

## Summary

In 2003, 67 research projects and 31 demonstration plans were conducted, 3 commissioned projects from other organizations were accepted. The results were summarized follow :

On rice : A superior breeding line HKY53 was submitted to attend the regional trials of 2004. The fertilizer tests on breeding lines, HKY32, 44, and 50, had shown that the highest yield was obtained on the application of nitrogen at 200 kg/ha. The on panicle germination tests showed that the germination rate of Japonica rice in the second crop was higher than the first crop. For Indica rice, however, it was rather low. On shattering tests, all Indica and Japonica type of rice were recorded as middle grade. On yield prediction trial, due to the good weather conditions, the yields in this year were higher than the average in the past. The results of local trials, for newly released rice varieties, showed that variety TY 1 is suitable for Hualien and Ilan area. Variety KH 143 appeared to be weaker and easier lodging, and that should be avoided in the future. To promote organic rice production, a total of 444 and 50.86 hectares were grown, respectively in Hualien and Ilan Counties. To enhance the production of good quality rica, a total of 4,000 and 2,700 hectares were guided respectively in Hualien and Ilan Counties.

On upland crops: A superior variety Hualien 2, commercial name Triple Pod, was released this year. The third-year trial for peanut was conducted, and four breeding lines HL87-09, HL87-10, HL87-13, and HL87-14 performed higher yield potential than the control. On regional trials, two breeding lines Hua-yu 15 and Nan-Kai-si 168 performed better than others respectively in the first crop, and second crop. On taro-like sweet potato selection trials, 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 Y74-2 has the best performance. On the research of green manure for landscaping, the common cosmos (*Cosmos bipinnatus* Cav.) was suitable for late autumn and early spring. The suitable sowing time for feather cockscomb (*Coleosion argentea* L.) is April, and the best sowing quantity was 3 to 4 kg/ha. On the research of health improving plants, using fine sand together. With cow manure as culture media, the growth of *Spirunthes sinesis* was enhanced. The best planting density for *Echinops grijsii* Hance is 50 cm per row.

On vegetables: The combining ability tests were conducted for wax-gourd, and a hybrid combination Hualien 1×TAI-2-2-22-3-13-4-18 showed the best performance. The fruit weight is 8.2 kg, and the yield is 62.1 metric tons per hectare. In bitter gourd the comparison trials within breeding lines were conducted, and one superior line HCM6333 showed the best performance with yield potential 4 metric tons per hectare. There were six tomato varieties been imported and grown in the greenhouses for adaptation trials. Variety FA832 and HA852 had the heaviest fruit weight, and could be recommended to the farmers. On the development of vegetable crops for aboriginal areas, one Asplenium breeding line 69 was selected with fast growing habit. The post-harvest research on yellow rotang palm was conducted to reduce browning symptom. It showed that utilizing vacuum package could inhibit the enzymatic browning of yellow rotang palm. Studies on breeding of green onion showed that the HAF10522,HAF10509,HAF10532 and HAF10534 new lines of hybrid progeny have good performance under summer season with higher weight, longer length of blanched. A selection program for virus tolerant garlic was conducted. The results indicated that the virus free and bulbils lines have higher yield and better horticultural characteristics than the other varieties. The cherry tomato line with high  $\beta$ -carotene content CHT1200 was registered in June 20, 2003 as a new variety‘Hualien ASVEG#13’. Another regional trial of tomato new lines with resistance to late blight was also conducted, FMTT795 has highest yield in spring crop,2003.

On flower crops: Crossings of lily were conducted by using *Lilium formosanum* as a maternal plant, and the Asiatic or oriental hybrid lilies as paternal plants. The hybrid embryos were rescued by using tissue culture techniques. One cross combination was obtained, and 30 hybrid plants were regenerated successfully this year. Sixty-nine plants, which were belonging to six combinations, started to bloom this year. Nine superior hybrids were selected and mass propagated. Studies on the development and usage of aromatic herbs were conducted. The cutting of sweet lavender was treated with 72-plug and 3-inch-plot, the 3-inch-plot treatment was better. The aromatic plants could be extracted to get essential oil by using stem distillation methods. It showed that 18 ml essential oil could be extracted from 2 kg of rosemary shoots. The clone 89-73 was registered in December 24, 2003 as a new Cat-tail variety ‘Lanyang #1’. The Lanyang #1 had big flower buds and red bud-scales, which is a bud-mutative branch of Chinese Shanshing variety willow. In flower-quine, there were 12 new varieties have been recommended. The callus forming rate and cutting survival rate of apical-bud-cuttage of: ‘Chang-Shou-Lu(CSL) is higher than other treatments. For the bloom regulation test of CSL, the performance of 5°C pre-processing is the best treatment. There are 300 species native ornamental plants were collected this year, for example *Peperomia nakaharai* Hayata and *Lysionotus pauciflorus* var *pauciflorus* Maxim. The results of cutting test indicated that the

