

RESEARCH AND DEVELOPMENT

RICE RESEARCH

Effects of Nitrogen on Bacterial Leaf Blight of Rice

Nitrogen application increased the incidence and severity of bacterial leaf blight (*Xanthomonas campestris* pv. *oryzae*) of rice. The purpose of this study was to evaluate performance of three rates of ammonium nitrate application on this disease. Nitrogen concentrations were applied at 80, 120, 240 ppm by hydroponic culture in greenhouse. Inoculated XP 13 strain of *X. campestris* pv. *oryzae* were done at tillering and booting stages, respectively. One susceptible cultivar TN1 and one resistant rice line TSWY 7 were tested, responded similarly to the three rates of nitrogen at tillering stage, but differently at booting stage in respect to each tested rice material. At tillering stage, no significant differences were observed among three rates of nitrogen both the two tested rice materials. But the disease lesion length developed fast in the susceptible cultivar TN1 and was more longer than that in the resistant rice line. At booting stage, there was significantly different response to nitrogen concentrations in cultivar TN1 and no significant effects of nitrogen on rice line TSWY 7. The disease lesion length of cultivar TN1 was increased with der-

creasing nitrogen concentration. The results of this experiment indicated that effects of nitrogen on bacterial leaf blight development depended upon varieties and growth stage of rice.

Study on the Damage of Rice by the Dipping Water

The second crop of 1991:

1. The dipping water trial at the beginning growth stage: the effect of dipping day on rice productions was lower than check treatment by 28-100%, 25-100%, and 17-100% under three treatments of seven, five, and three dipping days, respectively. For the rice production, the effect of dipping stage treated after transplanting gave lower yield by 45-100%, 32-100%, and 17-100% under the treatment of first, second, and third week after transplanting, respectively.
2. At later growth stage, the dipping water resulted in the yield loss under the treatment of seven, five, and three dipping days by 49-65%, 45-56%, and 24-32%, respectively, compared with the check. The yield was lower by 27-65%, 24-63%, and 32-49% when the dip was treated at panicle initiation stage, full heading stage, and the third week after heading, respectively.

The first crop of 1992:

1. The dipping water trial at the beginning

growth stage: the effect of three dipping days on rice production was the least loss than check by 0-28%. On the other hand the effect of dipping stage treated by the first week after transplanting gave the least yield loss by 3-21%.

2. At later growth stage, the dipping water resulted in the yield loss under the treatment of seven, five, and three dipping day by 15-56%, 12-57%, and 11-44%, respectively. The yield was lower by 17-40%, 11-57%, and 12-20% when the dipping water was treated at panicle initiation stage, full heading stage, and the third week after heading, respectively.

Effects of Soil Moisture Regime on Growth and Yield of Rice (*Oryza sativa*. L)

This experiment aimed to research on saving irrigation water, improving soil aeration and rice root activity by drying the paddy soil. Two cultivars, Taichung 189 (Japonica type) and Taichung Sen 10 (Indica type) were used in the field and in pots under green house during the first crop and second crop of 1992. Soil moisture tension of 0, 0.02, and 0.04 MPa were the beginning points for irrigation. The results of field experiment showed that yield of Taichung 189 treated by soil moisture tensions of 0.02 and 0.04 MPa were 25 and 31%, respectively, lower than that by 0 MPa. The yield of Taichung Sen

10 treated by soil moisture tension of 0.02 and 0.04 MPa were also about 18% lower than that by 0 MPa. The results of pots experiment under green house were the same as that of field experiment. Root activity, root weight, photosynthetic rate, leaf water potential and stomata conductivity of rice by 0.02 and 0.04 MPa treatments were lower than that by 0.00 MPa. Two cultivars, Taichung 189 and Taichung Sen 10, had the same response to soil moisture treatment, but Taichung Sen 10 showed more resistance to water stress than Taichung 189. When soil moisture tension higher than 0.02 MPa on the vegetative stage, physiological function of rice would significantly decreased, the yield of rice declined as a result of reduced rice tillers. On the other hand, yield and eating quality of rice was not affected by water stress after the full heading stage. Rice responded to water stress during the vegetative stage more sensitively than after the full heading stage.

Influence of Planting Time on the Yield and Quality Characteristics of Rice cv. Taichung Sen 10 Grown in the Second Crop Season

The purpose of this study was to investigate the effect of late planting on the performance of yield and quality characteristics of indica rice cv. Taichung Sen 10 grown in the second crop season in central Taiwan. It was found that delay

of transplanting from August 5 to August 20 could extend the days needed to heading and maturity by 29 and 39 days respectively. Low temperature was considered as the main factor in affecting the growth duration of rice plants. In comparison with normal-planting treatment, a decrease of 65% in grain yield was recorded as a result of reduced filled-grain percentage and 1,000-grain weight for late-planting plants. Delay of transplanting also tended to decrease the width of brown rice and volume weight of both rough and brown rice. The protein content of rice grain increased while amylose content decreased significantly in response to late planting, presumably the result of abnormal starch synthesis and accumulation. Based on the consideration of economic land utilization, stable yield and high grain quality, early planting of Taichung Sen 10 cultivar in the second crop season was suggested.

WEED RESEARCH

Preliminary Studies on the Peroxidase and Acid Phosphatase Isozyme of Paddy Weeds.

In order to study the peroxidase and acid phosphatase isozyme zymogram of paddy weeds, the starch gel horizontal electrophoresis system was used on the organs of *Alternanthera nodiflora* R. Br., *Ammannia multiflora* Roxb., *Cyperus difformis* L., *Echinochloa crusgalli* Beauv.

var. *formosensis* Ohwi, *Fimbristylis miliacea* (L.) Vahl., *Leptochloa chinensis* (L.) Nees, *Monochoria vaginalis* Presl, *Sagittaria trifolia* L., *Scirpus juncooides* Roxb., *Scirpus maritimus* L. etc. which were collected from different places of Tatsuen, Changhua county. The results showed that the zymogram of *Echinochloa crusgalli* Beauv. var. *formosensis* Ohwi, *Leptochloa chinensis* (L.) Nees, *Alternanthera nodiflora* R. Br. and *Fimbristylis miliacea* (L.) Vahl. had more clearer pattern than other weed species. Furthermore, the zymogram analysis of *Echinochloa crusgalli* Beauv. var. *formosensis* Ohwi and *Leptochloa chinensis* (L.) Nees showed that the existence of regulation of organ specification within different organs, but didn't show gene polymorphism between different plants.

RICE QUALITY

Study on Amylograph of Viscosity for Milled Rice Powder

The 8% milled rice powder of 60 indica and japonica type of rice varieties with different quality were evaluated for their viscosity by Brabenber's Amylograph. The data were analyzed by the method of cluster analysis. The result indicated that the viscosity of japonica and indica type of rice varieties could be classified into 4 groups and 5 groups, respectively. The relative breakdown for

japonica type was decreased, but the setback ratio was increased by the order of groups. The similar result was found for indica type, except the increase of breakage ratio. This indicated that the retrogradation of starch was also one of the major affecting factor for rice quality. Although amylose content is an important factor affecting retrogradation, but it is not the absolute limiting factor.

UPLAND CROPS

The Purification and Evaluation of Local Peanut Cultivars in Taichung District

A total acreage of 5,000 hectares of peanut were cultivated in Taichung district in which approximately 30-40% were cultivated with local cultivars. Although they were never officially released as a cultivar. Lichi-Tzae was the superior performing one among local cultivars. Because the local cultivars were adopted by farmers widely and cultivated for a long period of time, these cultivar performances gradually became poor and its productivity decreased. Therefore, the objectives of the present study were to evaluate the effectiveness of purification and selection for three local peanut cultivars and to examine the relationship between agronomic traits and the environmental effects.

