

Summary

In 2004, 64 research projects and 20 demonstration plans were conducted, 6 commissioned project from other organizations were accepted. The results were summarized as follow:

On rice; A new rice variety, Hualien No.20, was allowed to registered in June, 2004. The variety contained the characters of good-eating quality, good appearance, high yield and better resistance to rice blast. The days from transplanting to harvest is 120 days in the first crop and 110 days in the second crop. And the average yield is 7075 kg/ha in the first crop, and 5568 kg/ha in the second crop.

HKY69 was submitted to attend the regional yield trail of 2005. The fertilizer test on breeding line HKY50、53 had shown that the highest yield was obtained on the application of nitrogen at 160 kg/ha, and HKY44 was obtained at 200 kg/ha. The panicle sprouting rate is higher in the first and second crop for Japonica type of rice. It's lower for Indica type of rice in both crops. In shattering character, most variety are graded in middle scales for Indica and Japonica type of rice. In yield forecasting trial, the yields are better than the past years in every variety. In new varieties extension, TT30 are suitable for Hualien and Ilan area. To promote organic rice production, a total of 566.56 and 49.78 hectares were grown, respectively in Hualien and Ilan Counties. To enhance the production of good quality rice, a total of 4,766 and 2,733 hectares were guided respectively in Hualien and Ilan Counties.

In the research of promoting the quality of rice in the valley of Hualien and Taitung, the yield are the highest in 120 kg/ha-Nitrogen and 100 kg/ha-K₂O, but the quality of rice are the highest in 100 kg/ha-Nitrogen and 80 kg/ha-K₂O.

On upland and special crops : The third-year trial for peanut was conducted and 2 breeding lines of HL89-19 and HL87-20 performed higher yield potential than the control. On regional trials, two breeding lines Nan-kai-si 170 and Nung-yu 49 performed better than others in the spring crop and fall crop. The second-year trial of taro-like sweet potato was conducted and a breeding line TLSP-024 performed better than others. On table-used sweet potatoes, the results of regional trial indicated that TYY81-142 has the highest yield potential. On yam selection program, breeding line HY74-02 has the highest yield potential, and the rate of 15 tons per hectare of organic fertilizer application could promote the tuber yield of yam. The experiment on the seed production of green manure for landscape was performed, the results showed that the productive cost of feather cockscomb, *Cosmos bipinnatus* Cav. and *Cosmos sulphureus* Cav. were 380, 1475 and 1200, NT\$ per kilogram, respectively. On the research of health plants, the best planting spacing for *Seutellaria baicalensis* is 60 cm per row and *Argelica* spp. has the better yield potential planting in the An-Tong area. The rate of 2.5L per hectare for 38.72% Pendimethalin CS was effective to prevent the

occurrence of goosegrass, jnngrice, pigweed and slender amaranth in the vegetable soybean field and the rate of 0.75L per hectare for 4.4% Pantera (Quizalofop-P-tefuryl) EC was effective to prevent the occurrence of goosegrass, junglerice, southern crabgrass and green bristle grass in the peanut field.