survival rates were all nearly 100% in all treatments of *Justicia Procumbens* var. *Procumbens* L.. The media volume ratio of peatmoss: perlite:tree fern No.4 equal to 1:1:1 is best for *Distylium racemosum* Sieb. & Zucc. rooting. For *Radermachia sinica* (Hance) Hemsl., the survival rate of newly born green cutting was the highest, up to 97%, than other maturity shoot. For aigamo-rice integrated farming, 100 ducks/ha is the best duck density in field and has the highest production. Paclobutrazol application (2.5 mg/L) had made the *Cyperus haspan* plants well-performed miniature potted plants.

On fruit trees: Several fruit trees were imported and evaluated, and the birib was selected for its good performance in Hualien area. The average weight of a biriba fruit was 150 to 250g, and the sugar content was 13 to 15° Brix. The relationship between tree age and fruit quality on wentan pomelo was investigated. The total yield of 20-year-old plants was significantly higher than the 40-year-old plants. However, the fruit quality including soluble solids content, acidity, percentage of juice, etc. was not significantly different. Breeding and selection of citrus cultivars in Hwalian area, eight cultivars were planted at Shoufen of Hualien County in the past 5 years. ‘Minneola’ had the best performance with average fruit weight of 200-300 grams and total solid contents of 12-13 degree Brix. ‘Acidless’ orange and ‘Ortanique’ tangor was the second, both of them had the potential for commercial cultivation. Among the 12 citrus cultivars/lines tested in Sanshing of Ilan County, ‘Fremont’, ‘Ortanique’, ‘Murcott’ and new line‘ ‘P158-2’ showed superior performance with high yield. A total of 24 lines of kumquat were top-grafted onto adult tree. Among them, kq-1-1, kq-1-5 and kq-1-11 had the highest bud-survival rate of 70%. A total of 250 virus free and seedlings were obtained, then planted at two of 0.3-hectare trial area. Improving fruit quality of was apple growing at Ilan area, five cultivars of wax apple were collected and top-grafted onto local-grown trees. ‘A-tu large’ had the largest average fruit weights of 172.9 gram.

On agricultural products processing: The aerial tubers of long shape yams contained abundant nutrition, which were even higher than underground tubers. To increase the add-value, the canned aerial tuber products were developed this year. Using the natural metabolites and the beautiful color of fermentative anka, several preserved vegetable products had been developed. The anka was also developed for making preserved pork products. Since the breadfruit flour contained abundant diet fibers, it was studied to substitute a part of the wheat flour when making baking foods. To evaluate the general acceptance of the consumers, the baking products were tasted. After evaluation the outlook, color, flavor, and taste of the products were acceptable.

On biotechnology: The bud primordia of ornamental pineapples, which were induced from stem nodes, were irradiated by the r-ray to induce mutations. There were 14 stable mutants obtained accordingly. The mutants obtained last year were planted in a greenhouse for further observation. It has shown that three mutants, G9002, G9004 and G9022 have stable performance with beautiful

chimeric leaves. Genetic transformation research was conducted for rice, and three callus lines induced from cultivars TNG67, TK16, and TK17 were investigated. An anti-DFR gene was successfully transferred into those cultivars by using Agrobacterium. The transformants which harboring a GUS gene could be recognized by blue staining. Tomato cultivar Hualien ASVEG 5 was successfully transformed by using Agrobacterium. When using plasmid PBI1121 as a transformation vector, the number of adventitious buds lies between 1.8 and 3.4. Explants cultured on MSG1 medium had shown higher regeneration ratio, and parts of the explants have had GUS expression. Flower gene transformation research on lilies was conducted, and there were two genes including DFR1AGUS and F3H1AGUS were transferred into LA2 and LG41 callus lines through particle bombardment. The transient GUS expression could be detected on the transformed calli.

