig. 2. Identification of old and new *japonica* milled rice by color reaction of testing solution (PR and BTB dissolved in NaOH).

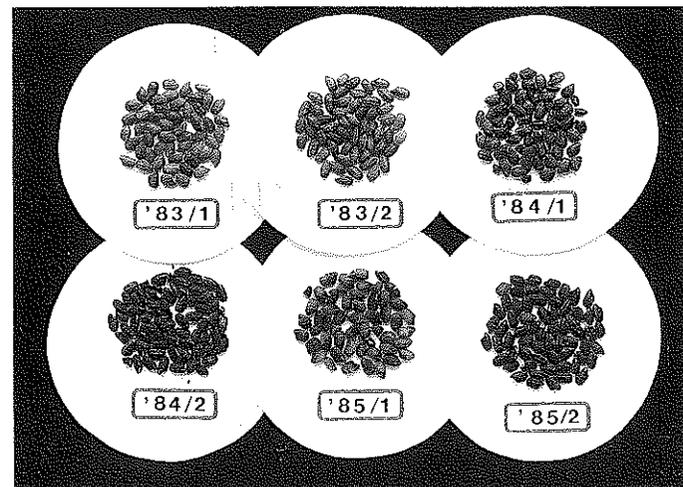


Fig. 3. Identification of old and new *japonica* milled rice grains by color reaction of tested solution (PR and BTB dissolved by NaOH).

between the long-stored and freshly milled rice. New milled rice was clearer than the old one according to the degree of translucency. When rice grains were rinsed in the solution of BTB and PR dissolved in NaOH, the new milled rice grains as well as the test solution showed the deep violet color. In case of old milled rice the color turned into yellow. When new milled rice grains were rinsed in the solution of MR and BTB dissolved in ethyl alcohol, the solution showed deep green color. In case of old milled rice the test solution turned into yellow to orange color. The pH value of the solution tested with BTB and MR

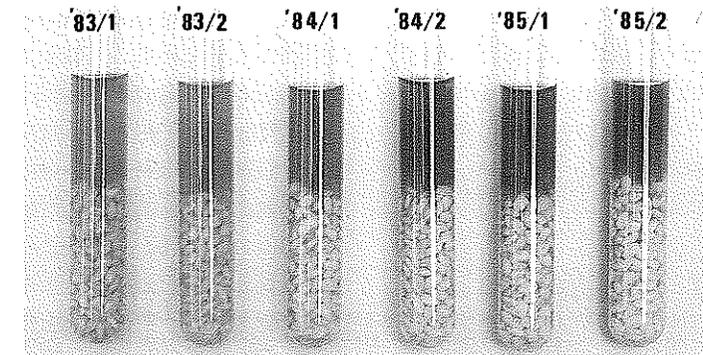


Fig. 4. Identification of old and new *japonica* milled rice by color reaction of testing solution (MR and BTB dissolved in ethyl alcohol).

decreased with the increased duration of storage of milled rice.

雜糧作物 Upland Crops

高粱臺中五號低發芽率之原因及解決方案

本試驗研究從採種流程來探討高粱臺中 5 號發芽不良之原因，經檢查民國 74 年初設置於嘉義一帶之採種田作業後發現導致種子劣變之因素為：

- (1) 種子劣變與種子活力、休眠性、後熟性及穗堆積熱無關。
- (2) 種子單寧含量在糊熟期時最高為 0.275%，至枯熟期時已降至 0.134%，此與種子罹病率增至 39.4%。
- (3) 種穗上粒徑大於 4.00 公厘之大粒種子，含較高之單寧 (0.191%)、罹病率低 (29.8%) 及發芽率高 (86.5%)，但在調製精選後此部分種子量從 24.9% 降至 7.9%，相對地小粒種子 (粒徑在 3.35~2.28 公厘) 量從 11.9% 增至 23.0%，且發芽率僅 54.4%。
- (4) 採收過程使用大型曳引機及聯合收穫機脫粒是造成種子破裂率從 9.4% 增至 49.0%，而發芽率由 87.6% 降至 59.4% 之原因。
- (5) 若以因果路徑分析法導出之貢獻百分比來

估算種子發芽不良之因素為：1. 因種皮損傷而導致罹病者佔 38.59%，2. 因種皮損傷但未罹病者佔 32.38%，3. 種皮未損傷但罹病者佔 15.22%，4. 種皮未損傷且未罹病者佔 5.80% 及 5. 原因未明佔 8.01%。

試驗中進一步在植株噴灑巴拉刈，七天後，利用國產 YS-2000D 型高粱聯合收穫機直接收穫之。由結果顯示經巴拉刈處理後植株及種子由於水分含量下降而增加收穫機之穀粒出口流量。完熟期時水分含量為 25.3%，噴灑後可降至 18.0%，此時收穫機行走速率定在 0.5 m/sec 而脫穀筒轉速為 500 rpm 或 400 rpm 時，種子破裂率可降至 9.3% 及 9.7%，而發芽率則提昇至 83.3% 及 80.7%。據此，促進高粱臺中五號發芽率之方法為在黃熟期後植株噴灑巴拉刈，使種子水分提早降至 20% 以下，此時利用聯合收穫機進行採收，將可減少種子之機械性損傷致發芽提昇到 80% 以上。

Hybrid Sorghum—Taichung 5 and its Improvement Method of Germination Rate

The germination rate of hybrid sorghum—Taichung 5 is usually low in the seed production in Taiwan. The cause of low germinability were regarded to be related with the natures of anatomy, physiology

and pathology of the seeds. However, all efforts failed to improve its germinability to pass germination test. This study, therefore, emphasized the measures during seed harvesting, seed processing, seed drying, and seed storage etc. Results were summarized as follows:

1. The low germinability of Taichung 5 was uncorrelated with its seed vigor, dormancy, post-ripeness and panicle storing heat.

2. The tannic acid content in the grain of Taichung 5 increased to 0.275% at mid-dough stage and down to 0.134% at full-ripen stage, while the pathogenic infection rate of seed was increased to 39.4% at harvest.

3. Taichung 5 could be divided into four groups by its seed size. The percentage of the largest seed was 24.9% in individual panicle and this parts of seeds obtained high tannic acid (0.191%), low pathogenic infection rate (29.8%), and best germinability (86.5%). Unfortunately, this part decreased to 7.9% during seed processing so that the germinability was down to 54.4% in average.

4. The seed breakage including damage of testa, endosperm and embryo changed from 9.4% to 49.0%. This breakage was due to mechanical damage by using tractor and combined harvester during de-seeding process.

5. Contribution percentage computed by path analysis was evaluated for the cause of low germinability in Taichung 5. It indicated that seed breakage resulted from mechanical damage was the major factors to cause pathogenic infection and low germinability in Taichung 5.

In advanced field survey, 18% of seed moisture was obtained by treating paraquat

immediately after seed yellow ripe stage, as in comparison with 25.5% of seed moisture found in untreated control. It also indicated that mechanical damage could be reduced during mechanical harvesting process, as if the seed moisture was getting lower. Moreover, more than 80% of seed germination rate could be obtained from paraquat treated plot at full ripe stage, while the cylinder running speed and velocity of local sorghum harvester (13 ps/2400 rpm) were set up by 400-500 rpm and 0.53 m/sec, respectively.

Therefore, using chemical desiccation of hybrid sorghum—Taichung No. 5 at full ripe stage to reduce seed moisture and then followed by mechanic harvesting process will be feasible for high germinability seed production.



Fig. 5. The sorghum variety "Taichung 5".

雜種高粱新品系產量穩定性之分析

在探討各高粱育種單位新育成之雜種高粱品系於本省 4 個不同氣候環境下之產量及其他主要農藝特性之表現穩定性後，得知臺中有 75-11 等九個新雜種高粱（包括臺南場及臺灣大學所育成之品系）之抽穗期與生育日數之表現與對照種臺中 5 號同屬中早熟品種；株高則介於 131-154 公分間，皆適宜機械栽培管理；穗長及穗重均較對照種優者有臺中 73-12 及臺大 2 號二種。單寧含量除臺南育 72-6，臺大 2 號及 3 號為高

單寧含量外，餘均與對照種同屬低單寧含量之雜種品系。參試品系之產量經變方分析及穩定性測驗結果指出產量之差與各品系間未達顯著標準，而環境與雜種品系間之交感作用則呈極顯著。穩定性介值 b 及 Sd^2 之分析結果指出臺中 75-11 之穩定性表現與對照品種臺中 5 號較接近。而臺南育 74-42 之穩定性介值雖然極佳，然其產量之平均值却較對照品種為低。

再者以臺中 69-27 臺南育 72-6 為參試品種於全省六個主要高粱產區進行試驗；試驗結果顯示該二品系之一般農藝特性均與對照品種臺中 5 號相近，僅臺南育 72-6 之單寧含量稍高，恐不適於供作飼料用。子實產量在品種間差異呈顯著，環境間各品系之表現則有極顯著之差異。穩定性分析結果則指出參試之二新品系之穩定性均較對照品種為低。

Grain Yield Stability Analysis of New Sorghum Hybrids

In order to test the grain yield performance and the agronomic characters of new sorghum hybrids, nine sorghum hybrids developed by Taichung and Tainan DAIS and National Taiwan Univ. were tested at four locations for regional yield. On the other hand, the local yield trial were conducted at six locations by using two sorghum hybrids: Taichung-yu 69-27 and Tainan-yu 72-06. The results of regional yields revealed that mean grain yield of nine hybrids were not significantly different from each other and check hybrid variety Taichung 5. Stability parameters of yield of the tested hybrid varieties were no better than those of the check hybrid variety. The results of local yield trial showed that the grain yield of Tainan 72-06 was higher than the check hybrid variety Taichung 5. However, yield stability parameters showed a significant deviation from regression (Sd^2) indicating that line Tainan-yu 72-06 can

not be considered to be a stable hybrid.



Fig. 6. New sorghum hybrid lines.

