RESEARCH AND DEVELOPMENT

RICE AND QUALITY RESEARCH

Identification of Glutinous and Non-glutinous Rice in Moisture Condition

The present experiment was conducted to discriminate glutinous rice and non-glutinous rice when glutinous rice was sold to Farmers' Association in the form of wet rice. The results are summarized as follows:

Before drying, there was no difference in appearance of brown rice between non-opaque waxy kernels and non-glutinous rice. When rice grains cut into half were rinsed in the iodine solution, the endosperm of glutinous rice showed brown color but non-glutinous rice showed deep purple. However, the cutting process took more labor.

When it took more than 17 hours to reduce the moisture content of rice to 14% with the temperature of 45℃, brown rice of non-glutinous rice showed the better translucency than that of glutinous rice which turned into opaque. But when it took about 5 minutes to reduce the moisture content of rice to 14% with microwave, we couldn't distinguish non-opaque waxy kernels from non-glutinous rice by translucency of brown rice both of which kept translucent. It suggested that after using microwave to reduce the moisture content of rice under 18% at which rice grains were hard enough, and using kett dehuller and kett milling machine to convert rough rice into milled rice, milled rice were rinsed in the iodine solution, then non-glutinous rice could be distinguished from glutinous rice, due to milled rice of glutinous rice showing brown color, but that of non-glutinous rice showing deep purple.

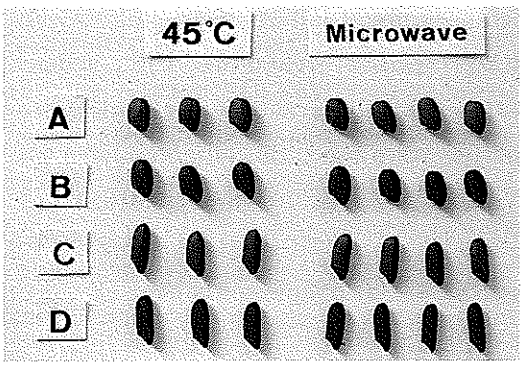

Fig. 1. The color reactions for milled rice of glutinous rice and non-glutinous rice in Idoine solution after drying. A: Taichung glutinous 70, B: Taikeng 9, C: Taichung sen glutinous 1, D: Taichung sen 10.

Establishment of Estimated Regression Model for Overall of Sensory Evaluation of Cooked Rice

117 rice varieties with different amylose content were used in the study. The general regression analysis was applied among physicochemical properties of rice quality and overall of sensory evaluation of cooked rice in order to

establish the regression model for overall evaluation of eating quality. The estimated regression model for overall of sensory evaluation of cooked rice, if based on the viscosity of milled rice flour, it was Y= -0.000562(Sb) +0.22037(RBd) -0.68627(C/H) +1.03301, Sb: setback, RBd: relative breakdown, C/H: total setback ratio. If based on the viscosity of extracted rice starch, the proper regression equation was $Y=-0.017647(GTI^s)-0.000188(P^s)+0.16332(RBd^s)$ $-0.32714(C/P^s)+1.06069$, GTI^s: gelatinization temperature of initiation, P^s: peak viscosity, RBd^s: relative breakdown, C/P^s: setback ratio. While general physicochemical properties were used, the suitable model was Y=3.69783(Ba) -0.010924(AC) -0.016333(SA) +0.20298(TS) -0.21049 (Lip) -0.04273(Pro) +0.13234, Ba: balance of cooked rice, AC: amylose content, SA: soluble amylose content, TS: total sugar content, Lip: lipid content, Pro: protein content. The results of combined all physicochemical properties including viscosity of milled rice flour, the best equation was Y=3.04484(Ba)-0.00037(Sb) +0.23907(RBd) -0.6118(C/H) +0.69057, Ba: balance of cooked rice, Sb: setback, RBd: relative breakdown, C/H: total setdack ratio. If viscosity of rice starch was included, the proper model was Y= 2.57177(Ba) -0.0156(SA) +0.11692(TS) $-0.05073(Pro) -0.01218(GTI^s) -0.000244(Sb^s)$ +0.54597, Ba: balance of cooked rice, Pro: protein content, GTI^s: gelatinzation temperature of initiation, Sb^s: setback.

Effects of Air Temperature and Solar Radiation on Rice Quality

Solar radiation and temperature are the two most important factors affecting crop growth. These two factors determined the crop production potential. Understanding for the production potential under various solar radiation and temperature, will promote the efficiency of management for crop production. This experiment aimed to investigate the effects of solar radiation and temperature on yield and quality of rice. The solar radiation was controlled by different degrees of artificial shading and the temperature was adjusted by different planting dates. Field experiment was conducted in Taichung DAIS during 1994. Three rice cultivars, Tainung 67 and Taicnung 189 of Japonica type, and Taichung sen 10 of Indica type were planted in March and September in 1994. About 4-6 seedlings were transplanted each hill. 80% and 50% shading were practiced to reduce solar radiation while control plots accepted full solar radiation. Experimental results showed that amylose contents were positively correlated with the differences of temperature between day and night during grain-filling stage. On the other hand, amylose contents were negatively correlated with mean solar radiation and mean temperature. Degrees of white belly and white center were positively correlated with mean solar radiation and mean temperature during grain filling stage, while they were negatively correlated with differences of temperature between day and night. Degrees of white center and white belly are negatively correlated with amylose and crude protein contents. Volumetric weights of rice grain were positively correlated with degrees of white center, white belly, and 1000-grains weight, respectively.

The Seed Fertility White Belly of Rice and Selection Rate of Elite Lines in Early Generations of Indica-Japonica Rice Hybrids

The eight crossing combinations of Indica and Japonica rice were made in 1993 by using Taichung Sen 10 and Tai-Sen yu 1774 as maternal parents and Tai Keng 6, 8, 9 and 10 as pollen donators. To investigate the F1 and BCF1 seed-fertility and grain shettering of F2 and selection rate of elite lines in F3 generations. In general, the grain shettering of hybrids are greater than their parants. However, the crossing of Taichung Sen 10/Tai Keng 9 was found to be the best in all cossing combinations, not only degree of shettering, less white belly in grains but selection rate (2.4%) of elite lines as well in this particular cross. The selection rate was about 4.2% in the back cross combination (BCF1).

Diallel Analysis of Bacterial Blight Resistance in Rice (Oryza sativa L.)

The main objectives of this study were to investigate the inheritance of bacteria blight (BB) resistance among the main breeding lines of Indica rice and Japonica rice, respectively. A total of 5 Indica rices (namely the susceptible TN1 and TCS10 and the resistant TCSW1, TSWY7 and TSWY1157) and 4 Japonica rices (namely, the susceptible TC189, the moderately susceptible TNG67 and TN5, and the resistant TKY6287) were used; their genetic inheritance of resistance against BB were explored by diallel set crosses. The F1 progenies generated were challenged with the XM42 strain of Xanthomonas oryzae pv. oryzae by clip inoculation at their maximal tillering stage in greenhouse and in field. The analytical method of Hayman (1954a, & b) was adapted to evaluate the hereditability of the resistance characteristics. The results obtained indicated that resistance among TSWY7, TSWY1157, TCSW1 and TKY6287 were all dominant gene conferred properties. In the presence of a complementary recessive gene, the dominance effect of these genes appeared to be partial; the maternal effect was not detected. In regard to the resistance expression among these resistant rices, an additive effect appeared to play a greater role as compared to that by dominance

effect. The overall performance of the F1 progenies indicated that the resistance of tested Indica rices were governed by polygene, whereas that of tested Japonica rices involved at least two genes. The heritability of these traits were all rated high--over 80%. The accumulated evidence suggested that pedigree method might be a feasible way for routine screening of the RBB resistance among bred rice progenies at their early stage of development.

Cultivation of Self-Growing Seedling on Rice in Taichung District

There are two labor-saving cultivations, directed-seeding and ratoon, on rice so far in Taiwan. Lately, the way that some farmers have utilized the dropping grains of rice as the direct germinated seedlings of second crop after the harvest of first crop, was temporarily called "cultivation of self-growing seeding on rice". The trial was studied the difference on the distribution of rice seedling.

We set up 6 - 9 investigated points on tillage and non-tillage lands, respectively. The seedling numbers per meter square were recorded after two week of harvesting rice and the tiller numbers per investigated point were collected at one week interval, besides investigating plant height after three week of havesting. The yields were callected and compared with the difference of quality after harvesting. The original results were showed as following:

The seedling and tiller numbers were decreased about 35 and 45 days, respectively, after germinating. The tillers per meter square, about 100 - 110 on the stage of reproductive growth, were 1/3 of machinery transplanting way. The distribution of seedling on tillage land was better than that on non-tillage, but the production cost was higher, in addition the rice quality of the former was better.

Development of Rice Cultivar 'Tai-keng Glutinous 5' in Taiwan

Rice cultivar 'Tai-keng Glutinooous 5' (Oryza sativa L.) (TKW5, formerly called bred line Tai-keng-yu 9480) is an early maturing, high-yielding, glutinous endersperm cultivar which developed cooperatively by Chiayi Experiment Station, of Taiwan Agricultural Research Institute (TARI) and Taichung District Agricultural Improvement Station (DAIS) by hybridization. TKW5 was officially released on December, 1995 through Rice Breeding Committee of Taiwan Provincial Government.

TKW 5 was selected from a cross Tainung 67/Tainan-waxy-yu 17 which made at Chiayi Station of TARI in 1987 and accomphished breeding works in Taichung DAIS. Parent Tainung 67 is a leader cultivar in Taiwan had an erect culms and leaves, high yielded, and pest tolerance characteristics, but poor in rice quality such as white belley.

The parent Tainan-waxy-yu 17, an experimental line developed at Tainan DAIS, is an early maturating, short-statured, resistant to lodging and blast disease, and has a bigger kernel but yield less than a popular Taichung Glutinous 70 (TCW 70). It is therefore desirable to develop high yield such as Tainung 67 productivity, early maturity, with big kernel glutinous rice. TKW 5 met with this requirement.

In seven regional yield trials conducted from 1993 to 1994 in Taiwan, TKW 5 matured at 123 and 107 day (d) in the first and second season crops, respectively, which are earlier 6 and 7 d than TCW 70 by transplanting. TKW 5 has 104 and 99 cm plant height in 1st and 2nd season crops, respectively. Grain yield of TKW 5 at nitrogen 120 kg/ha fertilization yielded averaged 6663 and 5136 kg/ha (13% moisture) are increased more 9 and 15.6% than TCW 70 as a check cultivar.

