

## Summary

In 2002, total 68 research projects and 57 demonstration plans were conducted, 12 commissioned projects from other organizations were also accepted. The results were summarized as follow:

On rice : A superior breeding line TKY 31086 was named as a new variety Hualien 19 at December 22nd. According to the second-crop results of 2002, two breeding lines HKY 44 and HKY 50 were submitted to attend the regional trials of 2003. There were 39 aromatic rice varieties been evaluated, and 13 of them showed strong fragrance in both leaves and grains. There were 36 rice varieties been chosen for evaluating the possibility for making 'SAKE' wine. The on panicle germination tests showed that the germination rate of Japonica rice in the second crop was higher than in the first crop. For Indica rice, however, it was rather low in both crops. On shattering tests, all Indica and Japonica type of rice were recorded as middle grade. The NIR prediction models were developed to predict the contents of amylose and crude protein in rice powder. These models are available for screening breeding materials. TN 71 and KH 143 appeared weaker and easier lodging under higher nitrogen fertilizer. To promote organic rice production, a total of 399 and 60 hectares were grown, respectively in Hualien and Ilan area. To enhance the quality of good quality rice, a total of 3,900 and 2,050 hectares were grown, respectively in Hualien and Ilan area.

On upland and special crops : The third-year trial for peanut was conducted, and 3 new breeding line performed higher yield potential than the control variety Hualien 1. On regional trials, the new breeding lines Hua-yu 12, Nan-kai-si 165 performed better than others in the first crop, and Hua-yu 13, Nan-kai-si 167 and Nung-yu 47 performed better than others in the second crop. On taro-like sweet potato selection trials, the yield of a breeding line TLSP-019 was the highest on autumn spring trial. On yam selection program, the breeding line Y90-5 (long-shape type), and Y89-5 (red-flesh type) got the highest yield. On the selection of green manure for landscaping and leisure agriculture, the feather cockscomb (*Coleosion argentea* L.) and *Cosmos sulfurous* Cav. were suitable for the spring season. and the common cosmos (*Cosmos bipinnatus* Cav.) was suitable for autumn season. To develop the native health improving plant resources, some experiments were conducted. Using the fine sand as culture media together with the infection of mycorrhiza, the results showed that the germination rate of *Spirunthes sinensis* was enhanced. The best sowing time for *Berchemia lineata* is November, and for *Ficus formosana* is April.

On vegetable : There were six breeding programs been conducted, including wax-gourd, bitter gourd, ornamental squash, green onion, garlic, and tomato. In wax-gourd, pure line selection was progressed to the sixth generation, and seven breeding lines were selected. To obtain hybrid varieties, the variety Hualien 1 was used as a maternal plant, and then crossed with 4 other pure lines to obtain hybrid seeds. In bitter gourd, pure line selection was progressed to the sixth

generation, and 14 breeding lines were selected. The percentage of female flowers ranged from 2% to 98%, the fruit weight ranged from 25.7 to 338.8 g, and the thickness of flesh ranged from 8.7 to 15.6 mm. Breeding of ornamental squash was conducted and nine breeding lines had been selected. In green onion, two breeding lines 10484 and 10540 have good performance under summer season, which higher yield, longer stem, and better quality. A selection program for virus tolerant garlic was conducted. The results indicated that the yield of a virus free strain VFG180 was 24 to 40% higher than control. A regional trial was conducted to selecting small-fruit tomatoes for high vitamin A content, better quality, and tolerant to bacteria wilt disease. The results of summer season had shown that breeding line CHT 1200 got the highest yield, followed by CHT1201. To study the effect of cultivation facility on melons, three simple facilities, including , A , type pillar, vertical pillar, and row tunnel, were compared. It has shown that cultivation facility resulted in higher yield and better outlook of the fruits. To reduce fungus infection, the cut ends of long-shape yams were treated with sodium oleate solution, and the storage quality was enhanced.