水田薏苡栽培技術之探討

本試驗研究旨在促進薏苡 (*Job's-tears*, *Coix lacryma-jobi* L. var. *mayuen stapf*) 成為水田轉作之新興替代作物。從民國 72 年至 74 年間經探討薏苡之品種特徵，種子發芽特性及幼苗素質後，藉以導引出適合於水田之栽種技術。茲將研究成果摘錄如下：

1. Major 種之生育期及成熟期株高分別為 209.4 日及 274.0 公分，Mayuen 種則僅 111.0-124.0 日及 120.0-135.0 公分，前者之單株分蘗數、小穗數、千粒重及容重等性狀比後者多 8.6~30.4%；甚至子粒產量亦以 Major 種之 440 kg/ha 比 Mayuen 種多 17.6%~28.2%，然而 Mayuen 種一年可兩收因株型與水稻相似，其栽種作業可利用水稻之慣行機械。

2. 薏苡種子未經浸種無法獲得整齊之出芽勢，經 2 天或以上之浸種可獲得 91.2% 之高發芽率。經淹水之種子，在淹水期間種子不能出芽，必需在排水後 3.1~5.1 天才能出芽。隨土壤水分提昇至田間保水量時，種子發芽率可達到 91.4%，但臻至最高保水量時，即降為 19.1%。薏苡種子之最適發芽溫度在 25°C~28°C 間，當溫度降至 15°C 時發芽率僅 3.3%，5°C 時則不發芽。惟經低溫處理之種子再移回 25°C~28°C 時，發芽率隨之提高。

3. 在諸秧箱播種量間以 250 公克/箱之處理，幼苗之苗齡、株高、根數、株重及葉面積指數達到最高或最低，且此種幼苗經移植後，

每叢插植數、插植深度、缺叢數、浮苗率及成活率分別為 2.9 株、3.0 公分、3.6%、1.8% 及 89.4%，因此取每箱 250 公克播種量及苗齡 2.7 葉之幼苗，將較適合於機械移栽。

4. 經機械移栽之幼苗，因機械性損傷而依其根部種子，種子根及不定根之有無，劃分成 5 種不正常苗，諸此不正常之多寡是造成移栽苗成活率低落的主因。改以稻殼混合砂質壤土作為育苗基質後，可因降低不正常苗比率而提高移栽苗之成活率。

5. 春作時疏植區 (60×20 公分) 之植株較矮，生育期較短但分蘗數及子粒產量較高，反之，夏作時以密植區 (30×20 公分) 產量較高。但不論在春作或夏作，移栽法均比直播法之產量多 4.6%~14.6%。

Studies on the Cultivation of Job's-Tears (*Coix lacryma-jobi* L.) in the Paddy Field

The purpose of this study is to promote the growth of Job's-tears to become a new substitute crop in the paddy field of Taiwan. In order to establish a feasible cultural method, the relationship among varietal characteristics, seed germinability, seedling quality and planting method were evaluated under the pot trial and field survey in 1983-1985 crop seasons. Results were summarized in the following:

(1) The growth period and plant height of the variety "Major" were 209.4 days and 274.0 cm and that of variety "Mayuen" were 111.0-124.0 days and 120.0-135.0 cm, respectively. The yield components, tiller number, spikelet number, 1000-kernel weight and test weight of Mayuen were 8.6%-30.4% less than Major. Moreover, Major performed the yield of 4404 kg/ha which was 17.6%-28.2% higher than that of Mayuen. Whereas, Mayuen can grow two crops a year and the mechanization was

also feasible due to its similarity with the paddy rice.

(2) It can not germinate without soaking. The uniform coleoptile emergence was observed earlier as the soaking duration was increased and 48 hours' soaking duration resulted in 91.2% germination rate. Continuous flooding blocked the seed germination. Germinating action only occurred 3.1-5.1 days after drainage, however the germination rate reduced with the increase of the flooding duration. Soil moisture in field capacity promoted the germination rate up to 91.4%, and it went down to 19.1% at maximum water holding capacity. The optimum germination temperature was about 18°C-25°C. The germination rate descended under low temperature, but recovered when it was moved back to 25°C-28°C.

(3) By increasing the sowing rate, the seedling age, plant height, root number, seedling dry weight and LAI met the plateau at 250 gm/box; but drastically decreased in seeding number per hill, seedling depth, percent of missing hill, and percent of floating seedling. Based on the survival percent, seedling from 250 gm/box with 2.7 leaf age was considered most suitable for the transplanter use.

(4) Five kinds of transplanter damage on root system was improved by mixing rice husk together with sandy loam soil in the nursery box.

(5) In spring crop, the dense planting treatment (30×20 cm) induced better plant height and longer growth period, but showed less tiller number and grain yield than those from the thinner planting (60×20 cm). The reverse was true in the summer crop. Transplanting method obtained 4.8-14.6% higher grain yield than direct seeding one

in two crop seasons.

栽培密度及氮肥用量對小麥產量之影響

為探討栽培密度及不同氮肥用量對小麥新品種臺中選 1、2 號產量之影響，於民國 73/74 年期冬季裡作小麥栽培期間於臺中舊場進行本試驗，藉以選出最適當之栽培密度及氮肥用量，以提高冬季裡作小麥單位面積產量及收益。根據試驗結果顯示，增施氮肥及增加種植密度，可顯著提高穗型小麥臺中選 2 號之單位面積產量，其增產之主要因素為單位面積穗數的增加。小麥新品種臺中選 2 號行距 17.5 公分之密植及每公頃氮肥施用 140 公斤之重肥栽培上，每公頃產量可達 6,069 公斤，比對照品種臺中 31 號在一般栽培情況 (行距 50 公分，施氮量 80 公斤/公頃)，達增產 61.9%，由於增產效果極為明顯，值得推薦給農民採用。

Effects of Planting Density and the Rate of Nitrogen Fertilizer on the Grain Yield of Wheat

This experiment was conducted in the 1984/1985 winter season at Taichung to study the effects of planting density and the rate of nitrogen fertilizer on the grain yield of the new varieties of wheat, Taichung S. 1 and 2.

The results of the experiment suggested that increasing either the rate of nitrogen fertilizer or the density of planting significantly increased the grain yield of the heavy-panicle type of wheat, Taichung S. 2, mainly due to the increase in the panicle number of the unit area. Under the planting density of 17.5 cm between rows, and the nitrogen rate of 140 kg/ha, Taichung S. 2. performed the yield of 6,069 kg/ha that was 61.9% higher than that of the check variety Taichung 31 under common method (50 cm between rows and 80 kg/ha of

nitrogen). Therefore the above method is recommendable to the farmers for increase the grain yield of wheat in Taichung area.



Fig. 7. Wheat variety "Taichung 31".

省產薏仁品質之檢定

本試驗旨在探討屬於 Mayuen 種之臺中選育一號薏苡精白種仁與屬於 Major 種之市售由泰國進口之薏仁或嘉義縣阿里山原產薏仁間之差異。經化學分析結果顯示，臺中選育一號因含較高量之蛋白質 (18.3%)，澱粉 (58.0%) 及脂肪 (6.6%)，因此其每 100 公克之熱含量 389.5 Cal 亦最高，其次為泰國之 374.5 Cal 及阿里山產 367.6 Cal。再者，臺中選育一號之每公克的氨基酸含量為 193.4 mg 遠高於阿里山產之 132.1 mg 和泰國產之 79.9 mg，尤其是臺中選育一號之 Glutamic acid, Alanine, Leucine 及 Lysine 含量亦高於其餘品種之數倍且臺中選育一號之 Lysine 含量高達 11.7%，遠高於一般禾本科飼料作物，臺中選育一號之直鏈性澱粉含量為 1.3%，泰國產者為 3.4%，阿里山產者為 19.4%，顯示臺中選育一號最具糯性，阿里山產者為非糯性種。臺中選育一號之含鐵質 0.028% 為泰國產或阿里山產之 9-14 倍。又泰國產及臺中選育一號之維生素 B₁、B₂ 含量相似，但阿里山產者較低。就具有抗腫瘤藥效之薏仁脂含量而言，臺中選育一號為 141.6 μg/gm 遠高於泰國產之 83.8 μg/gm 及阿里山產之 60.7 μg/gm。據此可知屬 Mayuen 種之臺中選育一號品質較優，值得進行栽培推廣。

Studies on the Varietal Differences in Chemical Components of Job's-Tears (*Coix lacryma-jobi* L.)

This experiment is aimed to identify the varietal differences among three Job's-tears varieties by way of chemical component analysis. Three cultivars *i.e.* Taichung S. 1, A-Li Shan and Thailand were involved in this study. The former one is the selection out of variety Mayuen and the last two were from variety Major. The contents of moisture, protein, amino acid, starch, amylose, fat, fiber, ash, mineral composition, vitamin B₁, B₂, and coixenolide (C₃ 8 Hg O₄) in polished grain of three cultivars were analyzed.

The results revealed that Taichung S. 1 contained 18.3% of protein, 58.0% of starch and 6.6% of fat which provided the 389.8 Cal/100 gm of the highest calorie content among them, and that in Thailand was 374.5 Cal/100 gm and in A-Li Shan was 367.6 Cal/100 gm. The total amino acid content measured from Taichung S. 1, Thailand and A-Li Shan were 193.4 mg/gm, 79.9 mg/gm and 132.1 mg/gm, respectively. As compared with others, Taichung S. 1 obtained higher contents of glutamic acid, alanine, leucine and lysine, especially 11.7% of lysine content will promote it to be a good fodder crop.

Based on the amylose content in Taichung S. 1 (1.3%), Thailand (3.4%) and A-Li Shan (19.4%), these varieties can be divided into two groups. Taichung S. 1 and Thailand belonged to glutinous Job's-tears and A-Li Shan was nonglutinous. Besides, Taichung S. 1 contained 0.028% of Fe₂O₃ which is 9-14 times higher than others. However, the vitamin B₁ and B₂ were quite the same in Taichung S. 1

and Thailand, but lower in A-Li Shan. Coixenolide is purified and the component of this fatty acid were measured respectively 141.6 µg/gm, 83.8 µg/gm and 60.7 µg/gm in Taichung S. 1, Thailand and A-Li Shan. Therefore, Taichung S. 1 is not only good in quality but also worthy of cultivation.

園藝作物 Horticultural Crops

菜豆抗銹病新品系之區域試驗

為改善本省目前菜豆栽培品種對銹病之感病性，以減少因感染銹病所造成的損失，本場業經回交法，移轉其抗病因子於栽培品種中，育成抗銹病新品系，於初級產量比較試驗中，表現優異，具豐產及抗銹病與莢形優美等特性，因此於全省五處進行區域試驗，其結果臺中系 11 號具豐產的特性，極為穩定，比對照品種增產（6.6% 及 8.5%），臺中系 11 號及臺中系 12 號在各不同地區之自然環境下，秋作（1985）銹病罹病度比對照品種“黑仁衣笠”減少 86~95%，春作（1986）減少 77.2~87.9%，因此可以確定菜豆抗銹病新品系之銹病抗病力，甚少受到不同試區不同生理小種的影響。

A Regional Test for the Rust-Resistant New Lines of Common Bean

In order to improve the resistance of common bean to rust disease for reducing the yield loss, backcross method was used to transfer the rust resistant gene to the cultivated varieties of common bean. As some high yield, rust-resistant, and good pod shape lines were selected in the primary yield trial, regional test for the selected lines was carried out at five locations distributed in the whole island. The results of the regional test showed that Taichung

line 11 had the stable and high yield performance. It showed 6.6~8.5% higher yield as compared with the control. Under the natural environmental conditions in the different regions, the rust disease index of Taichung lines 11 and 12 had reduced for 86-95% in the fall crop, 1985 and 77.2-87.9% in the spring crop, 1986 as compared with the control. This suggested that the rust resistance of the newly bred lines of the common bean was rarely affected by the physiological races of the different regions.



Fig. 8. Rust resistant line of common bean "Taichung 16".

噴滴灌多目標利用於蔬菜生產之研究

本試驗之目的乃在利用噴、滴灌等灌溉設施多目標的應用於蔬菜生產。經試驗結果，在蘿蔔的生產上可節省施肥、灌溉人力支付，約可降低生產總成本 7.7%~11.1%，在產量方面以滴灌灌溉，一天一次，每次 5 mm 處理之每十公畝產量 6,820 公斤為最高，較溝灌（對照）的 4,930 公斤增產高達 38.3%，其他各噴滴灌處理亦分別高出對照區 5.0~13.8% 之間。惟綜合試驗結果，在效益上仍以滴水灌溉為最佳。

Multiple Utilization of Sprinkler and Drip Irrigation for Vegetable Production

The objective of this study was to

utilize the sprinkler and drip irrigation systems for vegetable production.