TKW 5 has shown moderate resistance to blast, but susceptible to bacterial blight, sheath blight, and hopper insects after tested in Taiwan Uniform Rice Nurseries from 1992 to 1994. The endersperm of TKW 5 is glutinous, nonromantic, and has a light brown pericarp. Results obtained from the Rice Quality Research Laboratory, Taichung DAIS, indicating that TKW 5 has good milling quality and low gelatinizing temperature according to alkali (1.7% KOH) spreading reaction of 6.

TKW5 is recommended to can be grown in both single and double season crop fields in Taiwan. Due to respondent of nitrogen application test, this cultivar will be lodged at dressing high level of 240 N kg/ha. The refer fertilizer is recommended to be moderate and applied as early as possible. In order to obtain the high quality of glutinous rice, irrigation should not be cut off too early before harvest, and harvest should be done at sunny day.

UPLAND CROPS

The Purification and Evaluation of Local Peanut Cultivars

The agronomic and yield performances of local peanut cultivars has deteriorated gradually during the prolonged period of cultivation. Efforts have been made by this station to purify these cultivars in order to enhance their yield potential.

Two generations of purification were executed in the spring and fall crop of 1991 for the source cultivars of Lichi-tzae, Lichi-tzae-fan, and Youdou-fan. The plant-to-row trial was conducted in the spring crop and fall crop of 1992 and 1993, two years and each at two areas, respectively. And in the first year of preliminary yield trial, 30 superior lines were selected in the spring crop and fall crop of 1994. The second year of preliminary yield trial was conducted at the two locations in the spring crop and fall crop of 1995.

In the spring crop of 1995, eight elite lines were 2-61% higher in pod yield than the check, Lichi-tzae. While the other two lines were decreased 2-3% than the check.

After Two years and four crop seasons of the preliminary trials, two superior lines will be selected for the regional yield trials.

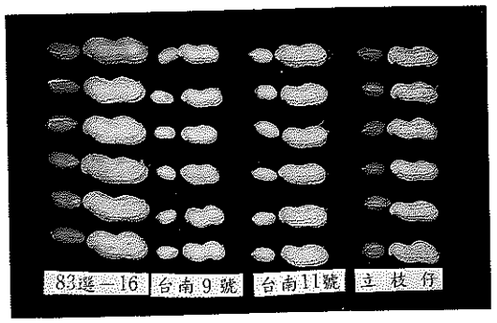

Fig. 2. Elite selected line 83-s-16 and check varieties.

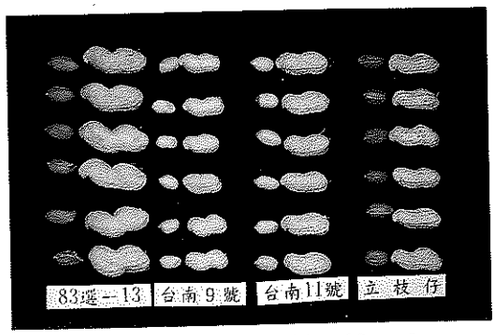

Fig. 3. Elite selected line 83-s-13 and check varieties.

The Development of A New Job's-Tear Cultivar Taichung No.1

Job's-tear is used as a healthy food of high economic value in many Asian countries. Six lines of Job's-tear were introduced from Japan in 1982 and evaluated for their adaptability in the spring crop of 1983. One of the introduced lines, Obanazawa Native, was high in yield potential but exhibited inferior agronomic characteristics in plant height and tillering ability. Accordingly, mass selection method was employed to improve the lines for four consecutive crops (two spring and two fall crops) from 1983 to 1985. A superior line, 74-T5 was selected and later renamed as Taichung Selection Yu No.5. Advanced, regional, and local yield trials, as well as chemical analysis and other field tests were then conducted between 1986 and 1993. The combined results indicated that Taichung Selection Yu No.5 possessed strong stem, resistance to lodging, drought tolerance, high yield and wide adaptability. The new line was therefore officially registered as job's-tear cultivar Taichung No.1 in January, 1995 and released to farmers for commercial production.

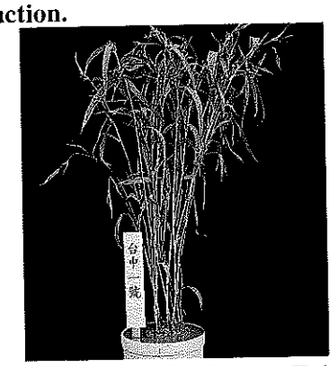

Fig. 4. The plant of Job's-Tear Taichung No. 1.

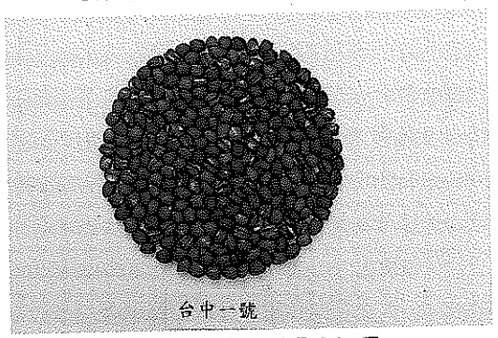

Fig. 5. The brown rice of Job's-Tear Taichung No. 1.

Lipid Peroxidation and Peroxide-scavenging Enzymes of Natural Aged Edible Soybean Seed

Aging is knowm to reduce seed viability in many crop species. The phenomenon is due in prat to the aging-induced lipid peroxidation, which has the potential to damage membranes of the seed tissues. This study was undertaken to evaluate the effect of natural aging on germimation and several physiological characteristics related to peroxidation in the seed of two edible soybean cultivars produced in different seasons. Natural aging was achieved by sealing the seeds in aluminum foil bags coated with polyethylene and storing the seeds at 5 ℃ or 25 ℃ for 3, 6, 9, and 12 months. the results indicate that both 5 and 25 ℃ natural aging inhibited seed germination and enhanced lipid peroxidation, but with more rapid seed deterioration and greater extent of lipid peroxidation in the latter. Aging also inhibited the activity of peroxidase, catalase, ascorbate peroxidase, superoxide dismutase and lipoxygenase. The seeds harvested form spring corp were more susceptible to aging than the seeds harvested form autumn crop. The changes in germination and physiological activities, experssed as a function of growing season and aging condition, were similar in the two cultivars.

Effect of Sethoxydim 12.5% E.C on Weed Control in the Peanut Field

In the study it contained six treatments: 1) Sethoxydim 12.5% E.C 2.0l/ha. 2) Sethoxydim 12.5% E.C 3.0l/ha. 3) Pendimethalin 34% E.C 5.0l/ha. 4) Fluazifop-butyl 17.5% E.C 1.0l/ha. 5) Weed control with man. 6)no weed control.

The results Showed that Sethoxydim 12.5% E.C 2.0l/ha had best weed control on Gramineae of weeds in both spring season sand autumn seasons, but no effect on Cyperaceae and wide leaf of weeds Sethoxydim 12.5% E.C and Fluazifop-butyl also showed good result on the weed control.

In the autumn seasons, it showed that weed control with man, the peanut production corn the greatest; Pendimethalin 34% E.C 1.0l/ha the next, and Sethoxydim 12.5% E.C 2.0l/ha the third.

In the spring seasons, it showed that weed control with man, the peanut production was the greatest too; Pendimethalim the next, and Sethoxydim 12.5% E.C. 2.0 l/ha the third.

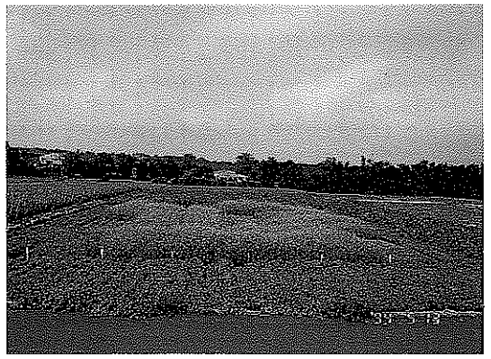

Fig. 6. Experimental field of peanut herbicide trial.

Fig. 7. Field day of peanut herbicide trial.

VEGETABLE CROPS

The effect of climate factors on pei-choi growth in Taichung area

Feng Shan pei-choi and local variety (San Feng) were compared in this study. From May to October in Taichung District, pei-choi were sowed every month, and the effect of climate factors in growth period were investigated. The rainfall and temperature could affect the growth and yield of pei-choi significantly, according to the data of two years. The best growth and yield were found in the low temperature during September to October. While, in high temperature during May to July, the growth and yield of pei-choi were worst.

The regression analysis showed that the significant relation between the growth, yield and climate factors (rainfall, temperature....etc).

Effect of Spraying Salt Solution on Seed Set in Self-incompatible Lines of Cabbage

In order to explore the effect of salt solution on breakdown of self-incompatible lines of cabbage, 20 inbred lines were used in this study. The results showed that the cabbage flowers which bloomed on that very day and were treated by spraying with 2% or 4% concentration of salt solution 10-15 minutes before or after the pollination could overcome the self-incompatibility and yield the inbred seeds. Depending on the different salt treatments, the average seed sets of treated flowers were 29.5-62.0% of that of the bud-pollination treatment.

Because flowers were easily damaged by the 4% salt concentration, the seed sets of 4% treatments were lower than that of the 2% ones. Besides, the seed sets of the before-pollination treatments were a little higher than that of the after-pollination treatments.

There were different seed sets among the tested inbred lines in response to the salt treatments. The seed sets of the lines which had a good reaction were 16.8 - 82.5% of that of the bud-pollination treatment, and 5.7-18.1% for the bad-reaction lines.

Yield Trial of Early Line of Water Bomboo

This trial focus on currently cultivated varieties in the major water bamboo (Zizania latifolia) production areas (Puli and Yutsz areas) in order to select early maturity, high yielding, disease resistance and high quality water bamboo line. The tested lines included "White-Shell early", "Pai-ho early", "Gandang early", and the "Green-shell" is the check variety. The stock rhizome was planting at late December and transplanted at early February. The results of spring crop indicated that the "Gandang early" is matured earlier than other varieties, the shoot length, shoot size, shoot weight showed better performance than that of "Green Shell". The average yield is 1, 053kg per 0.1ha, which is 24% increase than check variety. The yield of "Pai-ho early" and "White-Shell early" is 21 - 30% lower than check variety. The result of fall crop is quite similar to spring crop. The yield of Gandang early is 950kg per 0.1ha, which is 8.3% higher than check variety. It's recommended that "Gandang early" is a potential variety, it will undergo regional and local yield trial beforel application for register and naming.