On vegetables : To breed new F1 varieties of wax gourd, crossings between variety Chifong and other pure lines were conducted. Two F1 breeding lines SFW01 and SFW03 together with two controlled varieties Chifong and Green Tiger were cultivated to make local trials. The experiments were conducted in three locations in Hualien and Ilan counties. The growth rate of F1 hybrids was more vigorous than that of pure-line variety Chifong, with longer stems and more leaves. All the tested plants produced long cylindrical fruits, with white wax on the surface. Breeding line SFW01 has the highest number of fruit setting, which was from 4.7 to 7.0 per plant in average. On yield potential, SFW03 got the highest yield with 43.3 to 93.6 metric tons per hectare. The hybrid vigor was found to be clear in this experiment. The 2004 summer crop new variety comparison test of wild bitter gourds has the results as: variety WB34 is the best of all, with small-area production above 29 kilograms and single plant fruiting number of 149. The experiment result of spring crop wild bitter gourds at three regions this year is: Production of WB9 is 22.3 tons/ha, this is much better than the comparison variety F1327. For summer crop, the result's at three regions is: variety WB9's production is 17.3 tons/ha, this is significantly more than the controlled variety F1327. WB9 was registered in Dec 29 2004 as a new variety Hualien #1 , . Regional trial of tomato new lines with resistance to late blight was made, FMTT795 has highest yield in autumn crop, 2003. Another regional trial of tomato new lines with resistance to tomato leaf curl virus (TLCV) was also made, FMTT965 has highest yield in spring crop, 2003 and spring crop, 2004. The cherry tomato line with high β -carotene content CHT1201 was registered in December 29, 2004 as a new variety 'Hualien Asveg # 14'. Studies on breeding of green onion, results of horticultural characteristics showed the HAF10532 and HAF10530, new lines of hybrid progeny, have good performance under summer season with higher yield, 20.4-24.0 cm length of blanched. Deterioration of usawa cane shoot product was induced by browning reaction and decay. The shelf life of usawa cane shoot was 1 to 3 days, and it extended to 5 to 7 days that stored at 5°C. Results of variety comparison test of *Asplenium nidus* L. are : HN69 and HN178 have the most speediest growth of leaf number, and HN178 has the highest production.

On flower crops: To create new lily varieties, crossings between *Lilium formosanum* and Asiatic/oriental lilies were conducted. Tissue culture techniques, including ovary culture and ovule culture, were used to overcome crossing barriers between different species. Therefore, many hybrid progenies were obtained. There were three crossing combinations, 93FLRS1, 93FLRS2, and 93FLRS3, successfully done. 16 plants were developed thereafter. Another nine crossing

combinations which were obtained last year had developed into plants. After analysis of the flowering characteristics, plants with better performance were mass propagated and a total of 1,345 plants were cultivated in the field for further trials. The aromatic plants were collected continuously, and were cultivated in an experimental garden. Observation and propagation were conducted. A perennial cultivation system, which was based on different pruning methods, was tested for lavender. It showed that a 25 cm pruning was suitable for lavender, which could enhance the shooting rate of adventitious buds to 46%. An investigation was conducted to compare the essential oil content among different lavender cultivars. The essential oil was extracted from fresh plants by water vapor. The application of aromatic plants for leisure agriculture, a one-hectare aromatic garden was constructed, which was surrounded water routes for discrimination. The aromatic plants were planted in the garden by a special design. Some other recreation facilities were placed around for children. The establishment of this garden was a new approach, which directs the management of fallow fields into leisure agriculture field. We had collected 5 varieties of *Salix* family in this year. They were applied in flower arrangement. In the early planting of Cat-tail willow to early harvested experiment, the results showed that the survival ratio of cuttings and early growth of Cat-tail willow were decreased by chilling. And the plant height and over 120 cm branches were less in the early planting treatments than normal planting treatment. The results of the post harvested experiment showed that 0°C and 5°C treatments were better than 10°C treatment wherever with bactericide or not. The different cutting test was using the variety of flower-quince “Chang-Shou-Lu (CSL)” tested in month of January, April and July. From this study, the survival ratios were unstable of CSL under varying meteorological conditions. All the different cuttings may use for propagation of flower-quince, but that must be have growth vigor of cutting wood. The performance of callus forming rate and cutting survival rate of apical-bud-cutting is higher and much higher. The germplasm collection of native ornamental plants had accumulated approx. 330 kinds up to now. As to *Peperomia japonica* Makino, the survival rate of cutting could reach 100%. The base of stalk is better for cutting. The requirement for cutting media is not so critical in this case. For horticultural application, 3-5 inches of miniature pot-plant is more suitable. It takes approx. 3-4 months to complete a pot. Light fertilizer is adequate for pot-plant fertilizing management. The cutting survival rate of *Lysionotus pauciflorus* Maxim var. *pauciflorus* can reach 100%, too. The top of stalk is better for cutting. Cutting media requirements are similar to *Peperomia japonica* Makino. 5” hanging basket is more suitable for horticultural application. It takes longer time completing a pot, about 6-8 months. Light fertilizer is also proper for fertilizing management. Blue waterhyssop (*Bacopa carolineana*) were cultivated monthly with apical and intermediate shoot cuttings to investigate the growth rate of year-round production. The results indicate that both cutting types which were cultivated during low temperature period between