The results showed that the reduction in cost was about 7.7-11.1% from the application of these systems for radish production mainly due to the saving of labor for fertilization and irrigation. The average yield of radish root in the treatment of drip irrigation for 5mm once a day was the highest showing the yield of 6,820 kg/10 a was 38.3% higher than that of the control (furrow irrigation). The yield of other sprinkler and drip irrigation systems were also higher than that of the control by 5.0-13.8%. However, the economic profit from drip irrigation was better than from sprinkler.

豌豆品種改良之研究

為選育抗白粉病之新莢豌豆品種及新甜豌豆品種，以供推廣栽培，經 1986~87 年期試驗結果，嫩莢用品系臺中莢系 12 號及 15 號具有抗白粉病力，嫩莢濃綠或綠色，產量高，適應性強等優良特性，又甜豌豆用品系臺中甜系 3A 號，則具有早熟，低位結莢，莢形大等優良特性；上述新品系均具有推廣栽培之希望。

Improvement of Pea Varieties

The objective of this study is to develop new edible podded varieties of pea with powdery mildew resistance and new snap peas.

In the yield trial of newly-bred lines in the 1986-87 crop season, two elite edible podded lines with powdery mildew resistance and other good characteristics, and one snap pea with the good characteristics such as early maturing, low-flowering node and larger pods were selected. The above lines are very hopeful for releasing.

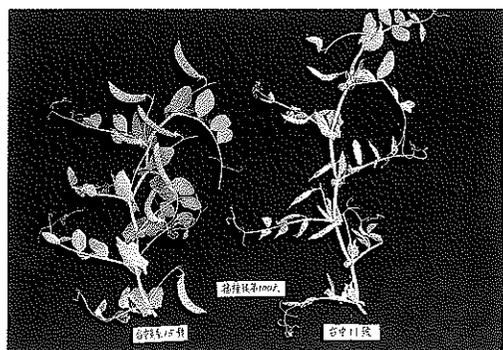


Fig. 9. Powdery mildew resistant pea variety Taichung 12.

高冷地溫室香瓜栽培觀察

供試品種為臺中選一號，秋作於七月播種十月採收，春作於四月播種七月採收。據調查香瓜果型橢圓，細紋粗密，果皮黃綠色，果肉淡綠，果肉厚度 3.1 公分，糖度 12.8~14%，果肉為溶解質，香氣濃，單果平均重量為 1.15 公斤比平地栽培者品質好，甜度高且坡地種植因日夜溫差大，不必花費室內空調設備，成本降低故山坡地發展溫室香瓜栽培潛力大，值得推廣栽培。但仍須注意炭疽病及蔓枯病之防治工作才能獲得好結果。

Cultivation of Muskmelon in the Highland Area

Muskmelon, Taichung S. 1, was planted at Puli in the fall and spring seasons in 1986 to study their performance on the highland area in central Taiwan. The fall crop was seeded in July and harvested in October, and the spring crop was seeded on April and harvested on July. The results are as follows:

The fruit of the melon was elliptical in shape with coarse netted lines on the skin. The fruit skin was yellowish green in color, and the flesh color was light green with a thickness of about 3.1 cm, a brix of 12.8-14%, and a strong flavor.

The average fruit weight of the muskmelon was 1.15 kg/fruit. Generally, the fruit quality was better than those grown in the lowland possibly due to the larger difference in temperatures between day and night.



Fig. 10. Cultivation of muskmelon in the highland area.

坡地番茄嫁接抗青枯病砧木試驗

為利用親和性高根群旺盛，發育快且抗病力強的野生番茄（野生刺茄，亞蔬 162 號、166 號及 285 號等四種）砧木之生長優勢，以嫁接技術，將一般栽培品種（農友 685 號及種苗 1 號）接於砧木上，使減少青枯病發生率以穩定夏秋作番茄產量為目的。夏作於四月播種，秋作為八月播種，嫁接於番茄幼苗展現兩片真葉時進行，試驗結果：在四個砧木品種中以野生刺茄砧木表現較差，因為刺茄雖然表現抗病，但幹部細小，發育慢且有砧木纖維硬化趨向，致養分吸收不足，上部接穗發育不良，產生穗負現象，果型小而差，產量低，不具實用價值，其餘三種砧木其抗青枯力強（發病僅 2.5~3.6%），且沒有野生刺茄所發生之缺點，秋作鮮果產量比對照無嫁接區增產 7.84~14.21%，而每十公畝嫁接費用只增加 3,075 元，實用性高值得推廣利用。

Experiment of Grafting Cultivated Varieties of Tomato on Bacterial Wilt Resistant Rootstocks

Four wild varieties of tomato, wild

spinous tomato, AVRDC-162, 166, and 285, were used as rootstocks grafted with the cultivated varieties of tomato, Known You 685 and Seed Service 1 to increase the resistance of tomato bacterial wilt and stabilizing the yield of summer and fall tomato. The rootstock tomatoes were seeded on April for summer crop, and on August for fall crop. After the appearance of two true leaves, they were grafted with the scion of the cultivated varieties of tomato. The results were as follows:

Among the 4 rootstocks, wild spinous tomato was the worst in performance. Although it also showed the character of bacterial wilt resistance, however, it had smaller stem, and was slower in growth. As the fiber of the rootstock had the tendency to hardening, the absorption of nutrients is not enough. Therefore, the growth of scion was poor and the fruits were small to cause lower yield in fruit. The other three rootstocks were strongly resistant to bacterial wilt (2.5-3.6% infection rate). Besides they did not show the disadvantages of wild spinous tomato. In the fall crop, their yields were 7.84-14.21% higher than that of the check, and the cost for grafting was only NT\$ 3,075 per 10 acre, suggesting that this method was

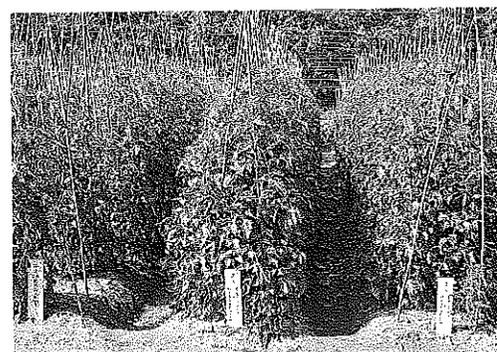


Fig. 11. Tomato grafting on bacterial wilt resistant rootstocks.

quite practical.

高冷地孢子甘藍採種試驗

供試種子由荷蘭進口，試驗地點分設於中海拔（625 公尺）及高海拔（1,748 公尺）各二處，試驗結果中海拔地區因氣溫偏高，只適合營養生長，而不利於生殖生長，雖有極少數植株開花，但稔實不良而沒有收穫，故此段地區不利於採種。而另一處高海拔地區則營養生長較緩慢，但所結孢子較大，植株於 3~4 月間均能抽苔開花且稔實率高，平均每株可採收種子 10.3 公克，因此得知孢子甘藍採種須在較高海拔進行為宜。

Experiment on Seed Production for Brussels Sprouts in High Altitude Area

The seeds were introduced from Netherlands. They were grown at two different locations, one at the elevation of 625 meters, and another at the elevation of 1748 meters above the sea level in the highland area. The results are summarized as follows:

As a result of higher temperature, the Brussels sprouts at the elevation of 625 meters did not turn into reproductive growth, and the plants did not seed at all, although there was a few flowers in some



Fig. 12. Seed production of Brussels sprouts.

plants. The Brussels sprouts at the elevation of 1748 meters grew slower, but produced bigger Brussels sprouts. The plants at this elevation flowered and seeded during March to April with high rate of seeding. The seed yield was 10.3 g per plant. This suggested that seed production of Brussels sprouts should be conducted at higher altitude area in Taiwan.

朝鮮薊試作及加工研究

朝鮮薊為菊科一年生至多年生作物，其肥厚多肉的花托可供鮮食或鹽漬加工用，為一種高級蔬菜，甚受外國人士喜愛。75 年度從美國引進 Globe Artichoke 品種種子經在本省中部地區包括大甲、埔里、苑裡、三義及斗南等地試作，其中除斗南因溫度太高影響其正常抽蕾開花外，其餘地區均獲滿意結果。即每十公畝平均鮮花產量約為 500 公斤左右，具有發展潛力，現由中興大學食品加工系及永森三九食品廠研究加工中。

Trial Planting of Artichoke in Central Taiwan

Artichoke "Globe", was introduced from U.S.A. in 1986 for trial planting in central Taiwan covering the 5 townships, Tachia, Puli, Yuanli, Sanyi, and Tounan. Except Tounan where higher temperature affected



Fig. 13. The artichoke variety "Green globe".

the normal flowering of artichoke, the other locations all showed favorable results. Generally, the yield of the fresh flower of artichoke was about 500 kg per 10 acre, suggesting that central Taiwan has the potential to grow artichoke.

梨園肥培管理對養分吸收及產量關係研究

以十五年生橫山梨為試驗對象，在每株果樹固定施用同量有機物的情況下，化學肥料採用臺肥五號複合肥料分 10 公斤及 15 公斤兩級，土壤改良劑分石灰燼渣 10 公斤，白雲石粉 10 公斤及不施用者三級，以複因子設計組合排列進行，試驗結果：複合肥料用量以每株施用 15 公斤區梨果產量較高，比施用 10 公斤區增產 5.4%，但就經濟收益比較仍以施用 10 公斤較為經濟合理。土壤改良劑之效果以石灰燼渣較佳，比不施用區 CK 增產 9.4%，施用白雲石粉增產 7.7% 居次，而以不施用區產量最差，在統計分析上顯示，施用土壤改良劑對梨果產量呈現極顯著增產，但石灰燼渣與白雲石粉間則差異不顯著。

Study on the Relationship Between Fertilizer Management and Yield of Hengshan Pear

This experiment was conducted at an orchard of 15-year-old Hengshan pear in Puli, a highland in central Taiwan. Two levels of compound fertilizer TFC-5 (N: P₂O₅: K₂O=16:8:12), 10 kg/tree and 15 kg/tree, and three levels of soil amendments, slug 10 kg/tree, dolomitic limestone 10 kg/tree, and the control were combined into a 2×3 factorial experiment and arranged in randomized complete block design. The results are: The yield of pear from the treatment of 15 kg/tree of compound fertilizer TFC-5 was 5.4% higher than that of 10 kg/tree of compound fertilizer TFC-5,

however, 10 kg/tree was more economical. Among the three soil amendments, slug was the best, showed 9.4% increase in the yield of pear; dolomitic quick lime next to it, obtained 7.7% increase in yield. Generally, the yield of pear from soil amendments were all significantly higher than those from control. However, the difference between slug and dolomitic lime was not statistically significant.