On plant protection: The major pests and diseases of bird's nest fern and Chinese yam have been identified. The most effective pesticide on bird's nest fern leaf nematode is oxamy1. Tribasic copper sulfate and dimethomorph are effective for control of gummosis on kumquat. For the control of Phytophthora disease, using the tribasic-copper-sulfate mixed calcium substance sprayed on the trunk of Kumquat is also effective. Experiments on non-pesticide control of bulb mites of leek shows that the best control material is tobacco extract, its controlling rate is from 59.6% to 77.2%. Application of 81.3% Kasugamycin+Copper oxychloride or 58% humic acid after harvest period can control bacterial wilt of water convolvulus. PBCAB had the highest controlling effect on Phytophthora disease of tomato. The antagonist rhizobacteria PBCAB is screened from pomelo compost and grown best when cultured in castor cake substance. Air temperature is the main limiting factor of leek rust development, and air temperature above 25°C inhibits leek rust. Rainfall is closely related with incidences of leek root mites. CR compost decreased the incidences of the cucumber Phytophthora blight from 62.4% to 25.2%, especially CR compost was mixed with castor cake had significantly decreased the incidences from 25.2% to 12.3%. Spraying clove oil 2,500ppm and ferric chloride 5,000ppm were effective on rice leaf blast. The phosphorous acid solution 667ppm had stable effect on bakanae disease of rice seedlings. Application of the improved formula of Bacillus amyloquefaciens B190 can inhibit the powdery mildew of muskmelon. The cooperative control conducted whole area decreased the incidences up to 60% of oriental fruit fly, and the incidences of beet army worm decreased 50%. The monitoring on Rattus exulans and field mouse reveals that long-term poison trapping gives a control rate of 89.4 percent. The control rate of field mouse is 87.3%. For timing of major pests of rice and other crops, 12 forecasts and 19 warning have been announced. The data of monitor stations for statutory quarantine pests shows that there are no quarantine pests found at Hualien area. The service of diagnosis and control consultation identified 206 cases on 60 crops. The consultation on good agricultural product (GAP) was held with 81 farmers' classes and pesticide safety area in Hualien and Ilan covered 1200 ha.

On soil and fertilizer: The highest yield 16,260 kg/ha of wild bitter gourd was found in the treatment which applied with organic fertilizer 10 tons/ha and chemical fertilizers nitrogen: phosphorus pentoxide: potassium oxide=300:75:225 kg/ha. For the compost tea, the rice hull compost soaked in water at the compost/water ratio 1/20, the extractor could be used as liquid fertilizer, and the solid residue could also be used as a suitable nursery medium for vegetables. The yields of cucumber and tomato grown on the pseudo-composted rice hull medium were not significantly different from those grown on the peat moss medium. Besides, the pseudo-composted rice hull medium has benefits of long-term availability, low salinity, well aeration and low cost, so it can replace the imported peat moss medium. By vacuum compressing, the compost bulk density could be enhanced 2.2 times by granulation and compost bulk volume could be decreased 15%. It can not only decreased the cost of transportation and storage but also increased the efficiency of applying fertilizer. For forcing culture of the Chaenomeles sanensis Kahn, the branching percentage were between 83.9~88.7%, and the best treatment was that shoots were pruned at 5 cm high and fertilized with high dose of nitrogen. For the soil survey data, the homepage of soil information system has been accomplished. This system includes the theme display of soil fertility and inquires system of grid survey data. The user can search data simply and easily by using the function of move, zoom in, zoom out, drag, or selection by point. In 2003, there were 2,068 samples of soil and plant tissues were analyzed. It included 1,082 samples of plant tissue, 905 samples of soil, and 81 samples of organic materials. Those data were used to make recommendation of soil fertility and plant nutrition for farmers.

On agricultural machine: To combine operations of vegetable seeding, fertilizer applying and ridge making, and integrated machine which loaded by tractor has been developed. It could reduce seed usage, operation time and man labor. The working capacity of this machine was average 2 to 3 hours per hectare. Wentan pomelo fruit peeling machine has been developed, and an air compressor has been used as the power source. It only needs 3.76 seconds to peel a Wentan pomelo. About 4.5 tons of Wentan pomelo fruits will be processed a day. This year, three fertilizer-spreading machines have been released. There are 147 organic manure spreading machine has been generalized, and 486 multi-functional manure spreading machine has been generalized. To combine the advantage of organic manure spreading machine and multi-functional manure spreading machine, the third type of fertilizer-spreading machine has been developed, and 8 machines were sold in the market. Besides, the carried vegetable seeding machine has conferred the national patent in 2003. And the small carrier, which the height and wheel width could be adjusted, has conferred the national patent in 2003.