Lichi-Tzae, Lichi-Tzae-fan, and Youdou-fan were used as the source

cultivars for purification. Purified lines for each cultivar were developed through utilizing mass selection in spring and fall planting in 1991. Progress from selection was evaluated in spring and fall planting seasons in 1992. In 1992, the C1 to C2 generations for each three cultivars and three check varieties were included to evaluate the grain yield in field experiment. The results indicated that the cultivar purification and selection would result in genotypes with larger seed size, higher grain yield, and greater harvest index than the original genotypes without purification. Nevertheless, progress is being made through purification and selection under two growing seasons. A continued selection and field evaluation to exploit purified peanut variety is needed. This purification task on local peanut cultivars was undertaken continuously.

Studies on Increasing Yield and Quality of Buckwheat

In order to promote the grain yield and quality of buckwheat in Taichung district, trials of nitrogen rates and application method were conducted. The preliminary results were summarized as followed:

The trials conducted in different locations indicated that the Tatsuen was better than the Erhlin and Puli in term of yield and quality of buckwheat. The Taichung Sel-Yu No.1 had good performance in grain yield. The Taichung

Sel-Yu No.1, Ibaraki Zairai, Hitachi Akisoba and Shinano No.1 had better performance in quality. The suitable nitrogen rate 60 kg/ha was suggested to be applied for Taichung Sel-Yu No.1 and Hitachi Akisoba. The nitrogen application method for buckwheat by using nitrogen 50% as basal and 50% as top dressing in 15 days after sowing was suggested.

Development of New Wheat Cultivar: Taichung 34

Taichung 34 is a spring Wheat (*Triticum Vulgare* Vill) with powdery mildew, leaf rust, and head blight diseases resistance, as well as high grain qualities for making wine-yeast. It has high yield potential and more stable than that of the extended cultivar Taichung Sel. 2. The original name of Taichung 34 'W-3' was introduced from Japan in 1983, and developed by pure line selection breeding at the Taichung DAIS. Taichung 34 was released as a recommended cultivar in March, 1992.

Taichung 34 which has 124 maturity days after planting is considered as a medium-early wheat variety. This variety has plant height in 95 cm and has 314 effective spikes per m². The seed weight is 50.6 gram per thousand seeds, and test weight is 888 gram per liter. Its starch value is 63%. The regional yield trials showed that the average grain yield is 4416 kg/ha, that is higher than the

Taichung Select 2 in 22%. Taichung 34 can be adapted to cultivate as an inter-winter crop in the paddy field after 2nd crop of rice, although the growth duration of Taichung 34 has 4 days later than the Taichung Select 2. Significantly, the 1000-seed weight, test weight, and the starch value of Taichung 34 showed that was superior to the Taichung Select 2.

For the resistance to the powder mildew and leaf rust, Taichung 34 has the same character as Taichung Sel. 2. Furthermore, Taichung 34 also showed good resistance to head blight, while the Taichung Select 2 was highest susceptible to that disease which could cause grain yield in decrease.

As Taichung 34 has the high tillering ability, spread planting method is recommended to be used, otherwise it may produce more ineffective tillers and reduce the grain yield. For managing wheat cultivation at paddy field in Taiwan, the inter-winter cropping of wheat followed by the 1st crop of rice is widely adopted in Taichung district.

Development of Newly Hybrid Line of Sorghum: Taichung-Yu 77-12

Taichung-Yu 77-12 is a newly hybrid combination of sorghum derived from the crosses between the restoring line of TCR-76432 and the cytoplasmic male-sterile line TCA-632. The male parent, TCR-76432 which was selected from the cross of 2R x TCR-76432, had the elite

traits of the semi-loosed head shape, well head exersion, and stable flowering time. While the seed parent, TCA-632, superior at the leaf zonat spot resistance, and stable flowering time. The results of regional yield trials showed that nonsignificant difference between Taichung-Yu 77-12 and the check variety Taichung No.5 on the traits of growth periods, plant height, head length, 1000-seed weight, and grain yield. The grain yield of Taichung-Yu 77-12 and the Taichung No.5 was 5,176 kg/ha and 5, 121 kg/ha, respectively. Although the grain yield data obtained were not superior to the check variety, Taichung-Yu 77-12 had the elite characteristics of easy to produce F1 seed, semi-loosed head shape and leaf zonat spot resistance. This elite hybrid will be offically named and released after the experiments on fertilization and plant density were done.



Fig. 1. Newly Developed. Hybrid Sorghum. Taichung-Yu 77-12.

VEGETABLE CROPS

Inheritance of Stringless Pod in Pea (*Pisum sativum* L.)

By crossing the stringy varieties of Taichung 11, Taichung 12 and Taichung 13 with stringless variety of Sugar Daddy, all plants of the F1 and backcross to the stringy parent had stringy pods. These results showed that stringlessness is a completely recessive character. Due to small number of stringless plants and no obvious or consistent pattern in segregation ratios in the progenies of F2 and backcrosses of F1 to the stringless parent, it is difficult to determine how many major genes controlling the stringlessness. Fixed differences in degree of stringlessness observed among the stringless parent and segregating populations indicated that there are modifying genes affecting expression of this trait. The lower percentage of stringless plants recovered in segregating generations in the winter crop than those of summer crop within each cross showed that temperature had influence on the expression of stringlessness.

Study on Bulb Dormancy of Garlic

The duration of dormancy period between different varieties and clover sizes of garlic (*Allium sativa*) were studied. The changes of bud length and weight of clover under indoor storage

indicated that the dormancy period for three varieties Hsiehchia, Yuanlin and Homei is 10, 14 and 16 weeks, respectively. The bud length of Hsiehchia, Yuanlin and Homei began increased markedly at 5, 6 and 8 weeks after cold storage. There was 2 to 4 weeks difference of dormancy period between different clover sizes of the same variety (Hsiehchia). The larger of clover size, the shorter of dormancy period, and the smallest clover size have the longest dormancy period.

Pathogenic Specialization of *Uromyces Phaseoli* in Taiwan and Rust Resistance in Beans

The urediniospore samples of bean rust, *Uromyces phaseoli*, were collected from central Taiwan for single spore isolations and pathogenicity tests. Seven races, TW-1 - TW-7, were identified by using 19 differential varieties of beans. Among those cultivars, US. #3 and Pinto 650 were susceptible and cultivars Mexico 309, Actopan x Sonilac Selection 37 (AxS 37), NEP-2, Compuesto Negro Chimaltenango (CNC) were either resistant or highly resistant and immune to Taiwanese races. 30% isolates of the pathogen from our collections similar to the race TW-1 in virulence reaction. Race TW-1 is probably the most common race of rust on *Phaseolus vulgaris* L., in central Taiwan. Most of the cultivars of Taiwan beans were susceptible to all of

the seven races, but cultivar Taichung #1 was resistant to races TW-2, TW-3. The cultivars of BARC-RR-13 and PI's were highly resistant to all of seven races. They may be potential germplasms for improving the rust resistance in the cultivars of Taiwan beans.

The Cultural Technique of Utilization of Bitter Melon Grafted on Luffa Rootstock

Bitter melon is tolerant to heat condition, but the stem and leaf could not tolerate the windy and rainy weather, especially in summer season. This is the major factor of plant wilting and yield reduction. Reports indicated that except bitter melon and bush pumpkin, most cucurbitaceous crops are resistant or tolerant to wilting disease. In order to improve the cultural conditions and ensure the production of bitter melon in summer season, the grafting method is adopted. The study of grafting different scions on bitter melon have revealed that pumpkin and bottle gourd are not good scions due to low grafting survival rate and incompatibility of grafting union. Using the long fruit luffa variety grafted on bitter melon have produced very successful union and vigorous plant growth. Results indicated that this grafting technique have increased the disease resistance of bitter melon, extended the harvesting period by 27 days, increased yield by 94% and improve fruit

quality. It will be recommended to the growers.