蛇麻花氮磷肥料需要量試驗

釀造啤酒原料之一——蛇麻花，其第一及第二年生氮磷肥料需求經試驗結果為：肥料處理間除秋作磷肥效應及氮磷交感效應達極顯著外，其餘效應對產量影響差異不顯著，但氮磷肥料效應却有一明顯趨勢，即秋作氮肥以 N₁ (每株 50 公克) 產量最高，增施氮肥會使產量降低，春作以施 N₂ (每株 100 公克) 產量最高，N₁ (50 公克) 次之，N₃ (150 公克) 最差。磷肥效應無論秋作或春作均以 P₂ (每株 90 公克) 產量最高，比 P₁ (每株 45 公克) 增產 5.6~9.2%，P₃ (每株 155 公克次之)，比 P₁ 增產 0.5~4.8%，故秋作以 N₁ (50 公克)，P₂ (90 公克)，春作以 N₂ (100 公克)，P₂ (90 公克) 的施肥標準可得較高產量。

Experiment of Nitrogen and Phosphorus Requirement of Hop

This experiment was conducted to study the nitrogen and phosphorus requirement of 1 and 2 years old hop. The results showed that the yield of hop was only responsive to the effect of phosphorus and the interaction of nitrogen and phosphorus in the fall crop. There was a clear tendency that the yield of hop flower decreased with the increase of nitrogen in the fall, and N₁ (50 g/plant) was the highest in yield. In the spring crop, the yield of hop flower

was the highest in N₂ (100 g/plant), N₁ (50 g/plant) next to it, and N₃ (150 g/plant) was the lowest. The effect of phosphorus was similar either in the fall or spring crop. i.e. the yield of hop flower was the highest in P₂ (90 g/plant), 5.6-9.2% higher than P₁ (45 g/plant), P₃ (135 g/plant) next to it, 0.5-4.8% higher than P₁. Therefore, the reasonable fertilizer rate for hop are 50 g of nitrogen and 90 g of phosphorus per plant in the fall crop, and 100 g of nitrogen and 90 g of phosphorus per plant in the spring crop.



Fig. 14. Flowering stage of hop.

植物保護 Plant Protection

溫度對葡萄咖啡木蠹蛾發育之影響

咖啡木蠹蛾 (*Zeuzera coffeae*) 係本省葡萄重要害蟲，各蟲期發育所需時間隨溫度之升高而縮短。在 20~30°C 時，卵期為 16.15~7.28 天，幼蟲期為 173.57~78.02 天，蛹期為 34.11~15.99 天，完成一世代需要 223.83~101.29 天。卵、幼蟲及蛹的發育臨界溫度分別為 12.23、11.99 及 11.64°C。有效積溫依次為 130.43、1408.90 及 302.73 日度，完成一個世代之有效積溫為 1823.33 日度，可由有效積溫推算本蟲一年發生二個世代，此可做為發生預測之利用。幼蟲的有效溫度帶為 9~39°C，9°C 以下為低溫不活動帶，4°C 而進入低溫致死帶，46°C 進

入高溫不活動帶，至 49°C 即達高溫致死溫度帶。

The Effect of Temperature on the Development of *Zeuzera coffeae* Nietner in Grape-vine

The coffee carpenter, *Zeuzera coffeae* Nietner, is a well known insect pest on grape in Taiwan. Temperature from 20°C to 30°C, the egg, larval and pupal stages last from 16.15 to 7.28 days, 173.57 to 78.02 days, 34.11 to 15.99 days, respectively, and completing a generation required from 223.83 to 101.29 days. Duration for completing a life cycle decreased with an increase of temperature, and the shortest was at 30°C. The threshold temperature for the development of eggs, larvae and pupae were estimated to be 12.23°C, 11.99°C and 11.64°C, respectively. The accumulated temperatures for the development of eggs, larvae and pupae were 130.43, 1408.90 and 302.73 D.D., respectively, and completing a generation required 1823.33 D.D.. By

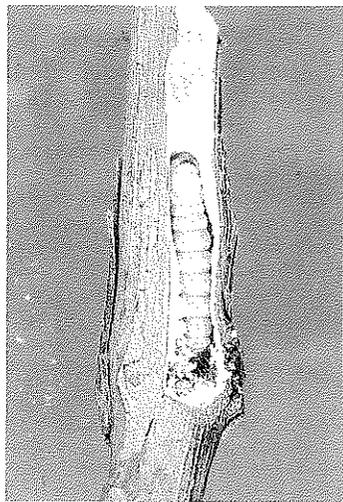


Fig. 15. The infestation of *Z. coffeae* on grapevine.

using accumulated temperature of development, the coffee carpenter was estimated to have two generations a year in the central part of Taiwan, and the data can be used for forecasting the occurrence of this insect. The effective temperature zone, high fatal temperature zone, and low fatal temperature zone for the old instar larvae were estimated to be 9 to 39°C, 49°C and 4°C, respectively.

臺灣中部地區危害葡萄之咖啡木蠹蛾的族群變動調查

咖啡木蠹蛾 (*Zeuzera coffeae* Nietner) 係本省葡萄之主要害蟲。田間調查結果顯示蟲每年發生二代，以老齡幼蟲在枝條內越冬，成蟲羽化期為 4~6 月及 8~10 月。族群密度調查發現在山地之葡萄園較平地者為高，在樹齡十年之葡萄園者較樹齡三年之葡萄園高，在巨峰品種較義大利品種族群高，果園管理粗放者較管理良好者為高。此外葡萄之採收方式亦為影響本蟲密度的另一因子，夏一秋採收方式似較易使幼蟲族群趨向較低水平。

Population Fluctuation of *Zeuzera coffeae* Nietner in the Central Taiwan

The coffee carpenter, *Zeuzera coffeae* Nietner, is a well known insect pest on grape in Taiwan. The population fluctuation of the insect has investigated for over three years since December, 1980. The overwintered adults and first generation emerge from April to June and from August to October, respectively. It shows apparently a bivoltinism without overlapping of the generations. The insect overwinters in the vine by the mature larval stages. Based on its appearance, and damage to the grapevine, April for the first gener-

ation and August for the second generation are considered to be the advisable season for controlling the pest.

The pest population was observed to be affected by several environmental factors. In general, the vineyards located in mountain area with the surroundings having alternative host-plants suffered a more severe damage than those in the plain, and those of old and poor managed vineyard had more abundant pest population than

those of young and well-managed ones. On the other hand, cultivar and cultural system of the vine were another important factors affecting the pest population. The damage to the Kyoho cultivar in general was more serious than to the Italia cultivar, and in vineyard having two harvest (pruning) especially those harvested once in the summer and another in the autumn had a distinctly lower pest population than that of one harvest in the summer per year.

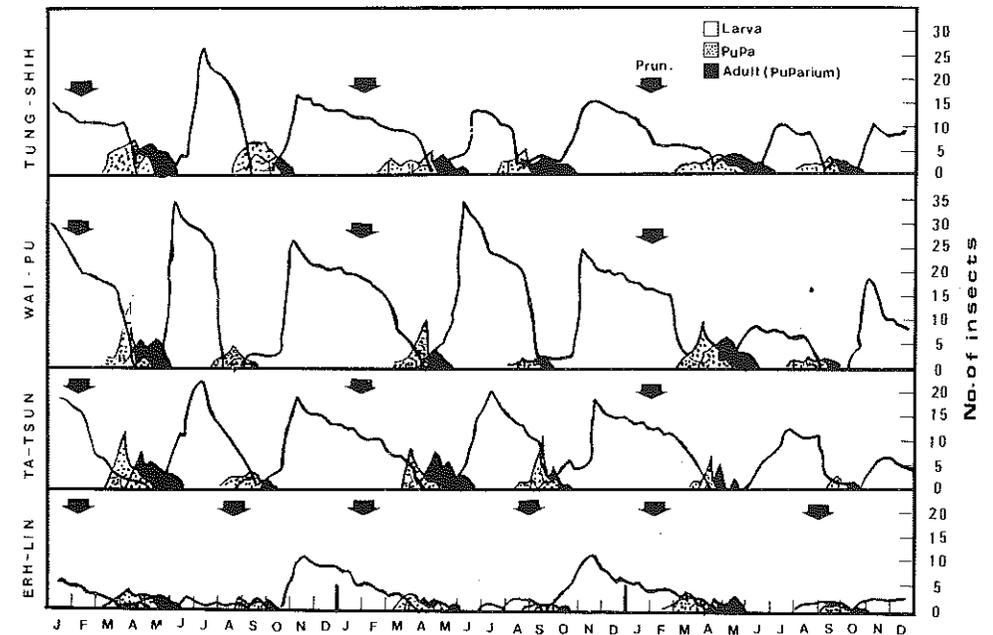


Fig. 16. The annual fluctuation of *Zeuzera coffeae* on the grapevine at 4 different areas in central Taiwan.

球莖夜蛾之生活史及田間發生調查

球莖夜蛾 (*Agrotis ipsilon*) 在室內定溫中，各蟲期發育所需之時間，隨溫度之升高而縮短。在 24~28°C 時孵期為 3~4 天，幼蟲期為 30~37 天，蛹期為 10~14 天，完成一代需時 45~55 天。在 12°C 之低溫下，幼蟲期長達 105 天，一代約 154 天。卵、幼蟲及蛹之發育臨界低溫分別為 8.7°C、6.33°C 及 5.6°C。有效積溫依次為 62.5 日度、666.7 日度及 256.4 日度。

幼蟲多數脫皮 5 次為 6 齡，但低溫時脫皮次數則增至 6~9 次。成蟲之雌雄性比為 1:1.15，成蟲壽命在 5~10 天，雌蛾比雄蛾略長。每一雌蛾可產 389~2458 粒卵，平均 982 粒。卵散產於接近地面之幼葉或莖上，少數產於枯葉中。3~4 齡以後幼蟲有潛土習性，晝伏夜出，切斷幼株食害，使造成缺株現象。年發生五世代，以發生于 4~5 月之第二代幼蟲為害最烈，甚者為害率可達 90%，但呈局部發生狀，平均之為害率僅 1.4%。由雄蛹腹部第九節性器呈兩個半球形隆

起，及雌蛾觸角鞭狀，雄蛾觸角羽狀等之特徵，可輕易辨別雌雄個體。

Life History and Field Occurrence of *Agrotis ipsilon* in Taichung District

In 24°C-28°C, the egg stage lasts 3-4 days, larval stage 30-37 days, pupal stage 10-14 days, and completing a generation required 45-55 days. In 12°C condition, the egg stage lasts 105 days, and completing a generation required around 154 days. The physiological zero points for eggs, larvae and pupae were also estimated to be 8.7°C, 6.3°C, and 5.6°C, respectively. The accumulated temperatures for the development of eggs, larvae and pupae were 62.5, 666.7 and 256.4 D.D., respectively. Most larvae undergo 5 moltings and become 6th instars. Sex ratio of adults is approximately 1:1.5 (female:male). Longevity of adult estimated around 5-10 days. It may deposit as many as 389-2458 eggs. It has 5 generations annually, and the 2nd generation in April



Fig. 17. The infestation of *A. ipsilon* on potato

and May resulted in the highest plant-cutting, reaching to 90%. The occurrence of the other 4 generations is not so obvious and damage is sporadic and slight, usually only 1.4% cutting rate. The hemispherical upheaval at the rear tip of the abdomen of male pupae, thread-like and plume-like antennae of the female and male moths, respectively, are useful characteristics for distinguishing the sex of this insect.