November and January regrew very slowly, but those cultivated after February regrew apparently faster. The cuttings cultivated during the period from May to September regrew much faster. The cutting from shoot apexes started to grow in 3-5 days and became salable in a week, and those from intermediate shoots grew in 6-8 days and became salable in 3 weeks. To reduce the cultivation time and cost, it is suggested to grow blue waterhyssop in the period between May and September.

On fruit tree : The relationship between tree age and fruit quality on wentan pomelo had been investigated. There was no difference on the total yield and the percentage of middle size fruit between 20-year-old and 40-year-old's wentan pomelo plant. However, the fruit quality was not significantly different. Utilizing 3,000 ppm IBA to treat stem cutting of abiu could promote the rooting.

Twelve citrus cultivars/lines, including 'Nankan No. 20' and others were evaluated for their adaptation to I-Lan area. All tested plants bloomed between early to late March. The cultivar 'Fremont' had the highest number of fruit per tree with 162.5 fruits. 'Shinjin No.3' and 'Nankan No. 20' were the two cultivars that matured earlier. 'Fremont' and 'P158-2' had higher sugar contents of 11.6 degree Brix in average and 'Murcott' had 10.8 degree Brix. These cultivars/lines are regarded to have the potential for cultivation in this area. The optimal new variety of citrus in Hualien area was Minneola tangelo, Minneola tangelo was grafted on 'Kwang-Tung lemon' stock had the highest shoot number. The optimal period to harvest Minneola tangelo fruit was from middle Jan. to early Feb. in Hualien area.

Buds of four cultivars/lines of wax apple were collected and top-grafted onto 3-year old stocks. Among them, the 'Feng-Shan No. 73-1' had the largest fruit size of 148.5 grams. With respect to fruit sugar content, the 'A-Tu Large' had the highest of 11.6 and 13.9 degree Brix in the upper and lower half of its fruit and is highly recommended for cultivation. Five different bagging materials were evaluated on fruit-splitting of wax apple. Fruits bagged with meshed bags had the lowest fruit-splitting ratio of 26.7% and fruits bagged with paper bags plus no shelter had the highest fruit-splitting ratio of 53.3%. There were significant differences among treatments.

In order to establish the production and propagation of virus-free healthy kumquat seedlings, 1855 sunki seedlings were raised for stock use. The cost for each self propagated and grafted stock seedling was 14 NT dollars, and it was estimated a total of 43,000 dollars of seedling cost could be saved per hector. One hundred virus-free healthy kumquat trees for budwood were raised and 656 bud-grafted healthy seedlings were obtained. Six different stock species, including sunki and others were collected and grafted with virus-free healthy kumquat budwoods. Among them, the sunki, with stem width of 5.8 cm and plant height of 172.5 cm, was superior than others. Improvements of cultivation practice, including the establishment of the proper shape of kumquat tree, the correct

method pruning and trimming and the establishment of grass ground cover, all showed positive preliminary results, and are worth of further experiments.