Effect of Mulching Materials on the Flower Bud Quality of Zingiber Mioga Rose

Effect of mulching materials and shading on the yield and quality of flower buds of *Zingiber mioga* were studied. Results indicated that shading could increase the flower bud yield by 8.5 to 20.1%. The shading material of nylon not with 50-60% shading have the best effect on yield, but no enhancement effect on quality of flower bud. Thus, it was not recommended this shading materials to growers. Among the mulching material, black-silver PE film have the best effect on quality of flower bud with less fiber and crisp pink bud, but have lower yield (39.7% yield reduction) due to poor air and moisture permeability. Although white non-woven have good light transparency, but the flower bud tend to be become unacceptable dark red due to light transmittance. Rice hull mulching could slightly reduced flower bud yield by 16.7% compared to control, but it produced acceptable bud quality. So it will be recommended to the growers.

FLORAL CROPS

Effect of Rehydration Timing on Quality of Cut Chrysanthemum (1) Water Uptake and Transpiration

Chrysanthemum cut flowers rehydrated in water for 4 hours at time intervals of 10 minutes, 2, 4 and 6 hours after cut from field. Water uptake and transpiration rate of cut flowers during rehydration were investigated. After flower rehydrated, cut flowers were packed in cartons over night and then vase life and flower qualities were determined from 2nd days to 19th days. The cut flowers were laid in shading condition after cut from field. The amount of water loss of cut flower were 0, 1.75, 2.1, and 3.36% for the treatments of 10 minutes, 2, 4, and 6 hours, respectively, while compare with the initial weight of cut flower. The amount of water uptake were 3.24, 4.94, 3.72, and 4.37% measured from above 4 treatments after 4 hour of rehydration. Transpiration rates were 6.47, 2.18, 2.45, and 2.51%. Vase life were 10.9, 12.2, 10.7 days for the treatments of 2, 4, and 6 hour shading before rehydration. The vase life of flower rehydrated in 10 minutes after cut was longer than 19 days and the flower quality was better than the other treatments.

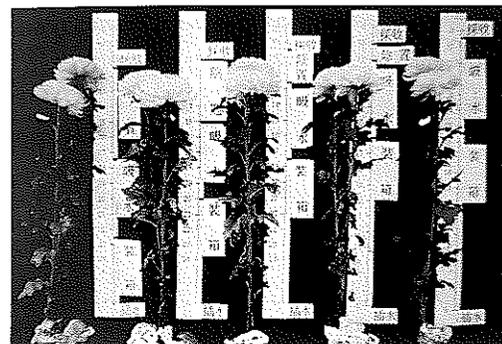


Fig. 2. Quality of Chrysanthemum cut flower in different time intervals. The cut flowers were treated by 4 hour-rehydration at time intervals of 10 minutes, 2, 4 and 6 hours after cut from field (from right to left).

Improvement of Harvest Technique and Vase Quality of Gladiolus.

Gladiolus is one of the important cut flowers in Taiwan. Although it has high value, the studies related to the harvest technique and improvement of quality were rare. The aim of this study was set to compare the efficiency of small carrier in the practice of cutting flower, and to compare the vase quality of 20 imported cultivars. The results showed the small carrier did not reduce the time demand of practice significantly, but it made the works easier. Based on the bend of stalk, vase-life, size of floret, and the no. of enjoyable florets at the time of 1st floret reached stage 5, the cultivar. Peter pears and Dream party were better than others.

Investigation of Diseases and Insect Pests and its damage on *Strelitzia* spp.

Results of field investigation of diseases and insect pests on *Strelitzia* spp. in central Taiwan was summarized as follows. Three important diseases that was occurred at growth stage of *Strelitzia* spp. 1) Flower rotting, caused by *Alternaria* sp., the infected flowers stopped growing, resulted in off-shape flower type and unopen flower bud. 2) Bacterial blight, caused by *Pseudomonas solanacearum*, mostly appeared on hot and humid seasons during July to September. The leaves of infected plants became browning and wilting. 3) Leaf spot, the black spots occurred on leaf surface caused leaf wilting and eventually dropping. There are eight insect pests that was found during growth stage of *Strelitzia* spp. 1) *Postica* sp. have the highest population density during July, the larva gathered on underside of young leaves, 2) *Euproctis taiwana*, the larva gathered on leaf underside, occurred mainly on mid-July. 3) *Thosea sinensis* appeared on July, the larva mainly feeding on leaves. 4) *Eumeta minuscula* mainly occurred on September, larva feeding on leaves. 5) *Nipaecoccus filamentosum* seriously attacked leaves on October to November, masses of adult and larva have found around leaf areas. 6) *Chrysomphalus ficus* appeared on October to November, sucking the leaf

nutrient resulted in yellowing leaves. 7) *Bradybaena similaris* adults appeared on April to May, causing leaf yellowing by secrete mucus on leaves. 8) Green beetle, the adults appeared in mid May.



Fig. 3. *Pseudomonas solanacearum* on *Strelitzia reginae*.

FURIT TREES

Microscopic Observation on Flower Bud Differentiation of Mei (*Prunus mume*)

The flower bud differentiation of Mei (*Prunus mume*) at orchard in Puli area was observed by means of micro-techniques. After two years of observation, it revealed that the flower bud differentiation of Mei occurred from early July and completed in mid-September. The differentiation procedure of each stage was as follows: the reproductive apex forming at early July, the floral primordia forming at mid-July, the perianth primordia forming at late-July, the stamen primordia forming at mid-August, the carpel primordia forming at

late-August and the floral parts completed at mid-September.

The Effects of Production Location, Soil Conditioner and Growth Regulators on Harvest Seasons and Qualities of Loquat

The duration of flower bud differentiation of loquat at high altitudes was shorter, while the flower bud forming rate was higher and the ripened fruits were bigger and sweeter. But the shoots on trees of early flower bud formation bore less leaves and smaller fruits. Whereas the fruitset were late in those trees with strong vigor, they bore more leaves and larger fruits with high sugar contents. The leaves were increased after application of soil conditioner at the fruits harvested, but the stages of shoot growth cease and flower forming were latter than the controls. Spraying of cell division promotors during shoot growth converted some vegetative growth to reproductive growth and promoted flower formation. The fruit weight could increased by the sprays of cell division promotors at blooming and 25 days after flowering.

Production of Oriental Pear in Low Altitude in Taiwan by "Twice Bud-forcing" Cultural Practice

Oriental pear variety 'Shinkou' was treated with 0.5% of hydrogen cyanamide at August to September to enhance bud

emergence. One month after treatment, the buds underwent flower initiation when the leaves matured. At January of the following year, the flower formation was completed, the percentage of flower buds could reached at 35.9% to 45.1%. Then the trees were treated with 2% of hydrogen cyanamide to promote uniform emergence of flower buds. This cultural practices designated as "Twice Bud-forcing Culture". This method could solve the problem of bud dying and abnormal fruit shape to ensure the production of Oriental pears at lowland areas in Taiwan. And, in the near future this cultural practice may replace the high labor and high cost "Top-grafting method".

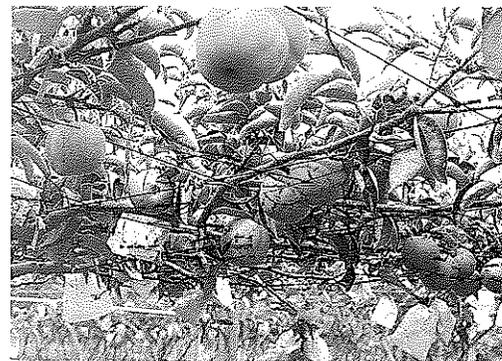


Fig. 4. Production oriental pear by "twice bud-forcing" cultural practice in low altitude in Taiwan.