福壽螺之生態觀察

福壽螺為目前本省作物栽培之重要有害動物，主要為害生育初期之水稻及多種水生作物。在中部地區年可完成二個世代，一代需歷時 88~204 天，隨季節而異。卵呈紅色，常 3~4 層重疊而呈葡萄串狀。每一卵塊之卵粒數為 151~773 粒，每一雌螺每次平均產卵數 250 粒。卵期在 16°C 及 32°C 時分別為 60 及 11 天，卵發育最適溫度為 24~32°C，高於 32°C 或低於 20°C 時孵化率顯著受到影響。螺體最適成長溫度為 27~31°C。夏天幼螺生長至 70~80 天時達性成熟期，幼螺成長至 40~80 天時，發育速度最快，平均每 10 天成長 1.0~1.4 公克。水温低於 20°C 或高於 31°C 時福壽螺呈休眠狀態，在乾燥土壤或雜草中休眠可達 6 個月之久。將卵塊浸於水中達 6 日以上或將仔螺置於乾燥環境 3 日以上存活率顯著下降。

Ecological Studies on Water Snail, *Pomacea lineata* Spix

Water snail (*Pomacea lineata* Spix) is an important pest to rice seedling and most aquatic crops in Taiwan. It took 88 to 204 days for a generation, and there were two generations a year in central Taiwan. The eggs were laid in mass, looking like a cluster of red berries, which consists of 151 to 773 eggs arranging in 3 to 4 layers. In each egg-deposition-period, a female laid

about 250 eggs in an average. Egg stage lasted for about 60 days at 16°C and 11 days at 32°C. Optimum temperature for the eggs development ranged from 24 to 32°C. The hatching rate was affected distinctively when the temperature was higher than 32°C or lower than 20°C. The young snail took 70 to 80 days to reach sex mature stage in summer and the fastest body weight increasing period was recorded from 40 to 80 days after hatching, with an increase from 1.0 g to 1.4 g/10 days. Optimum temperature for young snail growing ranged from 27 to 31°C. The snails hibernated in mud when the water temperature was lower than 20°C or higher than 31°C. They could hibernate in the soil or weeds for more than 6 months when the paddy field was dry. The snail was a polyphagous pest. It can feed on most aquatic plants. Unfavourable condition such as submerging egg mass in water for more than 6 days or keeping the newly hatched snail in dry conditions for more than 3 days could reduce their survival rate remarkably.

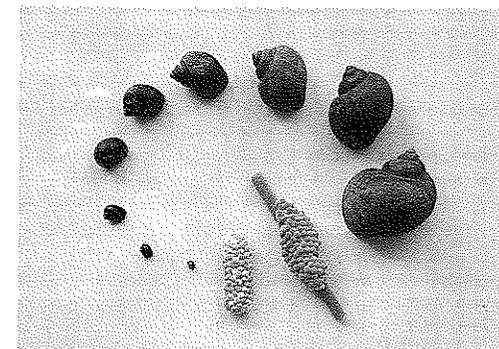


Fig. 18. Water snail *Pomacea lineata*.

稗草皺縮矮化病之病徵、寄主範圍及傳播

稗草皺縮矮化病於民國 69 年首次發現，其

主要病徵為分蘗增多，植株明顯矮化，葉色濃綠、葉緣形成鋸狀缺刻，並於罹病莖葉形成白色脈紋突起。罹病株多不能抽穗，能抽穗期顯著延遲，產生空殼粒。除水稗外，在田間小米、小麥亦為其自然寄主植物。試驗寄主包括黑麥草、玉米、龍爪稗、白茅、野稗及看麥娘等七種。

稗草皺縮矮化病由白背飛蝨 (*Sogatella longifurcifera*) 以持續性方式傳播。病毒在蟲體內之潛伏期 9.3 日 (6-17)。最短獲毒及接種時間分別為 2 小時及 30 分鐘。本病毒不能經卵傳播，亦不能以機械方法傳播，但以病毒汁液注射稗草幼苗，約有 5% 注射株能表現病徵。

Echinochloa Ragged Stunt: Symptomatology, Host Range and Transmission

Echinochloa ragged stunt was a new virus disease first found in central Taiwan in 1980 with characteristic symptoms on *Echinochloa crus-galli* var. *oryzicola* that included excessive tillering, severe dwarfing and the production of malformed leaves with serrated margins and veinal swellings. Infected plants appeared darker green than normal. They failed to head or showed a delay in heading time to result in the formation of empty grains. Besides *E. crus-galli* var. *oryzicola*, *Setaria italica* and *Triticum aestivum* were found to be other natural host plants of ERSV. Seven graminaceous plant species infected with ERSV were *Lolium multiflorum*, *Zea mays*, *Oryza sativa*, *Eleusine coracana*, *Imperata cylindrica*, *E. crus-galli* var. *formosensis*, and *Alopecurus aequalis*.

The planthopper *Sogatella longifurcifera* transmitted ERSV in a persistent manner. The virus had an incubation period of 9.3 days (a range of 6 to 17 days) in the insect vector. The minimal acquisition and inoculation access periods were 2 hrs and

30 mins, respectively. No transovarial passage was observed. Rubbing of *E. crus-galli* leaves with virus did not result in plant infection. However, about 5% of *E. crus-galli* seedlings became infected when virus crude sap was injected into vein tissues.

水稻縞葉枯病主要感染時期之推定及適期防治試驗

縞葉枯病為近年臺灣第一期稻作之重要蟲媒毒素病害。其病徵潛伏期約 25~38 日，視接種時之季節（氣溫）及水稻植齡而異。在田間約有 86% 之罹病株的病徵在插秧後 61~100 日出現。根據田間斑飛蝨棲群密度消長，縞葉枯病感染時期在插秧後 40~60 日間，當第一世代斑飛蝨密度開始增加時，噴佈 25% Buprofuzin W. P. 1500 倍液一次，防治媒介昆蟲斑飛蝨 (*Laodelphax striatellus*) 使縞葉枯病之罹病株率比不處理區約減少 55%，推測實施大面積防治媒介昆蟲時，將可更有效控制縞葉枯病之發生。

Studies on the Time of Rice Stripe Virus Infection and Field Experiments on Disease Control

Stripe has become a major virus disease of the first rice crop in Taiwan since its wide occurrence in 1984. The disease showed a latent period for symptoms varying from 25 to 38 days with the seasons (temperature) and plant age at time of inoculation under the field condition. The infected plants exhibited symptoms at about 40 to 60 days after transplanting. Field survey indicated that about 86% of the diseased plants of the 1st rice crop were infected with RSV at the 2nd infection peak with symptoms appearing 61 to 100 days after transplanting.

For the suppression of the 2nd infection

peak, application of Buprofezin made between 40 and 60 days after transplanting, *i.e.* immediately after the population of the 1st generation of vector insect was increased, reduced the disease incidence by 55%. A better result would be expected when a large scale of insecticide application is adopted to control the vector of RSV at the critical time pointed out above.

葡萄葉斑病之發生與防治

葡萄葉斑病由 *Alternaria alternata* 真菌所引起，主要危害葉片，自 5 月中旬開始出現病徵，至 8~9 月收穫時為發病盛期。發病期間平均溫度為 25~30 °C，相對濕度在 80~91% 之間，二期作葡萄種植期間因平均氣溫及相對濕度降低，發病輕微。

本病原菌寄主範圍窄僅葱蒜、絲瓜、茭菜、萵菜、豌豆及桃發生病斑。不同葡萄品種對本病反應，金香種為感病品種，巨峰種為耐病品種，而義大利及黑后品種為抗病品種。

田間藥劑試驗結果：50% 依普同可濕性粉劑 (1000 倍)，24% 倍福朗乳劑 (800 倍)，80% 大富丹可濕性粉劑 (800 倍) 及 80% 錳乃浦可濕性粉劑 (400 倍) 有防治效果。

Occurrence and Control of *Alternaria* Leaf Spot Disease of Grape

Alternaria leaf spot disease of grape caused by *Alternaria alternata* mainly cause damage on the leaves. The disease first appeared in the middle of May and became severe in August-September. High relative humidity (80-91%) and high temperature (25-30%) favored its occurrence. The incidence of the disease was low under low temperature and low relative humidity during the secondary crop season of grape.

Job's tear, sponge melon, coriander,

edible amaranth, pea and peach were the hosts of *Alternaria alternata*. Grape, Golden muscat variety was susceptible, Kyoho variety was tolerant, while Italia and Black Queen varieties were resistant to the disease.

Field experiment showed that 50% Rovral W. P. (1000×), 24% Befram E. C. (800×), 80% Difolatum W. P. (800×) and 80% Maneb M-22 W. P. (400×) were effective for the control of the disease.

蚜蟲傳染甘蔗嵌紋病之研究

甘蔗嵌紋病 B, D, S-4-S 及 S-4-M 型病毒，以 *Rhopalosiphum maidis* Fitch, *R. padi* Linnaeus 及 *Melanaphis sacchari* Zehntner 等三種蚜蟲，以接種單隻蚜蟲方式，由授毒植物 (donor plant)——玉米臺南 5 號，甜高粱 Mer 64-5 或 AM-4 品系，或甘蔗 C. P. 31-294 品系，傳毒至受毒植物 (receptive plant)——玉米臺南 5 號或甜高粱 AM-4 品系，結果顯示：以玉米為受毒者，發病潛伏期在一個月左右，甜高粱則在 20 天左右；以玉米為較佳受毒者，甜高粱有時不發病，發病率偏低。三種蚜蟲皆能傳播此病毒，但 *R. maidis* 不能將 B 型病毒由甜高粱傳播至甜高粱，亦不能將 D 型病毒，由玉米傳播至甜高粱；*R. paid* 不能將 B 型或 D 型病毒，由玉米傳播至甜高粱，亦不能將 S-4-S 及 S-4-M 型病毒，由甘蔗傳播至甜高粱。一般而言，*M. sacchari* 常能傳播這些病毒，但傳播能力不高。

當玉米病授毒及受毒植物時，三種蚜蟲對 B 型病毒之傳毒效果最好，其次為由甘蔗傳播 S-4-S 型病毒至玉米。S-4-S 型比 S-4-M 型較能經由三種蚜蟲，由甘蔗傳播至玉米；B 型亦比 D 型病毒較能經由三種蚜蟲，由玉米或高粱傳毒至玉米。當受毒植物為甜高粱時，無規則可循。

由甘蔗傳播 S-4-S 及 S-4-M 型病毒至玉米或由甜高粱傳播 B 及 D 型病毒至玉米，三種蚜蟲中，皆以 *R. padi* 之傳播能力最強。

Transmission of Sugarcane Mosaic Virus by Three Kinds of Aphids

With single aphid inoculation method, strains B, D, S-4-S and S-4-M of sugarcane mosaic virus from donor plants (corn cv. Tainan 5, sweet sorghum var. Mer 64-5 or AM-4, or sugarcane var. CP. 31-294) could be transmitted to receptive plants (corn cv. Tainan 5 or sweet sorghum var. AM-4) by *Rhopalosiphum maidis* Fitch, *R. padi* Linnaeus and *Melanaphis sacchari* Zehntner.

Latent periods of about 30 and 20 days were observed on corn and sweet sorghum, respectively, used as receptive plants. On sweet sorghum, symptom didn't occur sometimes and the disease incidence was low.

R. maidis could not transmit B strain from sweet sorghum to sweet sorghum, neither did D strain from corn to sweet sorghum. *R. padi* could not transmit B or D strain from sugarcane to sweet sorghum, neither did S-4-S or S-4-M strain from sugarcane to sweet sorghum. Generally, *M. sacchari* always transmits these strains, but has a low transmissibility.

When corn cv. Tainan 5 was used as donor and receptive plants, transmissibility of the three aphids was better for B strain than for other strains. Transmission of S-4-S strain from sugarcane to corn by the three aphids was also good, and was better than that of S-4-M strain. Transmission of B strain from corn or sweet sorghum to corn by the three aphids also was more efficient than that of D strain. When receptive plant was sweet sorghum, the transmissibility of the aphids was erratic.