Effects of Fertilizers on the Growth of Plug Seedlings in Different Cabbage Cultivars

The objective of this research was to study the effect of fertilizers on the quality of plug seedling in different cabbage cultivars. Experiment with three cultivars (K-Y, Kaiya, Chun-Chon No.1) and three fertilizer treatments (F1: control; F2: N-P_2O_5-K_2O, 20-20-20; F3: N-P_2O_5-K_2O, 31 -10-10) were conducted in summer season in central Taiwan. The results showed that there were good responses on the growth, seedling index and G value of absolute growth rate (AGR) for plug seedling of Chun-Chon No.1 and Kaiya. It indicated that the cabbage plug seedling of Chun-Chon No.1 and Kaiya were satisfactorily sown in summer season in the central Taiwan. Significant differences were found on the plant height, number of leaves, leaf area, shoot fresh weight, leaf length, and leaf width of cabbage plug seedling in different fertilizer treatments. For that the positive effects were obtained from three fertilizer treatments, the best one is F3 treatment and followed by F2 and F1 treatment. However, as considering the balance of seedling index and G value of AGR of cabbage plug seedling, the superior treatment is F2. Reviewing all results, it indicated that both seedling index and G value of AGR could be utilized to evaluate the quality of cabbage plug seedlings.

The Effect of Amending a Zn and Ni Polluted Soil on the Growth of Pai-tsai (*Brassica campestris* L. Chinensis group)

The objective of this study was to investigate the growth enhancement of Pai-tsai which was planted in an amended mixture of serious Zn-Ni metal polluted soil and unpolluted soil by different dilution rates. The results showed that the germination rate was only 62% when seeded at the original polluted soil. The

length, and width of leaf or cotyledon and height of seedling were significantly smaller or lower than that of the control at the stage of 18 days after seeding. At the harvest stage, the length and width of leaf and height of seedling at the original polluted soil was only 40, 60, and 36% to that of the control respectively, and the edible fresh weight was 8% to the control. Diluting its Zn and Ni metal content to about 50 and 25ppm respectively with an unpolluted soil could increase the germination rate to 92%. The amendment of adding normal soil to the polluted soil also could much improve the plant growth. However, it should be borne in mind that the amendment did not lower significantly the Zn and Ni content of the edible leaf.

FLOWER CROPS

Improving Cut-flower Quality by Shading Culture of Spray Chrysanthemum

In order to improve the cut-flower quality of summer Chrysanthemum in Taiwan, the shading experiment was carried out at this station. The tested varieties were "Little Lady", "Golden Yellow" and "Pink Ali". The shading treatments included 40%, 50% and 60% shading nets, the control plot was without shading. The data of plant height, leaf number and node number were collected for each treatments every 15 days from pinching stage after transplanting to blooming stage. At harvesting period, the horticultural characters, quality and vase life of cut flowers were also investigated.

Results indicated that chrysanthemum plant under shading condition grew faster and plants were higher than that of open field. Under shading treatment, it showed that cut flowers had longer stems, leaf and node number increased, the leaf area, chlorophyll content of leaves, fresh and dry weight of cut flowers also increased. It was also found that the cut flowers under shading condition had less dry weight percentage, slender stem on the middle part, smaller flower size. While stalk length of 2nd flower to 5th flower from top was increased, the difference of number of ray-florets showed not significant. The leaf yellowing cause by aging process was slower and vase life was increased at shading plots compared with that of non-shading plot. The results showed that shading culture could improve the florescence distribution form of spray chrysanthemum, increased cut-flower quality, prolonged vase life. The optimum shading percentage was suggested 50%, it will avoid producing slender cut flowers under two much shading.

Effect of Different Shade Levels on Plant Characters and Vase Life of Asiatic Lily

Asiatic lily, cultivar London, was cultivated in a simple facility environment to determine the plant characters and vase life with and without shade. Shade was provided by covering black shade cloth which shade density are 50%, 60% and 70%. All shades were removed when flower buds were visible.

There was no difference in day-to-flower and flower number in all treatments. As shade percentage increased, plant geight, fresh weight, leaf number, floral-bud length and peduncle length increased. The diameter of stalk with 60% shade treatment is the lavgest of all. According to the experimental results, we find shade removed in floral buds visible stage can significantly improve the quality of cultivar Lodon.

The other effect of shade percent in vase life is the increase of transpiration rate and absorption rate. Fresh weight changes rate and water balance are not significantly different. The 6th day in vase the petals fell in all treatment, so the vase life is the same. In the vase 60% and 70% shade treatment, we can find the numbers of valuable florets are more than others from the first day to the fourth day. On the other hand, from the fifth day to the sixth day in vase, the controlled and 50% shade treatments can offer the more valuable florets.

Effect of Basal Arching technique on the yield and Quality of Cut Roses under Facility

Several varieties of roses were cultivated on the rockwool with nutrient drip irrigation under protective greenhouses. A new technique, arching method, was evaluated. Seedlings were tranplanted on June 6, 1994. The new sprouts which were bent or twisted on the basal part of stem were so called arching. The arching was started on 35 days after transplanting. 3-4 branches were bent down on the basal part of stem. Varieties Eskimo, Samantha, Super Star, and Tog clown were tested. Preliminary Results indicated that Toy clown had the best performance of growth vigor, yied and vase-life of cut flower. Eskimo, Samatha and Super Star were next in the order. The average uholesale price for cut-flower of Toy Clown, Eskimo, Samatha and Super Star is NT$5.03 - 10.18, 6.19 - 4.29, 4.40 - 3.92 and 5.12 - 3.80, respectively. It is recommended that the flower growers who choosed right varieties and were care about cut flower quality could get more profit.

Influence on the Growth and Cut-flower of Lilies by Using Precooled Bulbs and Seedlings

In order to promote the cut-flower quality and to solve the problems of diseases and physiological disorders due to continual cropping of lilies in field, the Oriental hybrid lily bulbs used for cut-flower forcings were received and then grown in cultivation boxes. Two Oriental hybrid lilies (Casablanca and Star Gazer) were used in this experiment. The 8, 10, and 12 ℃ day/night temperature were

treated while the bulbs were cultivated in peat moss medium keeping high moisture in cultivation boxes. The forcing periods were 2, 3, and 4 weeks in growth chambers in a dark condition

The result indicated that plant height, the number of leaves, leaf area, and the diameter of stem increased by forcing treatment. The leaf area of Star Gazer reached the highest in the forcing 10℃for 2-3 weeks, and the Casablanca in the treatment of 12℃in 2 weeks obtained the highest leaf area. Generally, it is suggested that the cut flower quality of Oriental lilies can be promoted by using forcing bulbs and seedlings in 10 or 12℃for two weeks.

Study on the Arching Cuture of Rose VAR. "Samontha"

A new technique "Arching" culture of roses was introduced from Japan and then studied. Some new shoots which were bent or twisted on the basal part of stems were so called vegetative branches. The other shoots which sprouted upright and produced cut flowers was so called flowering branches.

The results of different proportion of vegetative and flowering branches indicated that: (1) The highest productivity was investigated of 2 vegetatives: 3 flowerings. The fewer vegetative branches produced more cut flowers when vegetatives were kept from 2 to 4. (2) The earliest harvest was from 2 vegetatives block. (3) There were more than 90% of first grade cut flowers, higher than 86 cm, were harvested. Stem diameter of 2 vegetatives: 3 flowerings block was wider than the others. The fifth expanded foliage of 4 vegetatives: 3 flowerings block was smaller than the others. The number of petals of 4:4 and 4:5 were less than the others. Height of flower buds was not significant of all treatments.

FRUIT TREES CROPS

Study on Two-harvests a Year of Oriental Pears at Low-lands in Taiwan

The high quality Oriental pears was produced by top-grafting method at low-lands. The price of flower bud scions and labor on grafting is a prime cost in cultural practice each year. For the purpose of decreasing production cost, our station has explored a method of producing Oriental pears at Low-land on "Hosui", "Shinko" and "Kosui" varieties. Spraying 2% hydrogen cyanamide in February effectively promoted budbreak and blooming, and the fruits could be harvested during July to August.

For the purpose of enhancing the production efficiency, experiment on two-harvests a year of Oriental pears at low-lands was conducted by spraying 0.5% hydrogen cyanamide in September. The trees were treated with 0.5% hydrogen cyanamide at Sep. 2nd, 8th and 15th, the days to budbreak after treatment were 8-9 days, the rates of budbreak were 76.8%, 61.5%, 56.7% for "Hosui"; 72.1%, 64.9%, 55.2% for "Shinko"; and 56.0%, 61.8%, 55.3% for "Kosui", respectively. The rate of flowering were 27.2%, 24.0%, 18.4% for "Hosui"; 26.0%, 24.8%, 18.3% for "Shinko"; and 13.2%, 18.1%, 10.8% for "Kosui", respectively.

Fig. 8. "Hosui" pear harvested in mid-January.

Studies on Flowering Characteristics of Native Pear Scions for Top-grafting Pear Production

This study was conducted to observe and improve the flowering characteristics of native pear scions, and eventually to increase the ratio of supply of native scion and to diversify the cultivars in top-grafting pear production. The shoots which contained flower buds of 5 cultivars, namely "Shinko", "Shinseiki", "Hosui", "Shinyuki" and "Niitaka", were collected from orchards at Lishan in December 1993, the scions were then top-grafted on the trees in the station at January 24th, 1994. The flower shoots of "Hengshan" and "Niauli" cultivars were collected from Cholan, Tungshi and the station, a comparison on the pollen germination rate of their pollens and those of the Lishan cultivars were undertaken.

The results showed that the budbreak percentage of Hosui and Shinseiki scion reached 100%, 86.7% for Shinko, 61.5% for Niitaka, and the Shinyuki had the lowest of 11.6%. The days from grafting to first bloom was 29 days for Shinko which bloomed more concentrated and uniformly, the others bloomed 3 days later, the rate of flowering had the same trend. The pollen of different source were incubated under 6 temperature, from 12-30 C, in the media to investigate the rate of germination. The pollen germination rate of Hosui and Shinseiki were the highest. Over 60% of germination occurred in all treatments when the temperature was 24 C or higher. The germination rate in Shinyuki decreased when the temperature increased, but the temperature reaction in the cultivars was highly different. The pollen germination after 1 hour of incubation was 38% for Niauli and Shinko, Hengshan and Kosui had the lower of 25.4% and 22.0%. After 4 hours of incubation, the higher ones were 60.6% for Kosui and 60.0% for Niauli. The curve of pollen germination were different among the cultivars, and the germination decreased as the cold storage prolonged.