Integrated Management of Pear Phylloxera *Aphanostigma piri* (Cholodkovsky) on Grafted Pear

Pear phylloxera, *Aphanostigma piri* (Cholodkovsky), injures pears wrapped

by the protection bag and causes fruit cracking and rotting. Spraying insecticides to pears with the bags already wrapped is usually ineffective. This work was carried out to investigate the proper measures which must be taken before fruit-bagging in order to effectively reduce the damage of this phylloxera. Full scale application of Sulfur 80% D.F. (400x dilution) 1 to 3 times between the harvest time in fall and next spring (September to February) reduced the pear phylloxera density by 76.6-81.2%. Dipping the scions in 80% Sulfur D.F. (200x and 400x) for 2 minutes could give 100% kill of the attached adults and eggs of pear phylloxera. Applying vaseline or some lubricating gel around the base of the grafts could prevent the phylloxera on the stocks to move in. In addition, dipping the open part of the bags in sulfur 52% F. (100x) could reduce 60% of the invasion of the pear phylloxera. Thus, the integrated management of the pear phylloxera involves: 1) spraying the pear trees at least once during fall/winter, 2) treating the grafts and bags, and 3) gel-applying around the graft base after grafting to cut off the invasion source. Full implementation of these measures could ensure proper control of pear phylloxera.

AGRICULTURAL ENVIRONMENT

Characteristics of Salt-Accumulated Soil under Protected Cultivation in the Central Taiwan

This study was to investigate the characterization of salt-affected soils under protected cultivation in the central Taiwan. The surface soils (0-60cm) from protected (30 sites) and unprotected cultivation (18 sites) were sampled to determine their electrical conductivity of soil solutions and concentration of water soluble salts. Salt accumulation was found in the surface soils (0-5cm) of the protected cultivation, and was more significant in slate calcareous alluvial soils than other three studied soil groups, i.e. sand stone-shale noncalcareous alluvial soils, sand stone-shale and slate alluvial soils and red soils. Significant correlations were shown between nitrogen as well as potassium fertilizers added and electrical conductivities of the soils under the protected cultivation. The concentrations of NO⁻ that was high enough to inhibit the crop growth were increased with the amounts of nitrogen fertilizer added. The regression equations between electrical conductivity and salt content of soil solutions (1:5) were found to be: Total Soluble Cation (cmol Kg⁻¹) = 0.114 + 3.62EC (1:5), r=0.957; Total Soluble Anion (cmol Kg⁻¹) = 1.31 + 5.16 EC (1:5), r=0.926. EC unit was in dSm⁻¹.

SOIL AND FERTILIZER

Effects of Different Organic Wastes on C, N, P Contents of Compost

In order to improve the maturity and nutrient quality of compost. An experiment was conducted to study the effects of different organic wastes on C, N, P contents of compost. Data showed that during the composting period, an increase in the content of N, P, K, and a decrease in C. When used sawdust and rice straw as carbon source, the loss ratio of N and C would be 31.1% and 58.7%, respectively, by using dairy waste as nitrogen source. The loss ratio of N and C would be 37.0% and 64.9%, respectively, by using chicken waste as nitrogen source. When used positive pressure aeration in composting the loss ratio of N and C would be 22.7% and 61%, respectively.

Composting and Application of Dairy Compost

Experiment was conducted to study the composting technology of dairy waste and the application effect of dairy compost. The result showed that both temperature changing pattern of compost and biological indices such as a germination test would be easily for farmer to make clear the degree of maturity. By adding urea and superphosphate at maturation could increase the total nitrogen and phosphate content

of dairy compost slightly, but increased the inorganic nitrogen content significantly. The high content of inorganic nitrogen would lower the germination rate of pai-tsai (*Brassica chinensis* L.). Therefore, it should be careful about the effect on inorganic compounds content of compost by adding chemical matter at the maturation. From of field experiments, the result showed that application of dairy compost could amend soil chemical and physical characteristics with lower soil bulk density, soil hardness and increased soil water content, pH., etc. There was significantly responded on both yield and quality of rose, bitter gourd, gladiolus and grape at the block of applied dairy compost.

Effects of Synergistic Crops in Inter-cropping System

The purpose of these studies were to compare the effects of synergistic crops on the growth of main crops in inter-cropping system. The results showed that the average yield of main crops under single-cropping with organic manure application were 11.3% higher than that with chemical fertilizer. Yield of main crops under inter-cropping system were higher than that under single-cropping, by 19.3% for sweet corn in the fall, 6.5% for potato in the winter, 36.9% for vegetable soybean in the spring, and 5% for garlic in the winter crop. In case that under using organic fertilizer, growing

sweet corn by inter-cropping system with bush kidney bean, green pea, flowering bean, peanut, edible rape and pole kidney bean in the fall, potato by inter-cropping with flowering bean, green pea and bush kidney bean in the winter, vegetable soybean by inter-cropping with radish, lettuce and Pai-tzai in the spring, garlic by inter-cropping with radish and spinach in the winter crop season are suggested to be good synergistic combinations.



Fig. 5. Field of garlic intercropping with green shell bean.

A Study on the Quality of Commercial Humic Acid Fertilizers

The study evaluated the quality of commercial humic acid fertilizers by analyzing their related features and compositions to soil and crops. The results showed that three of the eleven sampled products contained 8-10% humic acid which were slightly lower than the 10% down level of the Government standard on this kind of fertilizers. However, the ash

contents of the commercial humic acid fertilizers were below 32% and had significant differences among them indicating the various inorganic composition varied widely. As to the plant nutrient content aspects, they were listed as follows: 2.5-43.0% of carbon, under 0.25% of phosphorus which was similar to that of literature-issued 0.16- 1.60 of nitrogen, and humic acid from soil and ground water, 0.2-9.6% of sodium and 0.0-5.7% of potassium indicating products of higher content of sodium or potassium by using NaOH or KOH as original extractant for humic acid, respectively, under 0.67% of calcium, under 0.06% of magnesium, under 0.49% of sulfur which was lower to the published values of humic acids from soils or water bodies or composts, and under 0.01% of chloride to all the samples. Referring to heavy metal content aspects, the results are summarized as follows: under 3.39 ppm of arsenic, under 2.30 ppm of cadmium, under 11.9 ppm of chromium, under 21.8 ppm of copper, not detectable quantity of mercury except one liquid-type and one solid-type products, under 28.8 ppm of lead, and under 128.4 ppm of zinc to all sampled products. The results also showed that different extractable raw materials caused some products contained higher specific heavy metal elements. In the aspects of physical and chemical properties, all products but one are very

alkali with pH value of 8.8-10.4 which offsetted to that of so called academic humic acid with acidic feature. So it would be proper to know them as humic acid-containing alkali substances. The electric conductivity of 1: 250 or 1: 1000 diluted solutions of the sampled products were under 3200 umhos/cm and could be sprayed directly to soil without causing electric conductivity-induced harm to crops. All products' cation exchange capacity (CEC) were in 29-673 cmol/kg but the chemical groups contributed CEC were still obscure. The particle sizes of liquidtype products had two categories with one under 1 m and another over 5 m which could be divided into clay and silt-size respectively. The smaller particles would be more active on surface physical, chemical reactions and would be more effective to crop growth.

A Study on the Organic Farming of Sweet Corn and Vegetable Soybean in Central Taiwan

This experiment was conducted on an acid soil in the farm of Taichung District Agricultural Improvement Station at Tatsuen, Changhua. Three kinds of animal manures, hog manure, cattle manure, and chicken manure were respectively combined with rice hull, rice bran, and bone meal to make composts for the experiment. The experiment for sweet corn had been conducted without any chemical pesticides and any natural

pest control material. In vegetable soybean, only four sprays of sugar vinegar solution with the additives of $\text{Ca}(\text{H}_2\text{PO}_4)_2$ and KH_2PO_4 were applied. This was the third consecutive year of experiment.