On biotechnology: When the lilies callus transferred by *Agrobacterium*- mediated method, the brown proportions of LA2 lily callus cocultured for 3 days (15.7% -16.0%) were better than LG41 callus (50.7% -52.5%). The brown proportions were lower when the LD3 preculture medium was used (45.8% -54.0%) than the PI-10 medium (74.0% -90.9%). The brown proportion of DFR1AGUS gene transformation was highest and CHIAGFP gene transformation were lower by particle bombardment method. The flower colors of flower-color antisense gene tobacco transformants had changed a little . The tomato cultivar 'Hualien AVRDC # 5' was transferred Bt genes with plasmids PBI121AC or PBI121IC. The regeneration proportions after selection were 8-27% and the regenerated shoots numbers per dish were 2.0-5.9. The regenerated shoots numbers after selection were higher when treated with AS 100 μ M coculture medium and PBI121AC plasmid. Ten areas of seedlings of papaya which were GMO-like plants and the papaya seedlings cultured in net-house were collected into our lab. The samples of 9 areas were detected the GUS gene expression by X-glcA solution and the PCR analysis. In contrast, the samples of net-house cultivation were not detected by X-glcA solution stained and PCR analysis. There were 15 mutated strains of ornamental pineapple selected this year. The shoots of 15 mutated strains have been sub-cultured several times, five of them sustained mutated characteristics with a 100% ratio, but three of them turned into normal green type. The other seven strains were still unstable, and further selection should be conducted continuously. To induce mutation on *Pratia nummularia* (Lam) A. Braum & Asch and *Chaenomeles speciosa* Nakai tissue culture plantlets, the *Pratia nummularia* (Lam) A. Braum & Asch tissue culture seedlings survival ration were over 90% whenever planted in acclimated boxes or not. In the other experiment of *Chaenomeles speciosa* Nakai, the results showed that 0.5ppm IBA treatment could induce health root formation. The results of tissue culture seedlings survival ration were very low, especially without planted in acclimated boxes treatments were less than 10% .

On processing of agricultural products: There are 5 research and development projects for processing of agricultural products of Hualien District. In processing of agricultural specialty products of Hualien District : 1. Millet : Millet porridge is a traditional food of primitive people. The processing procedure of healthy ready-to-eat millet porridge using local produced millet (Taitung S7) packaged in glass bottle and retortable pouch has been developed. Two formulas, sweet millet porridge and healthy millet porridge, were studied. The consumer preference test of the final products packaged in glass bottle and retort pouch revealed good acceptance. 2. Breadfruit : Breadfruit is a very popular plant in Hualien with limited utilization. A new procedure to processing breadfruit flour was tested. The flour were used to produce high diet fiber and low

calorie snack food and Mochi with golden color. 3. Wentan pomelo : Wentan pomelo is the most important fruit tree in Hualien. A new utilization of Wentan pomelo has been developed. The essential oil of Wentan pomelo flower was extracted with recycle of alcohol and vacuum-condense. The components of ssential oil of Wentan pomelo flower were analyzed. The essential oil could be utilized as food and cosmetic additive. In processing of traditional agricultural products : 4. Monascus : The procedures of solid and liquid koji fermentation for Monascus had been established. Five different strains of Monascus were screened. The results showed that one of five strains could produce the product with Monacolin K > 800ppm, and Citrinin < 10ppm. This strain could be used for further studies. In new utilization of Rice : 5. Rice acrospires : The health food processing of rice acrospires and the extract method for the acrospires oil of rice had been developed. Some chemical components of the acrospires oil of rice were analyzed by GC/MS. The product could be used as additive for healthy food products.