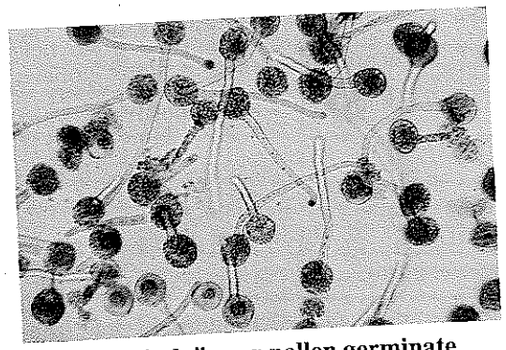

Fig. 9. "Shindo" pear pollen germinate after 2hrs of incubation under 20℃.

Studies on the Flower Bud Formation of Loquat at Different Altitudes

The production area of loquat spread at 100m to 900m of altitude in Taiwan. This study was conducted to discuss the influence of altitude and pruning on the shoot growth, flower bud formation, blooming and fruit setting of loquat. Five loquat orchards in Taichung and Nantou, the altitudes were 250m to 1000m, were chosen as the investigation sites, the shoots were labeled at 1-2 months after harvest and pruning, and the observation of shoot growth and flower bud growth were taken periodically.

Mnay typhoons during the autumn in 1994 caused severely damages to the loquat trees in central Taiwan. The flower buds of highland areas, as Erhqui and Touqui at 800m to 1000m, were pruned after the disasters to rebuilt the shoots and flower buds, therefore their blooming were postponed. The cold days during December 1994 to early Spring 1995 caused damages to the growing fruits, consequently the yield was decreased and the fruit quality was lowered down.

The observation on the shoot growth in 1995 revealed that the length of the shoot was longer at low altitudes and shortened as the altitudes were higher, the number of leaf had the same trend. The first flower bud formation was observed at Touqui of 1000m altitude during August to September where the orchard was severely damaged last year. The result of observation on the degree of flower bud formation showed that the loquat trees at higher altitudes, such as 500m to 1000m, had early formed flower buds, whereas those trees at 250m to 400m bore flower buds later. The period and rate of flower bud initiation might fluctuated in those vigorous trees, especially at low altitudes, have a high relationship with climatic factors.

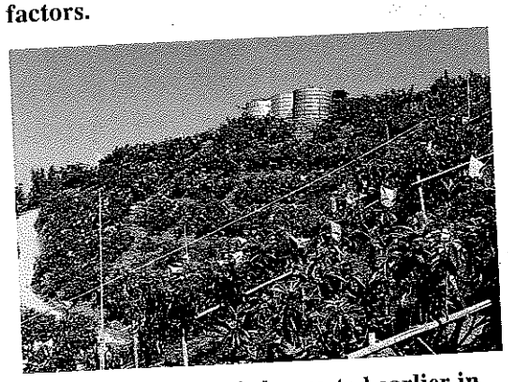

Fig. 10. The loquat is harvested earlier in higher altitudes.

Alleviation of Supra-optimun Temperature Stress of High-chilling Pears in Taiwan's Lowland by Adoption of Apical Dominance

High-chilling pears can not be cultivated successfully in Taiwan's lowland due to supra-optimum temperature stress including abnormal leaves dropping and buds opening in autumn, as well as insufficient chilling in winter which resulted in the abnormal buds opening in the following spring. This experiment was conducted to study the alleviation effect of supraoptimum temperature stress by apical dominance and try to develop a new cultural model. Niauli scions were top- grafted on one-year old high-chilling pears (*Pyrus serotina* Rehd.) cv. Shinko, Kosui and Hosui plants on the trunk 180 cm in hight above ground. The other treatment was side-grafting Hosui scions on the Niauli's trunk. A continuous observation of growth habits was undertaken for 3 years. Top-grafting Niauli on Shinko pear increased the trunk cross section area. The shoot number of the 2nd and the 3rd flush decreased. The cessation of shoot terminal growth and the maturation of shoots delayed. The percentage of leaves dropping varied with the year. In autumn, the abnormal leaf dropping decreased, the bud opening percentage did not affect significantly, and the percentage of flower bud decreased; Top-grafting Niauli on Kosui pear decreased the trunk cross section area. This treatment did not affect the shoots number, but delayed the cessation of shoot terminal growth and enhanced the shoot maturation. In autumn, the percentage of leaves dropped and abnormal bud opening decreased. Besides, the percentage of bud opening and flower buds were not affected significantly; Top-grafting Niauli on Hosui pear did not affect the trunk cross section area, but increased the shoots number of the 1st and the 3rd flush. The treatment enhanced the cessation of shoot termination, but did not affect shoot maturation. The leaves dropping varied with the years, and the abnormal bud opening increased in autumn. In addition, the percentage of bud opening decreased, and the percentage of flower bud was not affected; The trunk cross section area of Niauli, which was side-grafted with Hosui scion significantly increased than that of Hosui (control). Comparing the habits of Hosui side-grafted on the Niauli to the Hosui (control), it was found that the shoots number of the 2nd and the 3rd flush decreased, the cessation of shoot termination growth delayed, and the maturation of shoots did not affect indefinitely. In autumn, the percentage of leaf dropping varied with the year, the percentage of abnormal bud opening decreased, the percentage of bud opening increased, but the percentage of flower bud did not affected. These results suggested that Niauli's apical dominance has

the possibility to help Hosui to alleviate the stress of supra-optimum temperature in summer time.

Study on Main Vine Pruning and Topping of Stake Culture of Jelly-fig (*Ficus awkeotsang* Makino)

Ficus awkeotsang Makino is a perennial vine plant, it wild habitat distributed at the wet broad-leaf forest, which is 800 - 1800 M above sea level. Recently, due to the deforestation and operation change of forest phase at midde and low level of mountairous areas, the wild habitat of Ficus awkeotsang Makino that climbed on the trees have been seriously destroyed. The yield of natural Ficus awkeotsang Makino fruit, is decreased, so the commercial production is needed. Ficus awkeotsang Makino have strong side branching tendency, vigorous main stem and the vines and branches are overlapping resulted in shortage of sunlight, weak branches. This random'y natural growth habit often have less flower buds and poor fruit-setting. In order to increase the fruit yield of ficus awkeotsang Makino, the side branching pruning and secondary vein topping were applied on stake cultural techniques. The three-year-old plants was selected for tested. The treatments included pruning between 30cm and 60cm interval at main vein as one cycle, each cycle save 3 and 5 branches separately. The primary result showed that the pruning treatment have advanced 5 - 10 days of blomming and fruit-setting stages than non-pruning plots. The fruit yield, fresh and dry fruit weight of pruning plot is increased compared of those of non-pruning plot. The 60cm pruning interval have better performarce than that of 30cm's. There is no significant difference between topping at 8 leaves and 12 leaves stage.

PLANT PROTECTION

Study on Integrated Diseases and Insect Pests Control in Paddy Rice

This experiment is aim to evaluate the proper timing for control of diseased and insect pests in paddy rice. The broad-spectrum insecticides and fungicides are selected in order to control the diseased and insect pests in paddy rice that occurred at the same period. It is hope to reduce the application times and production cost as well as establish the control model for releasing to farmers. Result indicated that one or two chemical applications could reaching the economical control effect in the lst crop. The suitable control stage for one chemical application is at 3 - 5 days before booting stage, the chemical included 75% Tricyclazole W.P. 0.4kg/ha, 25% Monceren W.P. 0.6kg/ha and 75% Acephate S.P. 0.8 kg/ha. It mainly control rice blast, sheath blight, rice leaf folder and leaf hopper and could increase the net-income of NT 28,122/ha. The suitable control stage for two chemical applications is as follows: the first control is at infertile tillering period, the chemicals included 25% Monceren W.P. 0.5kg/ha, it is to control sheath blight; the second control is at 3 - 5 days before botting stage, the chemicals included 53% Rabcide-V W.P. 1.2 kg/ha and 75% Acephate S.P. 0.8kg/ha, it mainly control rice blast, sheath blight, leaf folder and leaf hopper, and could increase the net-income of NT 26,172/ha. In the 2nd crop, the lst application is at infertile tillering stage, 6.5% Neo asozin S. 1.0L/ha was used to control sheath blight, the 2nd application is at 3 - 5 days before booting stage, the chemicals included 10% streptomycin Tetracycline W.P. 1kg/ha, 25% Monceren W.P. 0.6kg/ha and 75% Acephate S.P. 0.8kg/ha, it could control bacterial leaf blight, sheath blight, leaf folder and brown planthopper, and increase the net-income of NT 6,559/ha.

Control of Bulb Mites Gloadiolus by Soil Treatment

Soil-dwelling bulb mites primarily damage the underground bulbs of crops and are difficult to control by chemicals. The present work was aimed at evaluating the control effect of these mites by soil treatment in order to improve existing field control measures. Dipping gladiolus bulbs in insecticides prior to planting is an effective way for the control of these mites. Otherwise, direct application of insecticides solution on to the bulbs and the ditches during planting is also feasible. Subsequently, the insecticide solution should be applied to the soil 7 to 21 days after planting. Delayed treatment would result in reduced efficacy. For the control of bulb mites on gladiolus, the best measures include dipping bulbs in advance and applying insecticide solution twice onto the soils between 7 and 28 days after planting. The alters calls for applying the insecticides to the soils around the roots in >4500 liter of water per hectare, mixing fungicide Prochloraz with the recommended insecticide (such as Prothiofos), and adding adjuvant (such as AquaGro) to enhance the effectiveness. Spreading granular insecticides (Such as 10% terbufos G) in the planting ditches at 60 Kg/ha gives good control effect. Treating soil with granular insecticides instead of with insecticide solution is labor saving and more economical.

Fig. 11. Control of bulb mites on gloadiolus by soil treatment.