The results of the experiment showed that continuous application of the three different animal manure composts made more positive effects to the soil than the negative effects. The main positive effects were increases in soil pH, organic matter content, available phosphorus, exchangeable potassium and magnesium, extractable manganese, zinc and copper, and decreases in soil salinity and extractable iron. The main negative effects were the increases in exchangeable sodium and extractable nickel and lead.

The responses of crops to organic farming were different with the kind of crops. Under 20% higher rate of nitrogen than that of the chemical fertilizer plot, the grain yields of corn in organic plots were all lower than that of chemical plot, and hog manure compost plot was the lowest. Chemical analysis for the plants in organic plots showed that corn plants were deficient in manganese, however, its higher phosphorus in corn grain seemed to be more favorable to the consumers. On the contrary, the tender pod yield of vegetable soybean in all organic plots were higher than that of the control, but their differences were not statistically different. Besides the significantly lower

nickel, cadmium, and lead in the tender pod of the organic plots suggested that its quality was better than that of the chemical plot.

The results of this experiment suggest that seeding cold tolerant varieties of sweet corn in November in central Taiwan may successfully avoid the damage of corn borer without using any chemical pesticides; and seeding vegetable soybean in the spring with occasional spray of sugar-vinegar solution may avoid the serious damage of thrip and other insect pests to obtain a good growth and yield.

PLANT PROTECTION

Studies on the Development of Bio-fertilizer

351 strains of fluorescent pseudomonads and 290 isolates of actinomycetes were isolated with King's B medium and peptone medium from rhizosphere and rhizoplane of cultivated cabbage, cucumber, radish, eggplant, kale and pea of natural infested soil. Dual cultures of each actinomycetes and fluorescent pseudomonads isolate against *Pythium aphanidermatum* were individually carried out on King's medium. Two strains of fluorescent pseudomonads (i.e. FP-13, Fp43) and two isolate of actinomycetes were hence screened out from this experiment. These soil microorganisms exhibited antagonism not only to *P.*

aphanidermatum, but also to other *Pythium* spp. and soil borne fungi.

A Baiting Technique for Assay of *Rhizoctonia solani* in Vegetables

According to the investigation on much vegetables including spinach, black mustard, ipomoea, lettuce and Chinese cabbage, we found that all of them had been damaged by *Rhizoctonia solani*, and among which, spinach and black mustard were the most serious. Because the angle-spinach-seed which was larger, angle-shape and light brown, a baiting technique using the angle-spinach-seed colonization method provided a rapid, sensitive and accurate means of assessing inoculum potential and population of *Rhizoctonia solani* in the soil of the vegetable field. The most of *R. solani* from soil was recovered when forty angle-spinach seeds were evenly distributed in 100g soil with 12-15% (w/w) water content and incubated for 24hr at 24°C. The angle-spinach-seed colonization method gave a significant correlation ($r=0.96-0.97$, $p<0.001$) between the amount of inoculum and disease severity of kale seedlings.

Studies on Ecology of Cucurbit Viruses

For the purpose to study the fluctuation of aphids and incidence of ZYMV and PRV-W in central Taiwan, the alate aphids were trapped by means of

yellow water pan (Moericke trap). During the period of May, 1991 to June, 1992, alate aphids were collected in quash field at Ta-tsun, Changhua. Among them, three species i.e., *A. gossypii*, *H. setariae*, *Malanaphis sacchari* rated 45%, 17% and 14% of total collections, respectively from May to October. During November to December, the majority of aphids collected belong to the *L. erysimi*, *M. persicae* and *A. gossypii*. The incidence of ZYMV and PRV-W in the quash field were detected by ELISA tests during 1989-1992. The results indicates two peaks of diseases incidence were detected during March to June and September to November. The spread of viruses into cucumber and the effects of these viruses on fruit yield were measured under field conditions in the Hsi-hu, Changhua on August, 1991. ZYMV and PRV-W were the major diseases detected in this experiment and they always found to be dual infection. The percentages of infected plants were 4 and 21% in seedling and flowering stage, respectively. When the test plants infected at seedling stage, the average number and weight of fruit per plant accumulated after harvest were measured about 18 and 42% of the virus-free plants; and about 80 and 92% of yield of virus-free plants when infected at flowering stage.

A Further Study on the Morphology of Rice Ragged Stunt Virus

Rice ragged stunt virus (RRSV) has been tentatively considered to be a member of the genus Fijivirus because it resembles most Fijiviruses in biological and other properties. The morphology of an intact virus particle has not yet been clearly determined, however. We prepared RRSV specimens for electron microscopy from diseased rice leaf tissue which had been prefixed in 2% glutaraldehyde (GA) or in a mixture of 1% acrolein and 2.5% GA in 0.2 M cacodylate buffer overnight. The leaf tissue pieces were finely cut in water with a razor and gently pressed. The crude sap was then mixed with an equal volume of 0.1% bacitracin and stained with 2% neutral phosphotungstic acid (PTA). Stained specimens were examined by a JEOL 200 CX electron microscope. Subviral particles 55-60 nm in diameter with an inner shell, and some smooth viral cores, about 50 nm in diameter, were frequently observed in dip preparations. The subviral particles retained some of the B spike as often seen also with other Fijiviruses. Occasionally, intact particles, 75-80 nm in diameter, with extruding A spikes were observed. The A spike was a papilla-like structure 13 nm in width and 10 nm in length. The possession of an outer shell as well as the A spikes by RRSV as demonstrated in this

study provides a basis, besides other known properties, for placing it in the Fijivirus genus. The close similarity of RRSV and Echinochloa ragged stunt virus (ERSV) in genome organization and in particle morphology, together with a serological relationship between these two viruses, may justify the inclusion of both RRSV and ERSV in a new subgroup, the fourth, of Fijivirus.

Screening Rice Varieties for Resistance to Bacterial Leaf Blight

Twelve released rice varieties were screened for their resistance to bacterial leaf blight at Tatsuen, Changhua county and Tali, Taichung county in 1st and 2nd crops of 1991. The rice plants were inoculated with five races of bacterial leaf blight pathogen with different virulence at late booming stage. Among the tested varieties, Taichung Native 1, 10 and Taichung Sen 3 showed the highest infected rate to five races of pathogen, followed by Kaohsiung 141 and Kaohsiung Selection 1. Other test rice varieties also reacted high infected rate to pathogen race XM-42 and XF-71-a. The varieties that showed high percentage of infected area and yield was greatly affected by bacterial leaf blight are Taichung Native 1, Taichung Sen 3 and 10, Kaohsiung Selection 1. While Taichung 65 and Tainung 70 showed medium rate of infected area and yield was also greatly affected by bacterial leaf blight.

Kaohsiung 139 and Tainan 9 showed medium rate of infected area to bacterial leaf blight, but yield was not significantly affected. Kaohsiung 141 have showed high percentage of infected area to bacterial leaf blight, but yield was not affected. It is recommended that Kaohsiung 141 is tolerant to bacterial leaf blight.