Among the three aphids, *R. padi* was the most efficiency for transmission of S-4

-S and S-4-M strains from sugarcane to corn, or B and D strains from sweet sorghum to corn.

不同來源之紋枯病病原及不同溫度對蜀黍紋枯病發生之影響

紋枯病病原 *Rhizoctonia solani* 病原菌編號為 TC-RS-1, TC-RS-2, TC-RS-3 及 TC-RS-4 等四個菌株 (分別取自二林、后里、朴子及新社等四個蜀黍產區之病株) 與兩個蜀黍品系 2R 及 shallu, 以複因子設計試驗, 於溫室內種植後 20 天檢定, 結果菌株間致病等級差異顯著, 品系間感病程度亦呈極顯著差異, 而菌株與品系間亦呈極顯著交互效應。TC-RS-2, TC-RS-3 及 TC-RS-4 等菌株致病程度比 TC-RS-1 強且此三個菌株間致病性差異不大, shallu 感病程度較 2R 大, 而以相關性測驗結果, shallu 感病程度與全株鮮重、株高、根長等皆成極顯著負相關, 而 2R 却無關連。

蜀黍九個品系於不同溫度下種植含有混合菌株之土壤中並於種植後 30 天及 60 天時, 分別檢定感病程度, 結果 30°C 較 25°C 對 *R. solani* 之致病力有利, 而品系間及品系與溫度間之交互效應亦皆達極顯著差異, 由此可知蜀黍品系感染紋枯病受菌株及溫度之影響很大。

Virulent Level of *Rhizoctonia solani* and Their Effects on Sheath Blight Levels of Sorghum under Different Temperature

For investigating the virulence of *Rhizoctonia solani* which caused sorghum sheath blight, four isolates, TC-RS-1, TC-RS-2, TC-RS-3 and TC-RS-4 and two sorghum lines, "2R" and "shallu", were combined into a 4×2 factorial experiment conducted at the greenhouse of Taiwan University from Dec. 2, 1983 and tested 20 days after planting. The results indicated that the virulence among isolates, disease

level between lines and their interaction were all highly significantly different. The virulent levels among TC-RS-2, TC-RS-3 and TC-RS-4 were not different but all higher than TC-RS-1. The seedling sheath blight level of shoot fresh weight, plant height, root length etc. all were highly significantly correlated, but not in 2R.

Nine lines of sorghum were tested for the sheath blight levels under different temperatures by mixed isolates of *R. solani* and tested 30 days and 60 days after planting in two different sowing date experiments. The result indicated that it was more favorable to the development of *R. solani* at 30°C than at 25°C. The sheath blight levels among the tested lines and the interaction between temperature and lines were highly significantly different. It may make conclusion from these experiments that sorghum sheath blight level was affected greatly by different isolates of pathogen and temperatures.

農業機械 Agricultural Machinery

滾筒摩擦式碾米機用於薏苡脫殼試驗改良

薏苡種實外殼堅實, 胚乳中央縱軸有一縱溝, 脫殼時受兩脫殼滾筒擠壓會產生應力集中現象, 極易造成破碎情形。目前一般市售滾筒摩擦式小型家用碾米機, 脫殼滾筒硬度為 95 度, 轉差率約 40%, 以此種碾米機作為薏苡脫殼, 其試驗結果顯示, 滾筒間隙在 50% 薏苡寬度時, 薏苡脫殼率可達 80% 以上, 但破碎率亦高達已脫殼部份之 80%, 嚴重影響商品價值。

經改用不同硬度之脫殼滾筒並調整滾筒轉差率發現, 較軟的脫殼滾筒能有效的降低破碎率。試驗結果, 薏苡含水率在 13% 以下, 使用硬度為 75 度之脫殼滾筒, 配合 35% 的轉差率, 在 40~

45% 薏苡寬之滾筒間隙下, 薏苡經兩次脫殼後脫殼率可達 80%, 破碎率則降低至 10% 左右。

Studies on the Improvement of Adlay's Huller

This experiment is focused on decreasing the milling breakage rate of adlay grain by using a conventional rice-huller.

Most of adlay grain was broken under the roller type rice-huller. It was found that rubber roller hardness, clearance and slippage between twin rollers were the three major factors correlated to the kernel breakage. More than 80% of hulling rate was obtained by using the roller type rice-huller, under 95° hardness, 40% slippage, clearance of 50% grain width and 80% breakage rate.

From experimental result, softer rubber rollers could decrease adlay breakage rate. Under conditions of 13% grain moisture content, 75° hardness, 35% slippage, 40-45% of grain width-clearance and twice dehulling process, 80% of hulling rate and 10% of breakage rate were obtained.

土壤與肥料 Soil and Fertilizer

彰化縣不同土壤肥力能限分類單位稻田之氮肥效應試驗

在彰化縣選擇屬於不同土壤肥力能限分類單位之稻田 10 處, 進行田間氮肥效應試驗, 在水稻品種相同之條件下, 結果顯示不同土壤需要不同氮素用量表土質地較粘重之土壤, 稻谷產量大於粗質地疏鬆土壤, 其氮素需要量較少。表土質地相同, 如底土質地不同, 則氮肥用量亦異。底土質地愈粗, 需氮量愈大, 每公頃每期作約需增加 10~30 公斤氮素。除質地有影響外, 土壤之肥力限制因子不同, 施氮量也有差異, 石灰質的土

壤需氮量較正常土壤為大, 稻谷產量較高 (LCb > LC), CEC 過小的土壤需氮量較大, 但稻谷產量反而較低, 排水不良土壤需氮量較石灰質土壤為小, 產量也較低。本試驗執行期中雨量少, 日照充足, 施用高於平年推薦量之氮肥, 在各試區仍明顯促進稻作增產, 低氮則明顯減產, 無氮區生育及產量最差, 10 處平均祇達高氮區之 76.6%。氮肥深施, 在中細質地土壤對稻谷增產效果大, 於此類土壤平均較對照區增產 5.7%, 且可減少施肥次數 2~3 次, 節省人力及氮素用量 (平均每公頃省 38.2 公斤), 但粗質地 (壤質砂土或砂土) 土壤氮肥深施則明顯減產。稻田施肥效果僅限於二期作排水不良土壤, 其他土壤施用無效。

Response of Rice to Nitrogen in Relation to Soil Fertility Capability Classification in Changhua Area

This experiment was conducted at 10 localities in Changhua Hsien, to evaluate the response of rice to nitrogen in relation to the soil characteristics specified under the soil fertility capability classification system. The results were as follows:

1. The N requirement of the same rice variety varied in different soils. Soils with fine-textured surface layer produced higher yields of rice grain and required less N than the coarse textured ones. Where surface soils had the same texture, N requirements varied with the texture of the subsoils; the coarser the subsoil, the more of N was required; their differences ranged from about 10-30 N kg/ha per crop. In addition to soil texture, several other fertility factors also affected the N requirements of rice; calcareous soils required more N than noncalcareous soils, and produced higher yields (LCb > LC); soils of very low CEC required more N but produced lower yields; poorly drained soils

required less N than calcareous soils and produced relatively low yields.

2. The weather during the experiment was sunny and less rain, and N applied at the rates heavier than recommended for average years still brought about marked yield increases at all experiment sites, and low levels of N application gave significantly lower yields. Plots without N showed poor growth and the lowest yields, with only 76.6% of the rice yield produced by high-N plots at the 10 sites.

3. Deep placement of N fertilizer gave a greater yield increase in medium to fine textured soils with an average of 5.7% increase over check plots. It can saving labor (2-3 applications) and N fertilizer (average 38.2 N kg/ha) expenses. However, deep placement of N in coarse textured soils (loamy sand or sand) significantly reduced the yield.

4. In Changhua area, slag showed slight effect only in the second crop and only when applied to poorly drained soils, but no effect in other types of soils in both seasons.



Fig. 19. Effect of nitrogen on rice in relation to soil fertility capability.

食用美人蕉肥料適量試驗

於民國 71~73 年，在南投縣集集鎮進行食

用美人蕉肥料適量試驗，經三作結果顯示三要素對食用美人蕉之效應，以氮素較大，鉀素次之，磷素較小。氮素用量間 (40、80、120、160 kg/ha) 以 120 公斤用量之粗製粉率較高，粗澱粉收量及其收益最大。磷鉀用量間 (36、54、72 kg/ha) 以 54 公斤用量之粗製粉率，粗澱粉收量最高。氧化鉀用量間 (120、180、240 kg/ha) 鮮薯產量、澱粉收量及其收益均隨鉀素用量增加而提高。食用美人蕉三要素施用量以氮素 120~160，磷鉀 36~54，氧化鉀 180~240 kg/ha 較為理想。

Experiments of Fertilization on Edible Canna

Two varieties of edible canna were tested at field with nine treatments of N, P, K fertilizers combination (N: 0, 40, 80, 120, 160 kg/ha; P_2O_5 : 0, 36, 54, 72 kg/ha; and K_2O : 0, 120, 180, 240 kg/ha) at Jhi-Jhi in Nantou Prefecture during 1982-1984. Nitrogen had the largest effect on yield of edible canna follow by K and P.

The application of nitrogen at the rate of 120 kg/ha and phosphate at the rate of 54 kg/ha obtained the best yield of fresh



Fig. 20. The edible canna.

tubers and starch. It was also found that the increased rates of potassium fertilizer had positive effect on the yield of edible canna. The results indicated that the best fertilizer combination for commercial production of edible canna were 120-160, 36-54, 180-240 kg/ha of $N:P_2O_5:K_2O$.

水稻再生節位之不同與氮肥之影響

本試驗之主要目的是要研究水稻生長後期施用氮肥可以促進稻株產生再生芽之真正原因以及稈稻再生特性之差異，以供改進再生稻栽培技術之參考。試驗結果發現：(1)在黃熟期施用氮肥可以促進稻株之光合作用，使其繼續製造碳水化合物，以利於延緩稻株之老化並產生再生芽。(2)成熟期水稻劍葉之碳素和氮素含量以及碳氮比之高低為該水稻收割後再生率高低之良好指標，碳素和氮素含量高而碳氮比低者再生力較強。(3)稈稻之再生節位次序完全相反，稈稻之再生芽是從接近地面之根部節位開始逐漸往上部之節位生長；秈稻之再生芽則從稻穗下面之第二節開始逐漸往下面之節位生長。由於稈稻之再生節位次序不同，稈稻之留樁高度也應不同，稈稻可以一次從接近地面之部位刈割也不致於將已經長出之再生芽全部割除，因而不但不會影響其再生力，更可節省再度刈樁之成本；秈稻於第一次刈割時應留高樁以免將已經長出之再生芽全部割除而影響其再生力，等下部節位長出再生芽後再刈割第二次。

The Difference in the Order of Ratooning Node between Japonica and Indica Rice and the Effect of Nitrogen Fertilizer

The objectives of this experiment is to study the reason why application of nitrogen fertilizer at the late stage of rice growth could promoted the growth of rice tiller, and the difference in the ratooning character between japonica and indica rice. The

results are summarized as follows:

Application of nitrogen fertilizer at the yellow maturing stage promoted the function of the photosynthesis of rice plants for the continuous production of carbohydrates, and thus delayed the incidence of the senescence of rice plants and stimulated the growth of ratoon tiller. The contents of total carbon and nitrogen, and the ratio of carbon/nitrogen in the flag leaves of rice plants at maturing stage are the good indicators for predicting the ratooning ability of rice plants after harvest. The rice plants with higher total carbon and nitrogen, and lower carbon/nitrogen ratio showed higher ratooning ability.