Seasonal Occurrence of *Dacus cucurbitae* in Central Taiwan and Reaction Observation of Attractants

Investigation of seasonal occurrence of Dacus cucurbitae by attractants con-

tained Methyl eugenol and Cue-lure solution at Changhua, Taichung and Nantou counties from March 1994 to June 1995. At Changhua county, except on April 1994, that all investigated areas occurred one population peak, while August at Tatsuen, November at Taichung station, November to January at Chichou also occurred another population peak. At Nantou county, the population peak occurred at the following area and period: September, 1994 at Puli, November, 1994 and March, 1995 at Mincien. At Shinshe, Taichung county, on December, 1994 and March, 1995 one population peak occurred respectively. Five attractant treatments, that is Methyl eugenol, Cue-lure solution, mixed solution of 1 to 1, 5 to 1 and 10 to 1 of Methyl eugenol and Cue-lure solution have tested at Tatsuen, Yuanlin and Chichou areas. Every 15 days investigated melon fly number and every 30 days renewed the attractants. The results showed that the mixed solution of 1 to 1 and 5 to 1 of Methyl eugenol and Cue-lure solution attracted more melon flies than other treatments. Six colors of sticky cards, that is yellow, white, blue, green, red and black colors, placed at Tatsuen area, investigated the melon fly number and renew the sticky card every 14 days. The results indicated that white sticky cards attracted more female melon fly than other treatments, which is 3.24 per card. The blue, yellow and white sticky cards attracted 5.24, 4.68 and 4.01 male melon fly per card, respectively. The yellow sticky cards plus Methyl eugenol or Cue-lure placed at vineyard of Taichung station and Tatsuen village, investigated melon fly number and renew the attractant every 14 days. The result showed that the yellow sticky card plus Cue-lure attracted 7.55 and 12.04 melon fly per card, more than other treatments. In general, *Dacus cucurbitae* occurred all - year - round in central Taiwan, the 1st population peak occurred on March - April, the 2nd population peak occurred on August - November. The presently using yellow sticky card by farmers recommended Cue-lure for attract male melon flies and the control technique need further improved.

Investigation the Insect Pests and Occurrence of Gerbera

Gerbera is one of the new flower crop in Taiwan. Field investigation indicated that there were 9 major insect pests occurred at gerbera growth stage. 1) *Liriomyza trifolii* occurred year-round under facility cultivation condition, it mainly attacked leaves surface resulted in gray to brown spot on leaf. 2) *Trialeurodes uaporariorum* occurred severely at October, young larva and adult moth gathered at underneath of leaf; 3) *Tetranychus urticae* mainly occurred at March and October-November. Young larva inhabited at leaf underneath areas, the affected leaves turned into gray spot, and eventually becomed yellow brown and dieback; 4) *Polyphagotarsonemus latus*, the major occurrence season is at Oct.-Nov. The larva infested unopened flower and leaf buds; 5) *Thrips palmi* has a population density peak stage at Oct.-Nov, the larva and adult infested young bud and young leaf; 6) *Frankliniella intonsa* occurred mainlyon March and October, it attacked flower parts resulted in white or brown spot on flower; 7) The major occurrence season for *Aphis gossypii* is from November to December, it often gathered and damaged on young bud, young leaf and flower bud; 8) *Spodoptera exigua* is mainly occurred on September, its larva damaged leaf and flower bud; 9) *Planococcus citri* mainly occurred on October, it larva and adult gathered at the underneath of leaf. The exudate of *P. citri* will induce the mold disease and the black mold could affect the leaf photosynthesis, resulted in poor growth of plant.

Fig. 12. The leaves of gerbera damaged by American serpentine leaf miner.

Investigation of Occurrence and Control of Borer in Rice and Barley

The study is to understand the effect of transplanting time on the occurrence of borer in paddy rice. The rice variety is Taichung sen 10, which is susceptible to borer. Result showed that early transplanting rice have more serious occurrence of percentage of yellowing side leaf, percentage of die-heart and percentage of white spike than late transplanting rice, of which is caused by borer damage, whather in lst crop or 2nd crop. The yellowing of side leaf during early growth stage is mainly caused by *Chilo supressalis* . At the eillering stage of lst crop, die-heart is mainly caused by *Chilo suppressalis* (96%) and only few caused by sesamia inferens (40%) . *C. suppressalis* and *S. inferens* played equal role on the occurrence of white spike after booting stage. The lamp trap was set up at this station, Tatsuen to monitoring the annual population occurrence of borer. Result showed that *C. suppressalis* have 4 population peaks, which is on mid-Feb to mid-March, early May, late July and late October. *S. inferens* have two population peaks which is on late June and late November. Investigation of borer in barley field at Shoshui showed that yellowing side leaf is mainly caused by *S. inferens* (83.4%), and few caused by *C. suppressalis* (16.6%) . Which spike is

mostly caused by *S. inferens*. The early barley have more occurrence of borer than late barley. Result of chemicals screening effect on borer. Field control by 35% Prosalone 1-3 times indicated that there is no significant difference between sprayed plot and non-sprayed plot. since this insecticide have on effect on control of *S. inferens* in barley field, it is recommended that delay the planting time of barley could reduce the occurrence of white spike.

Investigation on Occurrence and Control of Insect Pests in Temperate Trees

Each of pear and peach orchards at Lisan area and Wuling Farm in the Te-Kee Dam reservoir conservation areas have been selected from 1992 to 1995. Each location have set up one trial plot and farmer control plot, respectively. Investigation on trial plot according to designed control calendar and farmer plot according to routine custom have been carried out. The major insect pest of pear is leaf mite (June-July), rust mite (July-August), aphids (April-July), nocturnal moth and pear curculio (May-August), *Aphanostigma piri* (April-August), *Dacus dorsalis* (August-October), *Anoplophora maculata* (June-August) and *Pseudaulacaspis pentagona* (October-December). The major insect pests of peach is *Tetranychus urtical* (June-July), *Dacus dorsalis* (August-September), *Pseudaulacaspsis pentagona* (October-December) and *Grapholitha molesta* (April-June). At Te-Ke reservoir area, in calendar control plot, spraying of 48.34% Carbosulfan E.C. and 60% Diazinon E.C. to control leaf insect pests and *A. piri* during early April to mid-May. At early October, spraying of 40% methidathion E.C. and 95% summer oil to control *P. pentagona* of pear trees. The control calendar for insect pests of peach trees is as follows: during early April to mid-July, spraying of 2.8% Cyhalothrin E.C. to control leaf insect pests and mites; at mid-July, spraying of 33% Formothion to control *P. pentagona*; at mid-August, spraying of 2% Abametin E.C. to control mite. According to this application calendar, it will decrease the amount of chemical, reduce the chemical pollution to dam while control the insect pest effectively.

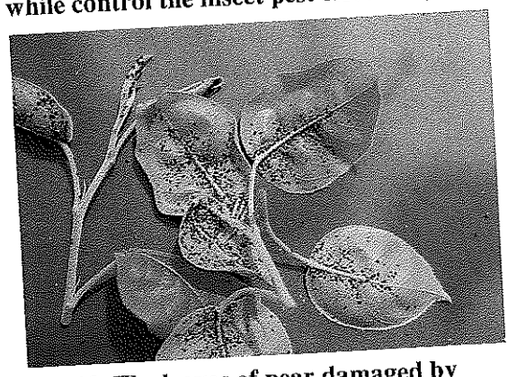

Fig. 13. The leaves of pear damaged by aphid.

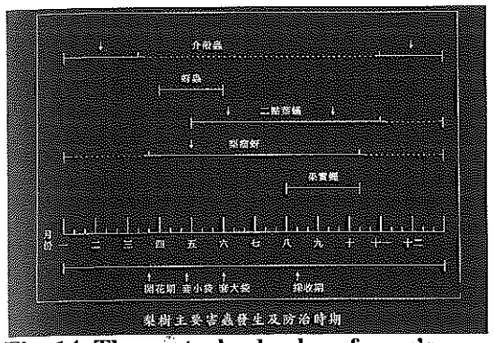

Fig. 14. The control calendar of pear's pest.

Population Occurrence and Ecological Investigation of *Nezara viridula* (Linne)

Nezara viridula belongs to genus *Hemipter* and family *Coreidae*. Result of field investigation indicated that *N. viridula* except infested paddy rice and also infested leguminous crops, such as asparagus bean and green bean, high population often occurred during pod-setting stage. It also attacked soybean, corn, eggplant, melon, radish and Pa-tsai. Lab feeding by green pods of asparagus bean and green bean found that it needed 36.5 days to complete a generation, average survival rate is 84.7%. Each female laid 215.3 eggs. Results of lab feeding by soybean pod, rice spike and corn ear showed that the days required to complete a generation is 42.6, 37.8 and 43.4 days, respectively, while the survival rate is 51.8, 45.3 and 22.6%, respectively, the average eggs laying is 102, 75 and 102. The survival rate of *N. viridula* is very low or died before lst instar stage when feeding by leaves of leguminous crop, rice, corn, eggplant and melons. Field investigation on rice, asparagus bean, green bean, soybean, peanut, corn and eggplant indicated that the population peak is varied by crop species. The population peak of green bean is occurred on late April-mid May and late October-early November; for asparagus bean is on mid July-late July and early September; for rice is on early June-mid June and late September- early October; for soybean is on early June-mid June; while in peanut, corn and eggplant, the population density is very low.

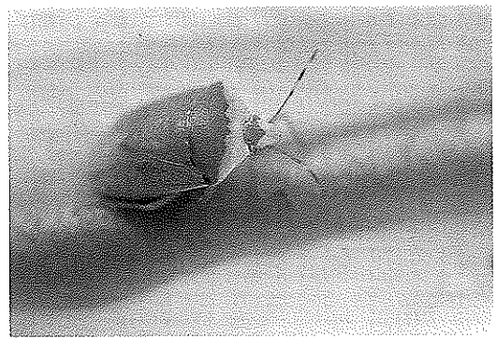

Fig. 15. The green bean damged by green bug.

Effect of Non-Pesticidal Substances against Two-Spotted Spider Mites on Roses

A laboratory test was performed to measure the effect of five non-pesticidal substances, i.e., Yu-li 2 organic fertilizer, Dahm 1 organic fertilizer, sugar-vinegar solution, wood vinegar solution and vinegar solution, on the two-spotted spider mites on rose plants. Water and a miticide, 50%

dienochlor, were used as references. In terms of 24 and 72-hr mortality toward female adult mites, Yu-li 2 organic fertilizer (250-fold dilution) was the most effective giving 73.9 and 75.6% mortality, better than the effect of 50% dienochlor, 3.9% and 52.8% mortality. The other substances were much less effective with mortality lower than 43.6%. Four of these substances were also tested in the field for their efficacy against the two-spotted spider mite. With one application, Yu-li 2 organic fertilizer (200-fold dilution) and vinegar solution (200- fold dilution) were more effective than the other two substances, with 86.7 and 88.6% mortality, respectively, toward adult and nymphal mites. All four substances performed well against the larvae with mortality higher than 82.3%. With two consecutive applications, Yu-li 2 organic fertilizer and vinegar solution gave better control of eggs, adult, nymphal and larval mites. The effect of Yu-li 2 organic fertilizer lasted for 21 days, longer than that of the others. The residual effect of vinegar solution lasted for 14-21 days and that of wood vinegar solution and sugar-vinegar solution persisted for only 7 days. No phytotoxicity or other adverse effect was observed with these substances. Therefore, they are recommended to be used alternatively with miticides for the control of the two-spotted spider mite on roses. The mechanism of their action against this mite remains to be studied.