Population Fluctuations and Control Calendar of Major Insect Pests on Kidney Bean

In central Taiwan, soybean root miner (*Melanagromyza centrosematis* Kato), Soybean stem miner (*Melanagromyza sojar* Zehntner), smaller green leafhopper (*Edwardsiana flarescens* Fabricius) and bean aphid (*Aphis craccivora* Koch) are the major insect pests causing serious damage to young plants of kidney bean, *Phaseolus vulgaris* L. Spraying within 10 to 15 days after germination with bifenthrin (2.8% EC at 2000x dilution), cyhalothrin (2.8% EC 2000x) or naled (25% EC 1000x) has been found to be the satisfactory control measure. During the flowering and pod-forming stages, serpentine leafminer (*Liriomyza bryoniae* Kalt), two spotted spider mite (*Tetranychus urticae* Koch), eastern flower thrip (*Fraklimiella intonsa* Trybon), smaller green leafhopper (*E. flarescens*) and some lepidopterous insects are the major pests damaging the foliage, flower bud and peapod. Their populations reach

the highest peak during September to November. Two consecutive sprays of the following chemicals while the population density is still low (before flowering and pod-forming stages) have proved effective. The control chemicals includes fibenthrin (2.8% EC at 2000x), Cyhalothrin (2.8% EC 2000x), deltamethrin (2.8% EC at 1000x), *Bacillus thuringiensis* (3% WP 1500x), malathion (50% EC 500x) or cypermethrin (75% WP 4000x) etc. These insecticides may be used in combination or alternately, depending on the occurrence of these pests. If chemicals are needed to reduce the insect pests during harvest period, insecticides of low toxicity should be used in order to avoid leaving residues on the vegetable.

Studies on the Ecology and Control of Bulb Mite *Rhizoglyphus robini*

Rhizoglyphus robini constitutes > 95% of the mites found on floral bulbs. Laboratory studies indicate that 24 to 28 °C was the optimal temperature for the development of this bulb mite, which was unable to survive at 23°C. Under constant temperatures of 16, 20, 24, 28, and 32°C, the egg stage lasted 7.3, 5.0, 3.2, 2.2 and 3.2 days, respectively; the larval stage lasted 5.3, 4.1, 2.4, 1.7 and 1.9 days; protonymphal stage lasted 5.3, 4.8, 2.6, 2.0 and 2.5 days; and deutonymphal stage lasted 5.8, 4.9, 3.2, 2.7 and 2.4 days. Pre-egg laying period varied from 2.7 to 4.6 days and the longevity of adult mites

was 17 to 33 days. Between 53 and 190 eggs were laid by a female and the optimal temperature of egg-laying was 24 to 32 °C. *R. robini* preferred humid to drought conditions and was able to survive 10 days in water. The occurrence of this mite was related to the damage and disease infection of the bulbs, and application of organic matter also had promotional effect to this mite. In a laboratory test of dipping floral bulbs in solutions for 30 min and 1 hr and recording the mite populations after 1, 4 and 7 days, Selecron 43% EC, Supracide 40% EC, Tokuthion 50% EC and Imidan 50% WP gave approximately 90% control efficacy toward eggs, nymphs and adult mites. However, these chemicals gave < 80% control efficiency in the field. Application of Prochloraz 25% EC and Tokuthion 50% EC (2000-fold dilution) to dip the bulb and at 1 month after planting gave better control of this mite. In addition, dipping the bulb in water at 40°C for 2 hr or at 45°C for 30 min and 1 hr was able to eliminate completely *R. robini*. This station has already commissioned the manufacturing of content-temperature water baths for floral farmers to use treating the bulbs.

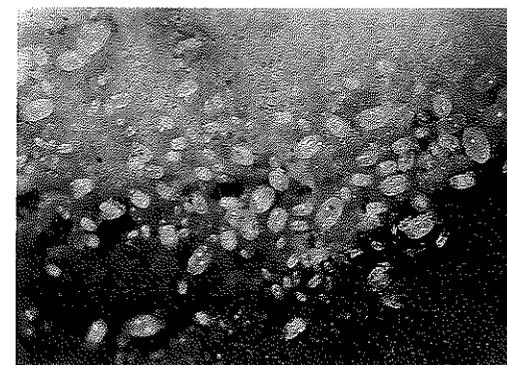


Fig. 6. Symptoms of flower bulbs damaged by bulb mite.

Control Efficacy of Several Miticides and Non-Pesticidal Substances against Mites on Crops

Thirty four miticides were tested in the laboratory for their efficacy against two spotted spider mite, *Tetranychus urticae* Koch and Kanzawa spider mite, *Tetranychus kanzawai* Kishida. Morestan 25% WP and Talstar 2.8% EC gave > 95.4% control of Kanzawa spider mite on roses, and Vendex 50% WP showed the best ovicidal activity with 92.4% mortality. Talstar 2.8% EC and Dicarzol 50% WP were most effective toward two-spotted spider mite on roses with > 91.4% mortality; Talstar 2.8% EC and Peropal 25% WP gave > 87% ovicidal control efficacy. Among the non-pesticidal substances tested, plant nutrient solution (Fuji 4551), Bai-lan detergent and Action Research caused > 86.3% mortality toward two-spotted spider mites on chrysanthemums; plant nutrient solution (Fuji 4551) and urea

(200-fold dilution) showed >94% control against both eggs and adult mites collected from snap-beans. Field tests revealed that Morestan 25% WP and Talstar 2.8% CE gave 99.3% and 98.5% control, respectively, against Kanzawa spider mite; Omite 57% EC and Morestan 25% WP were effective toward two-spotted spider mite, with mortality of 94.5 to 98.2%. With sticky tape method to test for the insecticide susceptibility, two-spotted spider mites were found to develop tolerance to several miticides while Kanzawa spider mite still retained its susceptibility. Thus the chemicals recommended for the control of Kanzawa spider mite remain effective.

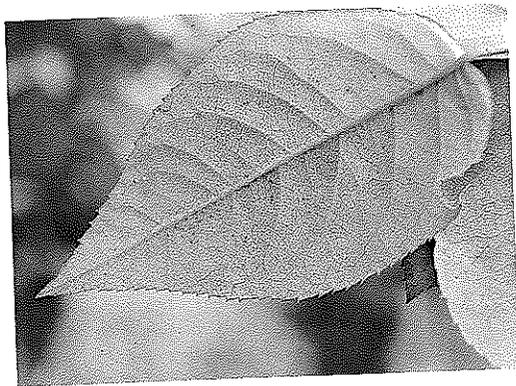


Fig. 7. Rose leaf damaged by Kanzawa spider mite.

Population Fluctuation and Control of *Liriomyza bryoniae* on Pea

Pea plants were usually attacked by tomato leafminer (*Liriomyza bryoniae*) since 20 to 30 days after sowing. The population density of the pest and their damage on plants increased gradually

with the plant development. The rate of infested plant and damaged leaf could reach 100% and 34%, respectively at population peak of the insect on the varieties of Taichung 11, 12 and 13. The average number of *L. bryoniae* adults attracted by a yellow sticky card in the pea field mulched with black plastic film, rice straw and non-mulching plots were 50.5, 195.4 and 281.1 per week, however, there were no significant difference of larva population density in pea plants among three mulching treatments. The yellow sticky cards and yellow water pans placed on the ground level attracted a significant higher number of adults than those placed higher than the crop. When water-pan trap was used, adding 4ml detergent in 1600cc water in a trap could catch more adults than other treatments. The female adults attracted by the yellow water-pan trap was 3 to 4 times higher than male adults. Among the chemicals tested, 75% Trigard WP 6000X showed the best control of the pest, rate of control reached as high as 90%. Using yellow sticky cards, yellow waterpan trap or plastic film alone for control of *L. bryoniae* was far beyond satisfactory, but when they were used integrated with chemicals in a wide area could reduce the damage of the leafminers.