On plant protection: The organic cultivation in crops, non-chemicals controlling and biological pesticides preparation, agricultural extension and safety using of chemicals in crops were conducted in this year. Besides, we also set up the detection, the monitor and the warning of plant epidemic system to enhance pest control efficiency and product quality, and maintains health of the consumer, and ensures the production of agricultural and protects the environment of agricultural in Hualian. The controlling rate of bakanae disease of rice may reach 80% by using of anti-disease of soil, and the rice blast may reach 55% preventing by the phosphorous acid. The incidence of Chinese leek rust disease is low when the temperature more than 26 °C, and the density of bulb mite is direct ratio with the rainfall. Application of humic acid may control bacterial wilt in water convolvulus, and combined with Bacillus B190 may effectively enhance the fresh weight. Application of Bacillus B190 and the improve agent may obviously decrease the incidence of powdery mildew on muskmelon, and observable antibiotics iturin A in Bacillus B190 by HPLC. The purification of antagonist may effectively promote the growth of tomato and sweet pepper. The citrus canker of pomelo was not found in field, and the incidence of black spot on pomelo was really low, and melanose and thrips occurs universally. The occurrence of silverleaf whitefly in the field was aggregation distribution, and also activated in the morning. The Beuveria fungus may effectively control the rice water weevil. The density of oriental fruit fly and damages ratio decreased by coordination of control compared with previous two years. The density of beet armyworm of green onion was reduced 50% compared with the control plot by coordination of control. The Burmese mouse and the wild mouse was monitored and controlled, and the controlling rate reach 94.3%. In order to control rice pest at suitable time and monitor plant epidemic system, the plant pest forecasts were issued 12 times, and the pest warning report and meteorological information were issued 18 and 30 times respectively. The survey points for quarantine harmful insect have been set, and

demonstrated that there was no quarantine pest in Hualien area. More than 50 samples of ant were identified and more than 18 times of control guidance were conducted. The execution of crops plant pest monitor and controlling service, counts diagnosis was 193 times in 50 kinds of crops. There were 84 classes using of GAP mark in Hualien and the Yilan county were assisted.

On soil and fertilizer: For the pseudo-composted rice hull medium, a suitable system of solution-nutrition supply by multi-function timer, pump, and some switch was established. For the quality of tomato, the sweet and acidity of fruit can be enhancing by raise the concentration of potash fertilizer, but the reaction is not same for add potash fertilizer to plant to different tomato type. Effect of different water logging periods on the yield of rationing vegetable: The materials of experiment included water convolvulus, chayote, Chinese leek, sweet potato and gynura waterlogging 48 hrs, 24 hrs, 12 hrs, and 0 hr. (CK) at grow prolifically stage, respectively. The results indicated that water convolvulus had the highest tolerance to waterlogging stress. The yield was 27.1% higher than the check at the treatment of 48 hrs waterlogging. gynura got the lowest tolerance, and followed by sweet potato, Chinese leek and chayote shoot. Their yield was 59.2%, 38.7%, 26.0% and 25.5% less than blank, respectively. Another result indicated that it got the highest yield 5,662 kg/ha of sweet potato leaves with top dressing chemical fertilizers nitrogen : potassium oxide = 84:24 kg/ha and applied again a week later in 24 hrs waterlogging treatment. Band application of compost can only enhance the yield of cucumber 2.0% to 11.2% than broadcast application one. In 2004, there were 2,003 samples of soil and plant tissues were analyzed, it including 915 samples of plant tissue, 714 samples of soil, and 374 samples of organic materials. Those data were used to make recommendation of soil fertility and plant nutrition for farmers.

On agricultural machine: Agricultural machine development and improvement: There are two portions with agricultural machine development in Hualien. In the farmland machine, the vegetable seeding, fertilizer applying and ridge making all in one machine has been developed. This machine functions includes plane the land, fertilizer applicator, churning with the land, making ridge, and seeding. In the process machine, the Wentan Pomelo fruit processes machine entire arrangement has been finished. First, the sorting machine is used to space the Wentan Pomelo fruit with three levels. And the peeling machine winnow the Wentan Pomelo fruit peel according to the three levels. Otherwise in the industry and academia collaboration, the vegetable seeding machine improvement has been entered the mold development. The entire development mold include three molds the seeding case and shell, the seeding channel, the seed box and cover. To convenience notice seed condition the transparency PE was used for seed box material. In the vegetable acrospire's automation culture guidance, the all acrospire's amounts are 28.8 million. The neoteric agricultural machine furtherance, there were 40 the third multifunctional manure spreading machine has been

used. In the technical devolution, the fertilizer applicator and ridge-making machine has been administered.