Monitoring and Forecasting of Insect Pests of Upland Crops by Sex Pheromone

Spodoptera litura Fabricus, *S. exigua* Hubner and *Agrotis segetum* are the major insect pests of nocturnal moths in upland crops. Those insect pests often caused yield loss of upland crops. This station have used the sex pheromone to attract the male moth, in order to monitor the occurrence of insect pests and provide the reference for control. Results of Four years consecutively monitoring at Tatsuen and Tachen indicated that *S. litura* have the high population occurred, next is *S. exigua*, while there was very few *Agrotis segetum* occurred. The annual population fluctuation of *S. litura* is varied, but two population peaks have occurred on May and November. The population of *S. litura* at mixed crops are as of Tatsuen is higher than that of upland crops are as of Tachen. The annual population fluctuation of *S. exigua* is similar to *S. litura*, on May and November Two population peaks occurred. The population of *A. segetum* at Tatsun is higher than that of Tachen, only on February-March have are clear population peak. According to the ARIMA model to forecast the population of *S. litura* and *S. exigua*, the confidence level at Taichen is about 80%, at Tatsun the confidence level is 60%. This difference is due to the simplicity or complexity of crop phase.

Investigate and control of seedling disease of ornamental plant

Investigated seedling disease of ornamental plant in field. We found the plant of chrysanthemum, vinca, begonia, celosia, salvia, petunia, dianthus have many disease in the seedling time of plant. The disease of we found were soil rot (caused by *Rhizoctonia solani*), watery soft rot (caused by *Sclerotinia sclerotiorum*), dampping off (caused by *Pythium* spp.) and Phytophothora blight. In summer, the climate were high temperature and humidity. So, the soil rot of seedling was very serious. It could caused 20-80% loss in the seedling bed. Sometimes could arrived at 100% loss. But, in winter, the most serious disease was watery soft rot. In selected useful fungicide, we found the DoRaDo could inhibited the mycelia growth ability of *S. sclerotiorum*. But no one had the effect on *R. solani* . In selected antagonist microorganism, we found some bacteria had the inhibited ability in these seedling's pathogens. Such as *Bacillus subtilis* , it's more effective than others. Maybe, this bacteria can be a biological control agent in seedling disease.

Fig. 16. The leaf blight symptom of periwinkle caused by *Phytophothora parasitica*.

Purification and Serology of the Nucleocapsid Proteins of Four Distinct Tospoviruses

The genus Tospovirus of the arthropod-borne family Bunyaviridae is unique in that it infects plants. A TSWV-like virus previously isolated from peanut was designated as Tospo-P in this investigation. In order to clarify the serological relationships of a Tospoviruslike virus isolate Tospo-PD2 from peanut with other tospoviruses, the nucleocapsid proteins of four tospoviruses including Tospo-PD2, a watermelon isolate of watermelon silver mottle virus (WSMV-W), an impatiens isolate of impatiens necrotic spot virus (INSV-M) , a TSWV isolate from New York (TSWV-NY) were purified from leaf tissues of *Chenopodium quinoa* infected with each virus. The antisera against the purified nucleocapsid protein (NPs) were prepared, and used to analyze the serological relationships of the NPs by immunodiffusion test, indirect ELISA, and Western blotting method. The leaves

tissues of *C. quinoa* 4-6 days after inoculation with the four individual tospoviruses were extracted with TB buffer. The supernatant after centrifugation at 15300 g (10 min) was treated with Triton X-100 (1% final conc.) and followed by high-speed centrifugation (79700 g, 120 min) through 20% sucrose cushion. The pellets were resuspended in TB containing 10 mM glycine, and further separated by 35% cesium sulfate isopycnic centrifugation. The nucleocapside zones were drawn and the NPs were purified by SDS-polyacrylamide gel electrophoresis. The yields of the purified NPs were 1-5 mg per 100 g tissue. Specific antisera were produced by injecting each antigen into individual New Zealand white rabbits. In the immunodiffusion, indirect ELISA and western blotting tests, the four antisera against NPs of Tospo-PD2, WSMV-W, INSV-M and TSWV-NY only reacted to their homologous purified antigens and crude antigens in plant extracts; and no cross reactions in the heterologous combinations were noticed. These results of homologous and heterologous assays with the four antisera against NPs of the different tospoviruses clearly indicated that the NPs of TSWV, INSV, WSMV and Tospo-P are serologically unrelated. Thus, Tospo-P is considered a new serotype and possible new member of the genus Tospovirus.

Isolation and Identification of Lisianthus Necrosis Virus in Taiwan

In May, 1995, several colors of unnamed cultivars of *Eustoma rusellianum* showing severe necrotic spots on leaves in a plastic screenhouse in Yung-chin, Changhua county. The main symptoms including producing a lot of necrosis spots or ring spots on the leaves and stem, plant stunting and flower symptoms such as white streak, color break on petals and malformation of flowers. The virus used throughout this study was derived from a diseased *E. rusellianum.* After three single lesion transfers, leaf extracts were used as virus source for various experimental purpose. Of a total of 32 plant species within 11 families were mechanically inoculated, 17 species were exhibited with symptoms on inoculated leaves only. Mechanically inoculated leaves of *Chenopodium quinoa* were extracts by phosphate buffer, after differential centrifugation and sucrose density gradient centrifugation, partial purified samples were obtained. The virus virions were spherical with diameters of 34-35 nm. Similar particles in irregular cluster or regular array in crystalline were also observed in the thin sections of diseased leaf tissue of host plants. The virus infectivity in crude leaf saps were still kept when heated for 10 min at 100℃ and diluted 10^{-10}. The virus showed serological relationship with lisianthus necrosis virus reported in Japan by ELISA test, using antisera prepared by Iwaki et al. Based on the host plant reactions, virus particle and serological relationship, the virus in *E. rusellianum* found in Taiwan was identified as LNV.

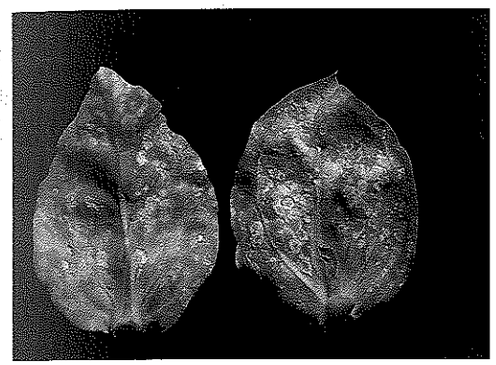

Fig. 17. Symptoms caused by Lisianthus necrotic virus on Lisianthus.

Effect of Cultural Constructions and Media on Orchid's Disease Development

Cultural practices, which include all manipulations necessary during crop cultivation, frequently can be modified to help suppress the rate of disease development. To test the effect of various cultural media and structured houses, Southern blight (caused by *Sclerotium rolfsii* Sacc.), Anthracnose (caused by *Colletotrichium gloeosporiodes* Penzig) , Phytophthora blight (caused by *Phytophthora pamivora* Bulter), and Erwinia soft rot (caused by *Erwinia carotovora*) of orchid were surveyed during cultivation period. The results indicated that there be not significantly different among various cultural sunlight-proof houses including simple black net system, plastic house, H-shape steel house, and stainless net house, to disease severity of those diseases as described above. For cultural media, coconut shell, bark, seaweed, and artificial green soil are most common materials used for orchid cultivation. It was no difference among these media to orchid growth, such as height, and tillers. However, the disease severity of each disease development or orchid was significantly different among these media. The most severe disease severity of southern blight disease (56%) occurred on bark medium related to other media. The orchids cultured in artificial green soil medium were more sensitive to anthracnose disease (58.5%) and Erwinia soft rot disease (13.5%) than that in other media. In addition, adding completely fermented or incompletely fermented organic matters in the same medium also affected the disease severity of each disease. For example, the orchids planted in coconut shell medium and amended with completely fermented organic matters grew more vigorously and less disease severity when compared with that amended with incompletely fermented organic matters. The disease severity of anthracnose, Phytophthora blight, and Erwinia soft rot disease of orchids was respectively, 15.5%, 10.5%, and 4.5% under added completely fermented organic matters, and was respectively 35.5%, 38.5% and 20.5% under

amended incompletely fermented organic matters.

Fig. 18. The good cultural constructions of orchid garden.

Investigation and Control Experiment for Insect Pests and Diseases of Peach in Taiwan

The major diseases of peach trees is *Taphrina deformans* (Berk), *Xanthomonas campestris* pv. *pruni* (Smith) Dye, *Botryosphaeria dothidea* (Moug ex Fr), *Tranzschelia discolor* (Fuckel) and *Monilinia fructicola* (Wint). The major insect pests of peach trees is *Singapora shinshana* (Matsumura), Diamond-back moth, *Grapholitha molesta* Busck, *Zeuzera caffeae* Nietner, *Hyalopterus arundinis* Fabricius, *Myzus perscae* (Sulzer), *Pseudaulacaspis pentagona* Tangion, *Qudraspidiotus persiciosus* Comstock, and *Dacus dorsalis* Handel *Botryosphaeria dothidea* (Moug ex Fr) is the most important and severe infested disease in peach tree. The most important insect pests in peach trees is *Singapora shinshana* (Matsumura), *Pseudaulacaspis pentagona* Targion and *Dacus dorsalis* Handel. *X. campestris* occurred at April-August, while the peak stage is on May-Jane. Tranzschelia discolor occurred at April-October. *B. dothidea* of April-August, resulted in dieback of branches and retarded growth. *Monilinia fructicola* occurred at April-July, it mainly infested fruits resulted in fruit rotting and dropping. *S. shinshana* occurred from May to November, on July-September it have high population density. The recommended chemicals after screening experiment according to the regulation of chemical examination committee is 2.8% Cyhalothrin E.C. 1000 X and 3% Alphacypermethrin E.C. 1000 X have the best control performance.

Fig. 19. The leaves of peach damaged by Taphrina deformans.

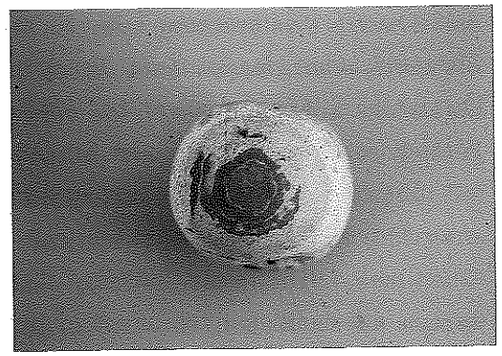

Fig. 20. The symptom of peach brown rot.