AGRICULTURAL MACHINERY

Research of Manure Applicator

Popular use of manure can solve the recycling problem of domestic animals waste, also can improve soil condition and the quality of agricultural products. But manure application work is very bulky, need suitable machinery to help raise efficiency and promote large quantity of manure usage. This research was set to investigate and analyze the distribution and using efficiency of manure spreader in Taiwan and to assort manure spreaders into different categories for reference. Manure applicator are generally divided into two categories, the first one is spreader for uniform applying manure on field surface and the second one is furrower with applicator for line fertilizing between crop rows. The manure spreader is a kind of popular machine using in America, Europe and Japan from long ago and has a lot of different types. The result of this report assort those different types into four categories and furtherly divides into over ten kinds by different structures and functions. The furrower with applicator was developed in recent year for using in row crops. There are 40 or more spreaders in 9 brands distributed and used in Taiwan. From comparison tests result of a single one SASAKI GT-1110K spreader and manual spreading, the

efficiency of the spreader is faster than labor about 10 to 70 times. The profit of using spreading machine compared with labor are NT \$ 5594 saving per hectare when used for 50 hectare per year, and NT \$ 4319 saving per hectare when used by a single farmer for only 8 hectare per year. Right now, only few farmers use manure applicator in Taiwan. About how to popularize these machines such as establishing a system of contractor or developing multipurpose function spreader and so on are very important topics for further research.



Fig. 8. Field testing of the agricultural carrier with manure spreader developed by Taichung DAIS.

Development of Agricultural Carriers for Melons and Vegetable Farm

This studies is based on present manufacturing technique and using experience of agricultural carriers in Taiwan. Two carrier types were designed and developed in this project for providing in-field transportation and fogspraying functions in row fields. The

first type is a mini-carrier, travelling in furrow, and can attach a fogsprayer. The carrier is driven by 5.3 Hp gas-engine with continuous variable-speed transmission or centrifugal pulleys plus a gear box for 2 stages forward and 1 stage reverse speed shifting. The performance of the machine was set up as max. speed 18 km/hr and max. loading capacity 300 kgs. Besides loading plastic baskets and paper boxes, the mounting platform can rapidly attach or deattach a fogspraying equipment for concurrent function of protecting from diseases and pests. This make the mini-carrier got multi-purpose functions and can reduced operating labors. Because of furrow width limitation, the tread of the carrier is only 37 cm. If driven on rugged furrow with heavy loading, it will be in danger of side-overturning. This defect needs to improve in near future. The second type was designed a over-ridge type and light structured carrier, its tread can be adjusted from 100 cm to 150 cm. This carrier is driven by 7 Hp gas-engine, and loading capacity is about 1,000 kgs. It can use for transporting in different fields of different ridge sizes. Also it was prospected and scheduled to be a machine with planting, transplanting, harvesting function and etc.. These parts will be gradually designed and assembled in near future.



Fig. 9. The mini-carrier for vegetable and melon when carrying water melon in field.

Development of Labor-saving and Low-cost Auto-fogsprayer for Plastic House Culture

The automatic fog-spraying system was developed to control plant diseases and pests under the plastic house culture condition. The facility can either be operated automatically or manually at a desired interval. When the power transformer was adjusted to DC 90 V driving voltage and at a spraying pressure of 25 kg/cm², the moving speed of spraying frame was 2.5 km/hr. An amount of 32-liter pesticide solution for an area of 330 m² plastic house need 78 second to finish spraying by this system. The spraying nozzles can be moved either vertically or horizontally according to the plant height and distance between plants. The number of nozzles and spraying pressure readily set before operation of the equipment, the amount of pesticide will depend on the moving speed of

spraying frame. In the meantime, the distribution of droplet will be changed according to different speeds of spraying frame. A good spraying distribution was obtained at the speed of 2.0 km/hr and 2.5 km/hr. This system could save 40% of the pest control cost and also could save the amount of pesticide when compared it with the manual application. This system also able to apply chemical pesticide in accurate way so that to ensure the safety of the farmer who handle the toxic pesticides.

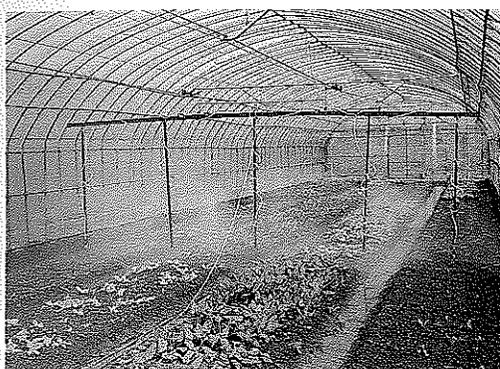


Fig. 10. Automatic fogsprayer is working in protected culture for multi-nozzles.

AGRICULTURAL MANAGEMENT

The Investigation of Enlarging Farming Scale-Entrusted Farming

In Taiwan, entrusted farming is the most effective method for enlarging the farming scale. The purpose of this study was to understand the status of entrusted farming in Taichung area during 1992. Data were collected from the information

of investigations for entrusted farming and direct visiting to farmers. The results were summarized as follows: 1) The operator of family farm received the entrusted farming from neighbouring farm. The areas included Lung-Ching Hsiang, Da-Yia Hsiang, Hou-Li Hsiang, Wai-Pu Hsiang, Da-Chia Chen and Tien-Chung Chen etc. A total of 33 farmer families received entrusted farming from 207 farmers families. Total areas of farmlands were 131 ha and the average acreage per household were increased from 0.89 ha to 4.89 ha. 2) Nucleus farmers or the teams received the entrusted farming from neighbouring farm by Farmers' Associations recommended. The areas covered Da-Yia Hsiang, Wai-Pu Hsiang, Da-An Hsiang, Hou-Li Hsiang and Da-Chia Chen etc. A total of 19 farmers families received the entrusted farming from 360 farmers. Total areas of farmland were 228 ha, and the average acreage per household were enlarged from 0.81 ha to 12.8 ha.

The goal of enlarging farming scale could be obtained through the entrusted farming. But in practical operation, related policies such as farmland reconstruction, paddy field diversion and fallow of paddy field, knowledge and confinement of law etc. should also be conformable with it.

Analysis on the Seasonal Fluctuation of Vegetable Prices

In order to obtain a long-term trend and seasonal fluctuation for the vegetable prices, 18 kinds of vegetable field price in their production areas were analyzed. Data were collected from 1983 to 1991. The results indicated that long storage life vegetables, such as wax gourd and onions showed smaller scale of price variation while kidney beans, egg plant and cowpeas showed larger scale of price variation in the long-term trend. For the aspect of the seasonal fluctuation on vegetable prices, in general, most vegetables were sold at their peak prices in April and September. Especially in September, wax gourds, Chinese cabbage, cauliflower, celery, radishes and cabbage were sold at their highest price, about 180% higher than their yearly average prices. In other words, the field prices of above mentioned six vegetables varied significantly with the changes of seasons.

Survey on the Efficiency of Fertilizer Application on Rice in Taichung Area

The purpose of this study was to understand the status of fertilizer application on rice in Taichung area and compare it with the fertilizer recommended by the Government Research Institutes. Data were collected by direct visiting to the rice farmers. The study was consisted of two parts: one was for the

general fertilizer application situation of 1,150 rice farmers, and the other was for the efficiency analysis of fertilizer application involving 150 selected farmers. The results was summarized as follows: 1) There was no significant difference in the application of N, P and K fertilizers between two rice crop seasons. Except K fertilizer, the amount of N fertilizer applied on three types of rice was statistically no significant difference in each crop season. The results obtained from this study was not coincident with the fertilization quantities recommended by the handbook of rice fertilizer application. 2) Owing to the labour shortage in the rural area, the application of compound fertilizer was increasing. However, it should be noted that the kinds of fertilizer used were not appropriate. 3) In general, rice farmers tended to apply more fertilizers than the recommended rate, particularly for japonica and glutinous rice, or for the K fertilizer during the first crop and N fertilizer during the second crop. 4) The present fertilization times for rice did not significantly differ from the official recommended times, but the method of fertilizer application was not appropriate.