Japonica and *indica* rice are completely reverse in the order of ratooning nodes. The ratoon tillers of *japonica* rice first appeared on the nodes in the rooting area near the ground, and then gradually to the upper nodes; and those of *indica* rice first appeared on the second node under the panicle (usually the fourth node above the ground) and then gradually to the lower nodes. This difference in the order of ratooning nodes suggested that *japonica* and *indica* rice should keep different stubble length at harvest time for ratooning. *Japonica* rice should cut to the part near the

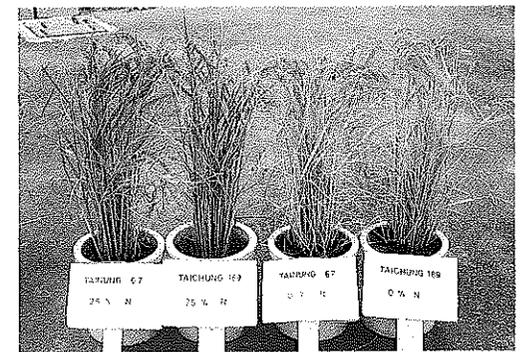


Fig. 21. Effect of nitrogen on the growth of rice tiller

ground without any worry of cutting too many germinated ratoon tillers; and *indica* rice should keep high stubble at the first cutting to avoid cutting off too many germinated ratoon tillers on the upper nodes and conduct the second cutting after the appearance of adequate ratoon tillers on the lower nodes.

液體複合肥料及鋅對菠菜生長之效果

本試驗於民國 74 年 11 月至 75 年 3 月在彰化縣永靖鄉微鹼性粘板岩沖積土舉行。全部試驗八個處理四重複，按逢機完全區集排列，各處理如下：(1)基肥追肥固體單質肥料、(2)基肥固體單質肥料追肥液體複合肥料、(3)基肥固體複合肥料追肥液體複合肥料、(4)基肥追肥均用液體複合肥料、(5)基肥追肥均用固體單質肥料並於基肥加硫酸鋅、(6)基肥固體單質肥料和硫酸鋅，追肥液體複合肥料。(7)基肥固體複合肥料和硫酸鋅，追肥液體複合肥料。(8)基肥追肥均用液體複合肥料並於基肥加硫酸鋅。試驗結果如下：

1. 本試驗田之土壤過份粘重，基肥追肥均用固體單質肥料時，土壤中之鹽分容易累積太高而影響菠菜之正常生長，因而產量最低。

2. 基肥追肥都用液體複合肥料時土壤鹽分較少，氮肥從土面之損失可能也較少，肥料利用效率似乎較高，生長較好，但到後期供應量減少，因而菠菜生長稍遜於基肥使用固體肥料追肥使用液體複合肥料處理，而優於基肥追肥都用固體單質肥料處理。

3. 基肥使用固體單質肥料或固體複合肥料而追肥使用液體複合肥料時，土壤鹽分之累積程度尚不致於影響菠菜正常生長，氮肥從土面之損失可能也較少，肥料利用效率似乎較高，基肥深施之固體肥料到後期仍可供應氮肥，因而菠菜之生長最好。

4. 本土壤有缺鋅現象，施用硫酸鋅可以促進菠菜生長，增進其利用化學肥料能力，以減少鹽分之累積，因而使用鋅各處理之菠菜生長都有優於未使用鋅處理之現象或傾向。

Effect of Liquid Compound Fertilizer on the Growth of Spinach

The soils in the experiment plots are rather heavy in texture (silt), therefore the treatment with solid single element N, P, K fertilizers both at basal and topdressing showed significant accumulation of salts in the topsoils to affect the normal growth and yield of spinach.

The treatment with liquid compound fertilizer both at basal and topdressing showed the lowest accumulation of salts, and the utilization of nitrogen seemed to be higher and thus promote better growth of spinach. However, the supply of nitrogen decreased in the later part of growing stage, this made the yield of spinach in this treatment be lower than those in the treatment with solid single element N, P, K fertilizers or solid compound fertilizer as basal and liquid compound fertilizer as topdressing, but better than those in the treatment with solid single element N, P, K fertilizers both at basal and topdressing.

The accumulation of salts in the treatment with solid single element N, P, K fertilizers or solid compound fertilizer as basal and liquid compound fertilizer as the topdressing was not high enough to affect the normal growth of spinach, and the utilization of nitrogen seemed to be higher due to the topdressed liquid compound fertilizer, and the supply of nitrogen in the later part of growing stage was still higher possibly due to the deeply applied solid fertilizers, therefore the growth of spinach in this treatment was the best, either with or without zinc.

The available zinc in the soil was too low, and application of zinc sulfate promoted the growth of spinach, and thus enhanced

the spinach to utilize chemical fertilizers and relieved the accumulation of salts in the topsoils. Therefore the growth of spinach in all treatments with zinc were either significantly higher or slightly better than those treatments without zinc.

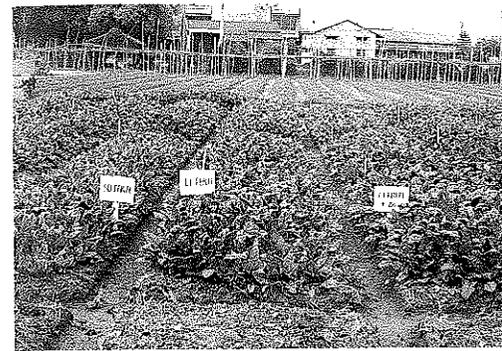


Fig. 22. Effect of liquid compound fertilizer on the growth of spinach.

氮素對春小麥農藝性狀及穀粒蛋白質的影響

小麥臺中 31 號及臺中選 2 號兩品種，於彰化大村鄉及臺中大雅鄉進行田間氮肥試驗，處理以 3 種氮素用量 ($N_1=85$ 、 $N_2=125$ 、 $N_3=165$ 公斤/公頃) 及 2 種施肥法 (A_1 =基肥及播種後第 25 天各施用 5% 氮素， A_2 =基肥及播種後第 25 天各施用 40% 氮素播種後第 40 天再追施 20%)，以探討施用氮素對本省春小麥穀粒產量、蛋白質含量及農藝性狀的影響，試驗結果如下：

兩品種之每平方公尺有效穗數、穀粒蛋白質含量均受氮素用量的影響，隨氮素用量之增加而增加，尤其以氮肥 165 公斤/公頃之效應最大。氮肥對穀粒產量之效應，在兩品種間有些差異，如小麥臺中 31 號在氮級 N_2 與 N_3 之間差異不顯著，但兩者之效應均較 N_1 明顯；小麥臺中選 3 號氮素用量間由 N_2 增加至 N_3 ，都有增產之效果。兩種氮素施用法對小麥穀粒產量之差異不顯著，但 A_2 施肥法，穀粒蛋白質含量，明顯的高於 A_1 施肥法。又以小麥之穀粒產量與蛋白質含量間之關係而言，顯示產量與蛋白質含量呈負相關，氮素用量間， N_3 及 N_1 較 N_2 佳。 A_2 施肥法

較 A_1 施肥法好。

Effects of Nitrogen on the Agronomic Traits and Grain Protein Content of Spring Wheat

In order to study the effects of nitrogen on the agronomic traits and grain protein content of spring wheat. Two cultivars were treated with three nitrogen rates [85 (N_1), 125 (N_2), 165 (N_3) kg/ha] and two application methods (A_1 : basal and one sidedressing, A_2 : basal and two sidedressings) in winter season, 1984.

Both cultivars showed that fertile spikes and grain protein contents increased when the amount of N-fertilizer was increased. The effect of N-fertilizer on the grain yield of wheat was slightly different between these two cultivars. Nitrogen rates at N_2 and N_3 showed no significant difference on the grain yield of Taichung 31, but both N-rates got much higher yield than N_1 . In Taichung S-2, grain yield significantly increased when nitrogen rates were increased from 85 kg/ha (N_1) to 165 kg/ha (N_3).

It also showed that no significant variation in grain yield between the two application methods of nitrogen, but the grain protein content in A_2 application method was higher than in A_1 application method. Protein content was negatively correlated to grain yield. The data suggested that N_3 and N_2 seemed to be better than N_1 , whereas A_2 seemed to be better than A_1 in considering both grain yield and protein content, although they were not statistically different.

氮肥對大麥產量與蛋白質含量之影響

本試驗採用中興 2 號二稜種大麥，於 72/73

年裡在彰化縣福興鄉及臺中縣外埔鄉兩處進行試驗，以探討不同氮肥用量及施用方法對大麥產量及蛋白質含量之影響。結果顯示氮素用量以每公頃施用 140 公斤及 100 公斤之籽實產量較氮素 60 公斤的產量為高。氮素施用方法以二次施肥法（基肥與播種後 25 天再施 50%）或三次施肥法（基肥與播種後 25 天各施 40% 及播種後 45 天再施 20% 等兩種施肥法對大麥籽實增產效果較佳，全量當基肥之一施肥法效果較差。籽實蛋白質含量則以氮素用量較少者有較低之趨勢，但氮素施用方法對蛋白質之影響則不明顯。

Effect of Nitrogen Rate and Fertilization Method on the Yield and Protein Content of Barley Grain

This experiment was carried out in the 1983/84 winter crop season at Waipu and Fushing. Two-rowed barley, Chungshing No. 2 was used as a test variety. The results suggested that the grain yields of barley from the nitrogen rates of 140 and 100 kg/ha were higher than that from 60 kg/ha. Nitrogen fertilizer splitted into two times (50% as basal and at 25 days after seeding, respectively) or three times (40% as basal and at the 25 days after seeding, and 20% at the 45 days after seeding) obtained higher grain yield than the whole rate applied once as the basal fertilizer. The protein contents of barley grain tended to be lower at the treatment of lower nitrogen rates. However, the effect of nitrogen application methods on the protein content in the barley grain is not significantly different between treatments.

農業推廣教育 Agricultural Extension Education

七十六年農業傳播工作

為加強農業傳播效能，重新組織臺中區農業傳播推行委員會，加強與大眾傳播媒介（電視、廣播、報紙、專業雜誌）及其他機關間的密切合作，運用現代化大眾傳播工具來教育農民，來加速農業推廣的效果。

一、製作教材錄影帶：共計

1. 蔬菜水耕栽培 (18分)。
2. 葡萄開花前、結果後之管理 (20分)。
3. 家庭式蔬菜水耕栽培 (38分)。
4. 良質米生產技術 (18分)。

二、製作農業報導電視節目：五分鐘單元錄影片

1. 東勢林場介紹。
2. 白鷓鴣飼養。
3. 蔬菜小菜蛾防治。
4. 創業青年種豬繁殖。
5. 絲瓜套袋技術推廣。
6. 岩棉栽培介紹。
7. 芒果產期調節。

三、製作幻燈片教材：葡萄害蟲之生態與防治 (18分)。

四、成立農業錄影帶圖書室：彙集全省各種農業推廣、企業管理、家政訓練及具觀賞教育性質錄影帶 120 支，並於 75 年 12 月份起、正式提供各鄉鎮農會借用觀賞。

五、與中廣分公司契約聯合製播“農業世界”區域性廣播節目，每星期日播一次，播出 45 分鐘。本場並提供農業報導節目錄音帶給中廣分公司臺北臺之快樂農家與好農家節目以及農業專業電臺之四健園地與農產市場等節



Fig. 23. Visitors from Brazil Parliament.