SOIL AND FERTILIZER

An Experiment on the Organic Farming of Broccoli

This experiment was conducted in the farm of Taichung District Agricultural Experiment Station at Datsuen in Changhua Hsien. The soil of the experiment plot is a slate alluvial neutral sandy loam. The whole experiment consisted of the four treatments as follows: 1. conventional farming, 2. half way organic farming with effective microorganisms (EM), 3. organic farming with hog manure compost and EM, 4. organic farming with chicken manure compost and EM.

The results of the experiment showed that the growth of broccoli plants in the organic treatments were better than that of the control. The size and weight of broccoli were significantly bigger and heavier in the organic treatments than those in the control, therefore the flower yields in organic treatments were significantly higher. Among them the yield of chicken manure compost treatment was the highest, 26.2% higher than that of the control, followed by hog manure compost treatment, 18.3% higher. This significant increases in yield seemed to be mainly coming from the better soil fertility factors such as lower salinity, higher organic matter, higher available phosphorus and microelements and the application of effective microorganisms (EM) in the organic treatments.

However it was difficult to explain that why with the same soil fertility conditions as the organic treatments, the half way organic treatment only showed similar yield performance as the control. It was possible that combination of chemical fertilizers in the compost with EM in the half way treatment caused the antagonistic effect to affect the mineralization and uptake of soil nutrient elements. Bacause chemical analyses revealed that the nitrogen, Mn, and Zn in the broccoli plants in the half way treatment was significantly lower than those in the control and organic treatments showing the tendency of deficiency. In this experiment the very significantly lower Mn and Ni contents in the broccoli flower in the two organic treatments may have positive or negative effect to the quality of broccoli flower.

During this experiment sugar-wood-vinegar with Bacillus thuringiensis was sprayed at 1-2 weeks interval to control cabbage worm, and a mixture of citronella oil, peppermint oil and camphor oil was sprayed twice to control aphid in the early stage of growth.

Relation on Organic fertilizer and Necrosis of Gladiolus

Gladiolus is an important bulbs with high economic cost in Taiwan. It is sensitive to toxic rate of fluoride. It usually showed a typical symptom of necrosis from the

top of leaf especially to sensitive cultivar. It must be improved the technology of culture to enhance the quality of cut flower.

This study was undertaken to determine the necrosis of leaves on the Wig's Sensation in water culture using thomaskali, fish meal, bone meal, bark, peat and guano, and calcium superphosphate as control. The results showed that thomaskali was better than calcium superphosphate in reducing necrosis. Fish meal or bone meal (especially after fermentation) was the best phosphate source only caused 0.15 cm of necrosis in 56 days after cultivation. The toxicity from calcium superphosphate was reduced by adding bark compost mixed with calcium superphosphate. The above results offer the culture of reference.

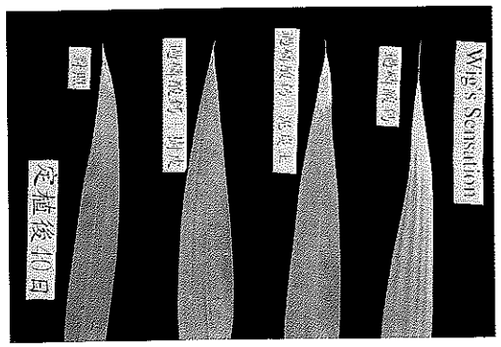

Fig. 21. Relation on organic fertilizer and leaf necrosis of Gladiolus.

Evaluation of the Potentially Available Nutrient of Compost

The most efficient way to understand availability of nutrient of organic fertilizers is to determine their PAN (potentially available nutrient) and manage their mineralization rates to match the amounts of nutrients needed for the aim crops. The objectives of this research was to develop a chemical extracting method for estimating of the PAN value of composts. Pot experiments with different levels of composts added were conducted to evaluate four chemical extracts(0.1 M NaOH, 1 M NaCO, 1 M (NH) CO, 1 M Urea) for estimating the PAN value of composts. Results inducated that the best correlation was between the amount of net available N and organic N extracted by the ammonium carbonate which could significantly be described by lnY=lna+b/X (X: potential available N of compost, Y: estimated net available N, r=0.673).It is concluded that the ammonium carbonate extraction method is effective on evaluating the PAN value of composts.

Study on Fertilizer Management of Lily

Two fertilizer experimental field for lily were set up at Wufeng (sand stone shale noncalcareous alluvial soil) and Waipu (red soil), Taichung count. Results indicated that under high nitrogen treatment (250 kg/ha) at sand stone shale alluvial soil, the plant height of lily is the tallest, which is 71.2 cm. At Waipu, the nitrogen amount of 150 kg/ha plot have the tallest plant height. Phosphorus and potassium fertilizer have no effect on plant height. Among three major elements, only in nitrogen amount of 200 kg/ha plot at two places could increase the flower number of lily. There is not significant different in quality of cut-flower among each plots. The pH value in experimental soil of two places is increased as the amount of nitrogen application is increased. There is not soil accumulation occurred. High nitrogen amount could increase the EC value of soil.

Studies on the Application of Soil Leaf Diagnosis Techniques to the Orchard

The object of the study is on encourging orchard farmers to do plant and soil analysis, and accept the recommended fertilization for their orchard sustainable production. Total of 4974 surfacesoils, 3969 subsoils and 4419 leaf shades were sampled and analyzed since 1995. The result showed that the initial higher ratio of pH value lower to 5.5 decreased to 66 and 71% of total surface and subsoils, respectively. Initial high ratio of organic matter content lower to 2% also decreased to 21 and 55% of surface and subsoils, respectively. There is also a tendency of lowering to the above mentioned ratio yearly. Initial higher ratio of samples that have nutrient level out of the range of recommended proper level also found to become lower yearly. Samples with high N level are more than those high in other nutrients. Depending on the kind of orchard, the Mg or B content of the samples is predominant among the elements that lower to proper levels. Fertilization in the way of high amount of organic fertilizers and low amount of chemical fertilizers is more public. Thus, it deserves continuing the work of soil and leaf diagnosis if the budget is available.

AGRICULTURAL MACHINERY

Development and Improvement of Automatic Medium Filling Machinery for Plug Production of Chrysanthemum

Chrysanthemum is a very important flower crop for about 1800 ha planted in ChungHwa area. Plug seedling of Chrysanthemum is better than traditional sand-bed seedling since plugs can grow and storage better with more anti-stress ability and higher quality, but needs higher cost and labor needs. This research was set up to develop and improve the medium filling machinery to decrease the plug production's labor needs and cost. The machinery include six parts as the medium agitator, the storage tank, the return conveyor, the automatic tray stacker, the integrated filler with puncher, and the manual-control conveyor. All the six parts are connected together and controlled by PLC to automatically process tray feeding then medium filling and leveling and hole punching. The highest operations speed of the system is 720 trays/hr, that is 6 times higher than the labor work. Also the medium is mixed better by the machinery

and can add water when in mixing. Even when in the lowest 60 trays/hr speed, labor and time were saved by the system. Now the chrysanthemum cuttings is still pluged in trays by labor. An automatic cutting setter is planing to develop for reaching further automation and for further use on other similar flower's production like gypsophia, carnation, gerbera and even on forest seedling production.

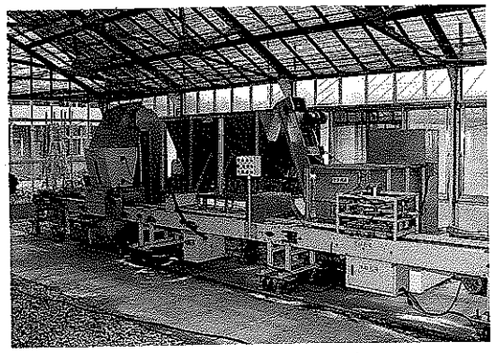

Fig. 22. Automatic medium filling machinery for plug production of chrysanthemum.

Development on Bulbs Flower Corm Elevating Digger

For the purpose to decrease the product cost of bulbs flower, there were two type of elevating digger developed. The machine performs are following the operation in sequence: (1) digging blade (2) soil separation system. The blade delivers the corms and surrounding soil onto a rod-chain type of elevating conveyor. Soil and other materials were separated through the rod-chain, and corms deposited on the top of row. The corms are then picked up by hand and placed in containers.

The first type elevating digger us mounted by power-tiller with 8 to 18 hp diesel engine (depend on the elevating conveyor), digger is 60 to 80 cm in width and 75 cm in length. Its max. field capacity is 0.1 ha/hr. The second type elevating digger is mounted by 40 to 50 hp tractor, digger is 110 cm in width and 100 cm in length. Its max. field capacity is about 0.3 ha/hr.

Development of Hang-boom Type Auto- spraying Equipment

Protected culture are more and more popular in Taiwan for higher products quality, most of them are using for vegetable, flower and seedling production. Though there are automatic pipe type watering system which can be use for management in these protected facilities, but the pipe system got problems such as dead angle and overlapping etc. The purpose of this research is to develop a better watering equipment for raising production quality and reducing environmental affection and labor needs. The structure of this equipment include a hanging pipe as a rail, a wide boom frame hanging on the rail by two U wheels, several vertical telescopic spraying rods mounting on the boom frame. The whole boom with rods can be moved back and fro and drived by a 1/4 or 3/4 hp DC wormgear motor and a looped wire. Dual switchable spraying nozzles include a imported U.S. Delavan flat nozzle and a local-wade flat nozzle. This system can be use as watering, liquid fertilizing and chemical spraying equipment. The testing results shows the boom's moving speed can be adjusted from 0.25 to 12.5 m/min for different requirements. It's spraying difference on a 1.67m wide testing plate in 30 samples gets 19% (C.V value). These results shows the equipment are highly efficient, easy to operate, adjustable and much more uniform than labor spraying.

Fig. 23. The hang-boom type of auto-spraying equipment.

Study on Mono-rail Spraying Equipment and Its Control System

Mono-rail spraying equipments was developed for both spraying water droplets in nursery and chemical pesticide application in floral protected culture.It could carry droplets to target by moving spray carrier, that is driven by a wire loop and a winch set. The basic principle to simplify farming work is mechanization first and then extend to automation. There are three levels of electrical sequence control method : manual operation, semi-automation and full-automation. The experience equipment has both manual operation and semi-automation control modes, and 1.2 ha floral protected field have 17 sets greenhouse spraying equipment. The equipment had been worked 67 times for chemical pesticide and fertilize application from Jan. to Sep. in 1995. The speed of spraying carrier was between 0.7km/hr and 4.3km/hr, and spraying volume was changed from 179 lt/10a to 29.4 lt/10a depending on the speed of spraying carrier. The operating time is about 2 hrs when carrier speed is 2 km/hr, spraying volume is about 1.2 tons water and the operating cost is about NT$3942, that is effective and cheaper than manual application.