AGRICULTURAL EXTENSION

Studied on the Guidance for Start-up Farmers in Taichung Area

Compared with the rapid develop-

ment of industry, agriculture in Taiwan grew slowly in the 1960's. Hence, farm productivity and family incomes tended to be lower than in other economic sectors. The rapid industrialization of this country drew the young peoper into the cities, and this made the problems of veteran peasants and part-time farmers even more serious. The education of rural youth is the foudation of future agricultural development. Those received specialized agricultural training to help obain a long-term and low-interest loads for funding farm start-up project or improving their farms. During this two years, a total of 208 rural youth were qualified to receive the low-interest loans from the government in Taichung area, but a total of 25 rural youth were rejected to receive the loan because they failed to meet the requirements. Results of the followups indicated that 51.1% of them was located at Nantou county, 93.6% of them was male farmers, 58.1% of them was 30-39 in age, and 48.9% of them had the diploma of senior high school, which about 33.8% was graduated from senior agricultural vocational school. The majority of loan is for guidance crops were ornamental plants, specialty crops and fruits. The most amount of start-up loans was NT\$ 1, 000, 000- 1, 990, 000 dollars about 33%, and the most duration of loan was 6-9 years about 68.9%. It was concluded from this survey that more

guidance in start-up farmers is necessary.

Studies on the Adoption of Protected Horticulture Technology by Rural Youth

In order to survey the adoption of protected horticulture technology by rural youth, a total of 209 trainees receiving an one-week specialized training course in 1989-1991 were evaluated by trainee fllowups according to the methods such as telephone interviews and questionnaires. The results indicated that 33.5% of trainees devoted themselves to non-agricultural job and 65.1% devoted to agricultural production. 28 trainees (13.4%) growing vegetables and using protected horticulture technology include 16 hydroponic vegetable farms and 12 protected structural vegetable farms. It was also found that the main factor of non-adopting new techniques was the cost of facilities too high. Consideration of the motivation of adopting hydroponic techniques was of industrial prospect, and then was of personal interesting. For the trainees worked at the protected structural vegetable farms, a marketing channal was indentified as the main reason, and then followed by the background of production techniques, personal interesting, industrial development in prospect. For the minority of trainees, the experts of Taichung DAIS and the extension workers of local Farmers Associations play an important role on

the impact on trainees adopting new techniques, but the most trainees decided to adopting new techniques by themselves.

Training Programs for Agricultural Technicians from Friendly Countries

As part of our national effort to strengthen substantial ties with countries friendly to us, Taichung District Agricultural Improvement Station has been carrying out training courses for foreign agricultural technicians. During 1985 and 1992, eleven sessions were organized with 124 persons from thirty seven countries participated. In order to evaluate the level of satisfaction from among the participants a questionnaire was distributed to 13 students attending a one month course in Rice and Upland Crop Production in Sept.-Oct. 1992. The result shows a 100% satisfaction with course content, 58% consider the faculty very good, 33% good. Teaching material receives a 92% of very good. 33% of the respondents think the length of the training course very good, 50% good. 58% think the food is very good. Only 50% think the living accommodation very good, another 50% good. As for recreational activities, 67% are highly satisfied while 25% are satisfied. A major reason for dissatisfaction in teaching was difficulties with the instructor's English. A preferred length of training program is two months instead of the current one month.

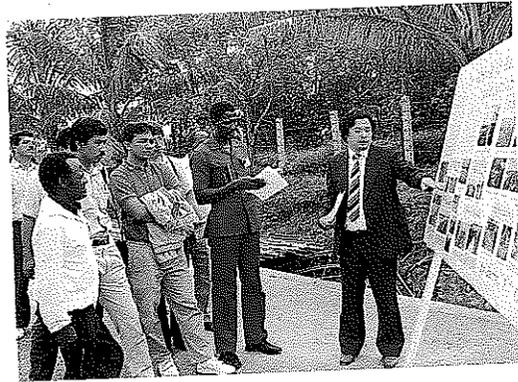


Fig. 11. The participants attending a study tour.

A Case Study on the Control Program for the Patients of High Blood pressure

Four patients of high blood pressure were selected from the members of home economic to deal with control program by daily diets and life guidance. Additionally, psychology, physiology, life style, dietary habits, their perceptions about high blood pressure and other related factors were analyzed. Results indicated that two of patients weren't take medicine for doctor's suggestion, and another two patients needed taking medicine continually. It was also found that the three of patient's over-weight were improved in the post-test. The total cholesterol of pre- and post-test were normal. The two of patient's triglyceride were abnormal in the pre-test, one of the patients was changed normal, and another one's triglyceride was decreased but still was abnormal in the post-test. The average score of perceptions about

high blood pressure was 67.5 and 85.0 in the pre- and post-test, respectively. Generally speaking, in order to promote the controlled effectiveness of high blood pressure, it is suggested that: 1) Promotion of nutrition and health education and guidance of a good dietary habits can prevent the high blood pressure. 2) Measure the blood pressure from time to time, then can prevention is better than cure. 3) In order to promote the controlled effectiveness of high blood pressure, the psychology, physiology and their life style and dietary habits were analyzed earlier on the control. 4) The high blood pressure to be cured for a long time, so patients need supports and assistance from other members in family. 5) The activity of control is good for the family because the controlled high blood pressure through balanced diet and daily life improvement.

RURAL LIFE

An Evaluation on the Control Program for the Patients of Chronic Diseases by Local Farmers Associations in Taiwan

The evaluated data of this study were based on the results of physical examination and their perceptions on the nutritional knowledge. A total of 11 chronic diseases controlled courses with 194 members throughout Taiwan on fiscal 1992 were evaluated. Terminal evaluation was employed by comparing

pre-test measurements with post-test measurements of change in patient's perceptions about the nutritional knowledge and patient's results of physical examination included uric acid, triglyceride, blood pressure, total cholesterol, weight and glucose fasting. Results indicated that there were significant improvement for the items of total cholesterol, blood pressure and nutritional knowledge, but the difference between pre- and post-test of the uric acid, triglyceride glucose and weight is very small, which might indicated that perhaps not enough time was devoted to long-term control of chronic diseases. Finally, in order to promote the effectiveness of this program, the following two prerequisites need to be concerned. Firstly, the Government has made great effort in helping the local FAs to enlarged initiate the controlled courses of chronic diseases. Secondly, strengthening the prevention and control of the chronic diseases by the training, education and mass communications.

A Preliminary Evaluation on the Program of Living Environmental Improvement in Farm and Fishing Villages

This program was based on the Projects such as Strengthening of Promoted Population Policy, Improvement of the Residential Environment in Farming and Fishing Villages and the Integrated Agricultural Adjustment Program, and

was approved by the COA from July, 1991 to June, 1997. The major policy goals are improving the living environment in farming and fishing villages, balance the difference between urban and rural areas, and slowdown the rural migrators left to the city and town. During the last two years, seven and sixteen villages were selected in fiscal 1991 and 1992, respectively. Most of public facilities of this program are repair or maintenance of farming road and renovation of rural drainage facilities, but few of greening or beautifying environmental improvement. Approximately, NT\$ 1,276 thousands of subsidies were used for each target village in Taichung, of which budget 17.9% is in local government. The working day of each target villages was 89.2 days, and 15 villages were selected by local government and one village was selected by local FAs in fiscal 1992. The implemented process of

this program can be indicated that were:
1) These constructions were executed efficiently, fast but poor qualitatively in the remote areas. 2) These target villages weren't selected to meet the integrated plan of the township. 3) The majority of target villages concentrated on the constructions and neglected for the greening or beautifying environmental improvement.



Fig. 12. Farmroad improvement of rural village in Tachia.