目，共三十六件。

六、發佈本場農業研究推廣新聞稿，計提供給報社雜誌 41 件，給電視臺 53 件。

七、編印發行臺中區農訊第八卷第四期。臺中區農業推廣簡訊第九卷一、二、三期計四期、臺中區農推專訊第六十四期至六十七期。寄送有關農業機關及臺中區下核心農民。

Agricultural Mass Communication Activities in 1987

In order to increase the efficiency of agricultural mass communication activities. Taichung District Agricultural mass communication Executive committee was reorganized to strengthen the relationship with the mass communication media such as television, radio, newspaper, and magazines, and other organizations concerned. The followings are the main mass communication activities carried out during the year of 1987:

1. Filming different kinds of video-tapes for teaching purposes.

- a). The water culture of vegetables (18 mins.).
- b). Pre-flowering and post-flowering management of grape-vine (20 mins.).
- c). Home style water culture of vegetables (38 mins.).

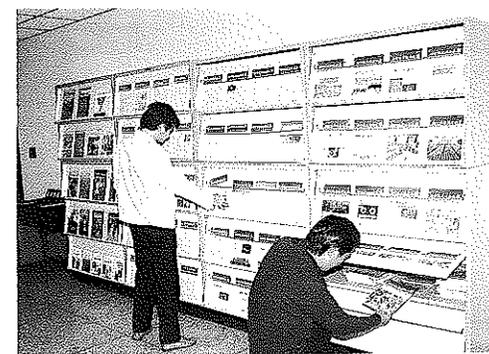


Fig. 24. Agricultural newsletters and special subjectmatter publications.

d). Production of high quality rice.

2. Making agricultural TV program: 5 minutes films.

- a). An introduction to Tungshih forest recreational center.
- b). The raising of special fowls.
- c). The control of diamond-back moth on vegetables.
- d). Propagation of hog breed by a young farmer.
- e). Paper-bagging of sponge gourd fruit to prevent melon fly.
- f). Utilization of rock wool for the cultivation of crops.
- g). Forcing culture of mango.

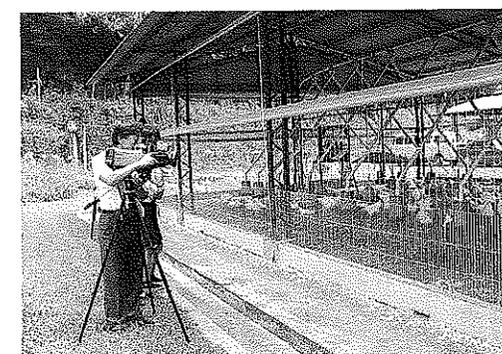


Fig. 25. Making agricultural TV program.

3. Producing color slides for teaching purposes: Ecology of grape-vine insects and its control.

4. Establishment of agricultural film library: A total of 120 pieces of video-tape covering agricultural extension, business administration, home economics and other educational video-tape have been collected in the library from all-over the province and lended to the township farmers' association since 1986.

5. Sponsoring a local radio broadcasting program "agricultural world" in cooperation with China Broadcasting Station. This program lasting 45 minutes is



Fig. 26. Recording of agricultural broadcasting program.

broadcasted once a week. Besides this station has also provided 36 pieces of agricultural reports to the "happy farm" and "good farm" programs of the China Broadcasting Station and to the "4-H club column" and "agricultural market" programs of the other broadcasting stations.

- This station has also provided 41 pieces of agricultural extension news to newspapers and magazines, and 53 pieces to TV stations.
- Some non-periodical agricultural newsletters and special subjectmatter newsletters were published and sent to the agricultural organizations concerned and the core farmers.

一年來之農業推廣教育工作

今日的農業推廣工作，為了適合現代化的農村建設之需要，其業務範圍包括下述三大特性：

- 為適應農業技術水準的提昇，農業生產活動的雜異化，相對的提高技術指導的水準及擴大其範圍，以提昇農業發展的層次。
- 為配合全體國民生活改善的願望，強調輔導農民生活質與量的改善觀念與方法，對經濟性、社會性、政治性與教育性的生活指導工作逐步予以加強，以提昇農村生活的品質。

三、為促進整體性的農業發展，配合農業政策的需要，規劃調整農業生產結構，輔導農民建立農企業的觀念，積極推動第二階段的農地改革與市場導向的農業活動，以提高農業生產的效率與利潤。

七十六年具體工作摘述如下：

1. 組訓核心農民部份：

對於區內基層農民講習訓練班，本場經常派員前往擔任講師，教導農民農業技能與農情政令方面的有關知識，76年度內支援講師的班次高達356班，受益農民數在13,838人次。

2. 農業訓練中心：

76年度辦理各項專業訓練班24班，接受訓練之基層農會指導人員計500人，核心農民幹部256人總計765人。為求提昇訓練效果。除講師自行發給講義參考資料，另由本中心工作同仁，收集講師的講稿以及有關資料彙編「臺中區農業推廣教材」發給受訓學員，做為講習訓練的教材，或用為補充參考資料。目前彙編發行「良質米生產技術」、「葡萄生產技術」、「玉米生產技術」、「高粱生產技術」與「農地法規與農地利用」等6冊。均採塑膠封面外孔式精美裝訂，可以長期保存。



Fig. 27. Training classes of home economics.

3. 農民服務中心：

本場的農民服務中心，隸屬於農業推廣課，其性質有些類似行政機構的馬上辦中心，其目的在於提供農民迅速而方便的服務，在76

年共計處理農民服務案件116,718件成果卓著，深受各方好評。

4. 創新農業技術諮詢服務模式：

技術諮詢研討內容限定單項主題，與會專家與農民均從事該一主題，在諮詢研討內容方面，更能相互溝通而切題，引發彼此的興趣，成果更為豐碩，本年度共辦理觀光果園、蔬菜、良質米、膳食營養等專題諮詢，出席農民共401人，出席專家41人，參加鄉鎮37鄉鎮，深受與會專家與農民的好評，認為較以往綜合模式更能收到推廣教育的效果。



Fig. 28. Meeting of consulting service for agricultural technique.

5. 加強農業研究教育與推廣聯繫：

農業院校協助辦理農業推廣業務，在農委會的積極推動下，本場與中興大學農學院及臺中、員林農校之間的合作，甚為好。

6. 培育青年農民，輔導四健會活動：

一方面由本場主動協調地方農會貸放「輔導農村青年創業與改進農業經營專案貸款」或其他可資運用的信用貸款，另一方面給予必要的農事技能訓練，培養其從事農業企業化經營之必要農業知識、技術與觀念，輔導青年農民創業，使之成為現代化農業的真正繼承人。

有關四健會活動的推展，除積極與學校及地方文化機構聯繫，並與各地救國團或教育文化組織密切合作，採寓教育於娛樂的方式，知識性與娛樂性並重的展開各類有益青少年身心的活動，不論農村或都市青少年，均對本場舉辦的活動甚感興趣。



Fig. 29. Field courses for young farmers at this Station.

Agricultural Extension Education During the Year

In order to meet the requirement of rural modernization, the current agricultural extension education is mainly laid emphasis on the following:

- Promote the diversified agriculture and raise the level of the agricultural technique of the farmers.
- Guide the activities of the farmers in all phases of activities covering economics, sociality, politics and education etc, to improve the quality of rural life.
- Help the farmers establish the concept of agricultural enterprise to facilitate the adjustment of agricultural structure for the overall development of agriculture.

The major activities in 1987 are summarized as follows:

- Training of the core farmers in the villages:
In total, 356 courses with a total of 13,838 trainees have been conducted for the farmers in the villages in 1986.
- Training courses at the training center of DAIS:

A total of 24 courses for the specific

farming technique has been conducted for the 765 trainees covering 509 members of farm advisors film farmers' association and 256 members of core farmers.

3. The service center for the farmers:

A service center for the farmers is established at the agricultural extension division of DAIS. This center provides prompt service to the question of the farmers. It has handled a total of 116,718 cases of the farmers' problems.

4. Consulting service for agricultural technique:

This consulting service is limited only on some single specific subject matter, and the invited specialists and the farmers should be majoring on that specific subject matter. Sightseeing orchard, vegetables, high quality rice, nutrition etc. were the subject matters that have been conducted consulting in this year. The participants consisted of 41 specialists, and 401 farmers from 37 townships. It is considered this kind of single subject matter consulting is more effective for the extension education purpose than the multi-subject matter one.

5. Strengthening the relationship between agricultural colleges and agricultural extension organizations:

Under the guidance of Council for Agriculture, Executive Yuan, this station has carried out many agricultural extension activities in cooperation with Chunghsing university, and the vocational agricultural schools at Taichung and Yuanlin.

6. Helping young farmers and guiding 4-H club activities:

Encourage the local farmers' associ-

ation to give loan to young farmers for the initiation of farm business of improvement in farm management. On the other hand, some training courses were carried out to help the young farmers obtain the necessary knowledge and technique of the farming and the new idea of modern farm enterprise.

4-H club activities were carried out in cooperation with schools and local educational organizations to help both rural and urban youth to become familiar with some agricultural knowledge and farming technique.

家政 Home Economics

農村早餐習慣與營養攝取之研究

本研究旨在瞭解農村早餐與營養攝取實況，經由農會會員名冊中分層隨機抽樣調查八百份之資料顯示：樣本空間大致認為早餐是三餐中最重要的一餐，但實際上三餐食用量分配以早餐最少，晚餐最多。早餐所攝取之熱量平均值為 501.3 仟卡，佔行政院衛生署建議國人全日攝取量之 23.2%，食用型式以米飯類為最多，其平均攝取量為 470.5 仟卡，僅佔全日建議量之 21.7%，因此早餐攝食的量與質仍有待改善。農村早餐來源以全部自己做為主佔 39.6%，型式以米飯類為主佔 65.0%，用餐地點以在家中食用佔 95.5%，用餐習慣上以每天都吃早餐者佔 80.0%，參加由農會主辦之家事改進班及膳食營養改善班者較能瞭解早餐之重要性，因此應加強此類班會組織與教育功能。

The Breakfast Eating Habit and Nutrient Intake of the Farmers

A study on the breakfast eating habit and nutrient intakes of the farmers in the rural area was conducted for 800 households

taken by stratified randomized sampling from the registers of farmer associations. The results indicated the breakfast was considered to be the most important meal in a day, however, the eating amount in breakfast was the least among the three meals. The average calorie intake from breakfast was 501.3 kcal/person accounting for 23.3% of daily essential calorie intake suggested by the government. Moreover, 65% of household favored rice for breakfast which provided 470.5 kcal occupying 21.7% of daily essential calorie intake suggested by the government. Therefore, some

educational programs should be conducted for the farmers to improve the quality and amount of breakfast. It also found that 39.6% of households made their own breakfast, 65% of them had rice as breakfast, moreover, 95.5% of them had breakfast at home and 80% of them had breakfast everyday. According to the basal data of ten subjects, people who usually learn home economics and dietary nutrient from the workshop of farmer association can understand the importance of breakfast. It is, therefore, an important course worth continuing.