Fig. 24. Automatic mono-rail spraying system used in rose greenhouse.

AGRICULTURAL MANAGEMENT

The Adoptation and Adjustment of Cabbage Growers as Affected by the GATT Impacts

Result of questionnare study among cabbage growers in central Taiwan indited that most of the samplers learn the

news that government is actively planning to attend the GATT is obtained from TV, which is 24.5%. The percentage of answer for there is postive effect on agricultural industry after government joint the GATT is about 25%, the answer for no effect is 73.2%, while 1.8% of the sampler sdidn't know the new. The main reason for answer of having positive effect are 1) enhancing competition by product exchange, 2) adjusting development trent for industry, 3) extending the marketing channel. 75% of samplers answered that the negative effect in short term when government joint GATT is serious or very serious, while in long lerm 58.9% of samplers have the same answer. The main reason for answer of have negative effect are 1) product price decrease due to supplyincrease, 2) high production cost of local product, can't compete with foreign produce. The study also found that the percentage of answer for that GATT have serious or very serious effect on industry in short term for member and non-member of production and marketing group are 66.6% and 86.9%, respectively. While the percentage of answer for that GATT have not serious effect on industry for themember and non-member of production and marketing group is 15.2% and 13.1%, respectively. It is clear that non-member of production and marketing group possessed more serious altitute on GATT issue thanthose of member's.

Study of Adjustment and Solution of Cabbage Industry after Joining in GATT

This research is focused on 56 cabbage growers in central Taiwan during 1995. The results indicated the negative impact will be occurred after joining in GATT. The management problems mainly is shortage of labor, high production cost, shortage of capital and lack of marketing channel. The improvement of above problem would summaried as follows: 1) Organization of production and marketing team for mutual assistance in labor; 2) Joint purchase and enlargement of farm scale to reduce production cost; 3) Reduction of cabbage import quota during June to Feb. the following year; 4) Offer agricultural loan and improvement of grading and packing method; 5) Strengthen farmer training, subsidy agriculturalmaterial.

Studies on the Enhancement of Agricultural Extension Regulation

The "Agricultural Extension Regulation" is still in the legislation process after the first reading dated on 10th October, 1991. There are 24 articles in this Agricultural Extension Reulation. It is owing to the big changes in agricultural situation in the past 5 years in Taiwan, some of articles are out of date. The objective of this study is to evaluate its islandwidely through questionary process among 504 representatives from agricultural school, government sectors, and farmers' organization. The results found that 15 articles of it was suggested to be improved. The sggestions were summaried as follows:

1. Township office should involve in this new agricultural extension network.
2. The roles of agricultrual extension agents in the county government level and that in district agricultural improvement station is confused in this new agricultural extension framework.
3. Instead of making agricultural policy annually, it had better evaluate the effort of agricultural measures year by year.
4. Both public and private agricultural school should be assigned to mission of agricultural education.
5. The agricultural service should contributed not only on agricultural producter but also on consumers.
6. The agricultural extension agents from districtal farmers' association had better under supervision by the new basic unit- agricultural extension station.
7. It is better to set up a subject matter specialist system in the new agricultural extension framework.
8. The recent manpower of agricultural extension center in each district agricultural improvement station can not affort to conduct all kinds of agriculutral extension activities in its district.
9. The roles of extension agents in district agricultural improvement station were not clearly classified.
10. There were no legal agreement to support the cooperation among the Farmers' association, district agricultural improvement station and country government.

Study on the Attending Factor of Flower Farm Women in Agricultural Management in Taiwan

The data was collected from the 265 questionnires for the flower farm women belong to cut-flower production and marketing team in Taiwan. It is to understand the attending factors of flower farm women in agricultural managemnet in Taiwan. The results is as following. 1) The mechanization degree in flower farm for farm management is not high, the assistance of farm women is very important, especially in the nursery job. The labor shortage problem will occur without the involvement of farm women. 2) Most of the flower farm women actually is involved in field work, but they hope they can joint the management job. 3) In communication activity for agricultural information, the frequency in human contact is higher than that of group contact and mass communication media contact. 4) Most of the farm women are willing to continue the farm management job for their own farm and have the support of family member.

They want to be a co-manager with

equal and independent status in family, but they feel they lack of production technique and agricultural information. The major bothering in living is the over-burden of agricultural activity and lack of leisure time. The reason that farm women are not joint the farm management job is lack of management ability, bad income and no time. 5) The present major problem for folwer production and management farm is shortage of farm labor, low and unstable price for farm produce, lack of capital. They hope the individual farm management will toward the direction of industrialized production and development, and earn the same net-income as other business.

A Case Study on Management for Cheng's Mushroom Farm

The edible musbroom industry in Taiwan was guite developed in the year of 70's, which was one of the major exported agricultural products. The production of edible mushroom was a by-product of rural farm family. The raw materials then were processed by food manufactory for exporting. Due to the high competition of mushroom product in the world market from mainland China and other Asian countries, the mushroom industry in Taiwan has declined rapidly. Some professional mushroom producing farms had been established. Cheng's Mushroom Farm is one of this kind of farm.

The purpose of this study were to analyze the characteristics of farm management and financial status in order to be used as a reference for guiding other similar mushroom producing farms. The results indicated that Feng-Nan Mushroom Farm was a industrialijed management farm. The major products of the farm were mushroom plastic bags. Recently, the fresh mushroom market was also exploited. The analysis also indicated that the farm in 1994 has a debt of NT$ 2222221 due to both net farm income and return to operator's capital were minus. The farm operation was under structure transformation stage. The farm productivity and construction were not fully operated, which reduced the farm revenue. In consideration of the farm financial structure, the ratio of operator's owned capital and benefit efficacy were 93.6% and 1, 454.9%, respectively. The rate of security on equipment investment was 98.4% and the rate of fixed assets was 104.8%. All these showed that the farm's financial sturcture was very healthy. It has excellent solvency for both long-term and short-term debt. The major problem of this farm was over investment on fixed assets and can not fully utilize the resources that affect the stability of investment and mobility of finance.

In the long-term development, Cheng's Farm possesses many Superior conditions, it will have great potential in the future if the unfavorable factors have been improved.

In order to maintain the steady growth of farm operation, the following recommendation have proposed: 1) The labor in Feng-Nan Farm is the limiting factor of production in stead of cultivation techniques and marketing. The introduction of foreign labor is one of the priority to solve this problem. 2) The expansion of exporting market is very important in the future for establish the multiple marketing channels. 3) Establishing the financial management and benefit orientation system will in favor of farm operation.

Utilization and Planning of Agricultural Waste for Compost in Farm Community of Taichung Areas

This study was adopted the ideal of rural development planning and community development and meet the requirement of different executive unit in rural areas, farm community and farm family. It also considered the development planning at different levels in each executive society in term of economic, ecology and system level. We developed the composting model for organic waste in different executive unit. The preliminary result of planning to use the farm family or farm community as the utilization model of executive unit. The compost accumulation method could adopt natural method, tank method, bag method or pail method according the actual situation. If the rural area is the executive unit, the large-scale open or seal accumulation method could be used for composting procedure, according the different kind of organic waste. Further researches and extension on organic waste composting treatment should be strengthened to utilize the farm organic waste for composting into organic fertilizer, and to reach the function of resource recycling and environmental protection.

Analysis of Rural Youth in Joining the Agricultural Professional Training Program

The research is to study the motive of the young farmers in joining the" Agricultural Professional Training Program". A total of 150 sampled trainees were selected for questionnaire, the analysis of the result of their answers was described as follows. The trainees are mostly at the age from 31 to 35, and then followed by the group from the age of 26 to 30. The 84.6% of the trainees are high school or professional high school graduates and above. The satisfactory degree in term of overall training related items, the trainees in "Fruit tree class" have the highest percentage of trainees showing satisfaction, which is 71.8%; then followed by "Protected vegetable class", which is 57.0%. For the individual training item, the training environment received the highest percentage of satifactory degree, which is 74.6%, followed by training subject arrangement, which is 45%, followed by instructor level, which is 59.5%. The training materials received the lowest satisfatory degree in

term of percentage of trainees, which is 45.0%.

Integration and Supervision of Agricultural Production and Marketing Team in Nantou County

The integration and supervision of agricultural production and marketing team is focused on the following seven agricultural industry: fruit trees, vegetable crop, flower crop, hog, fishery, broiler and layer. Until July, 1994, there are totaled 400 teams and 9185 members have been organized, in which flower crops have 83 teams, 1027 members; vegetable crops have 122 teams, 2622 members; fruit trees have 183 teams, 5265 members, the other 4 categories have 12 teams, 271 members. The main task is to supervise the team operation, training team staff, increase produce competivity and establish team brand name. Nation-wide team evaluation result showed that there are 7 teams have been judged as outstanding teams in Nantou county.

Service Statistics of Farmer Service Center

Statistics of tour arrangement for local visitors by Farmer Service Center is as follows: 135 groups and 9178 people is 1993; 131 groups and 8960 people in 1994; 103 groups and 7141 people in 1995, for foreign visitors is 51 groups and 741 people in 1993; 59 groups and 762 people in 1994; 45 groups and 1082 people in 1995. Lecture or training arragement is as follows: 254 tims and 1969 lecturers in 1993; 224 times and 817 lectures in 1994; 206 times and 436 lecturers in 1995. Case service of farmer problems totaled is 656 cases and 1872 people in 1993; 574 cases and 1461 people in 1994; 575 cases and 916 people in 1995.

Integration and Supervision of Agricultural Production and Marketing Team in Taichung County

There are totaled 322 agricultural production and marketing teams have been registered and organized in 1995 at Taichung county. In which, vegetable crops have 86 teams; flower crops have 34 teams; fruit trees have184 teams; layers chicken have 11 team; broiler chicken have 8 teams; hog raising have 9 teams. The activities related to agricultural production and marketing team is as follows: joint team meeting 32 times, technique consultant meeting 8 times, workshop 33 times, field day 18 times, subject-matter interview 51 times, produce exhibition 11 times. Team evaluation result in Taichung county showed that 44 teams belong to first-grade team, which is reached 14.2%; 99 teams belong to 2nd-grade team, which is reached 32%.