On flowers : Breeding of lily had been conducted by using *Lilium formosanum* as a maternal plant, and the asiatic or oriental hybrid lilies as paternal plants. To overcome inter-specific crossing barriers, the in vitro culture techniques including ovary-culture and ovule-culture were employed. A breeding program has also been conducted in order to select Taiwan native lily cultivars. One self-pollinated line FLTK908 was selected with good characters. To collect herbal plants with different fragrances and to investigate the usage of those plants, a total of 242 cultivars, belonging to 12 genres, were collected. To find suitable varieties for making processing products, there were seven basil varieties been investigated. It showed that different variety has different growth habits and specific fragrance. Besides, different types of processing products were developed according to the specific fragrance. The propagation system for *Scutellaria* sp., which is suitable for developing into hanging plants, or landscaping plants ,has been established. The selection of big-bud in cat-tail willow was conducted and 30 superior plants were selected. For the selected plants, the number of branch, the length of shoot, and the buds per shoot were higher than ordinary plants. New varieties of flowering quince were introduced for adaptation tests. The results indicated that variety Yukigoten, Hakuju, Hojunohomare, and Niji had better adaptability than others. The results of cutting trials for flowering quince indicated that the best protocol is: Using the softwood with leaves as a cutting, using the mixture of perlite and vermiculite (1:1) as a soil medium, and using 500 ppm IBA solution for pretreatment, the survival rate was raised to 70%. Different mulching materials were compared to study the effect on growth of *Lycoris aurea*. It showed that non-woven and grass-inhibiting mat have the best effects on weed control. The highest bolting ratio happened on rice-hull mulching, and the tallest scape happened on paper mat mulching. A shading trial for watercress was conducted in summer season. It showed that the yield of watercress grown under

50% and 80% shadings were decreased to 75% of that under full sunlight conditions. The number of shoot per hectare and the dry weight were also decreased.

On fruit trees : In order to diversify the Citrus industry, eight and twelve cultivars were introduced and cultivated, respectively in Hualien and Ilan area. After a four-year observation, the results indicated that cultivar 'Miniola' performed the best results with good quality in Hualien area, followed by sugar-orange and Ortanique. Cultivar Fremont, Ortanique, and Murcott performed the best results with good quality in Ilan area. There were nine kumquat trees, with superior performance, been selected and cultivated in Yuanshan. The fruit weight of number 2-46 and 2-52 trees was higher than local varieties. To improve the quality of wax apple, five cultivars were introduced and grafted onto domestic trees. Cultivars Green Diamond and A-Tu Large set fruits for the first time and the weights were higher than local cultivars. A regional trial of pineapple was conducted for 7 cultivars. Cultivars Tainon 16 and Tainon 17 performed the superior characteristics with good flavor, high sugar content, and earlier maturation. To establish a virus-free propagation system for kumquat, a total of 1656 seedlings of *C. sunki* were propagated and used as rootstocks. The scion buds, taken from virus-free plants from kq-1-1 to kq-1-20, were grafted. A total of 695 grafted plants were obtained, and the survival rate was 85.1%.

On processing technique: The result of studies on the application of brewing and pickled foods on *Monascus* indicated that the special local agricultural products could be used to develop the pickled food with low-sodium and nourishing *Monascus* drinks, The final products adding more sugar, soy sauce and treating heat can get better flavor, delicious taste, and longer storage. Development the tea bags for healthy purpose of the native plant in eastern area was conducted. The result showed that tea bag quality was better using 50 ~ 60 than 70 for plant dry. Four tea-bags products were developed according to combination of proportion rate which including mesona, sweetening chrysanthemum and cinnamon etc. The flavor of these tea bags was popular for persons. The processing products, including yam, *Spiranthes sinensis*, *Ficus formosana* etc., developed in this year, showed non or less toxic, SOD contents was 3329 unit/g, and the heavy metal content was not detected. Due to safety evaluation, the processing products were safe for persons. Development of large agricultural product processing technology in Taiwan showed that the optimal temperature of pre-fermentation and post-fermentation on wentan pumelo materials that produced in Hualien area was 22 , and avoiding other bacterial pollution was necessary. Fragrance of the wentan pumelo was kept in the product. The vinegar of Wentan pumelo was manufactured by brewing of Wentan pumelo, rice-vinegar, and crystal sugar. It can avoid the bitterness and maintain special flavor. The essential oil of Wentan pumelo was extracted by applying cold-pressure and high speed centrifugal. By the GC/MS analysis, the essential oil contains more than 11 compounds, including Limonen,  $\alpha$ -Pinen,  $\beta$ -Pinen, and Phenol. The essential oil was processed into bath foam,

shampoo, moisture hand cream, and skin cream.

On biotechnology: There were six rice cultivars been compared, and TK17 and TN67 got the highest percentage of callus formation. The proliferation rate of callus was enhanced on the medium supplemented with proline. The number of shoot was increased on the medium supplemented with 2mg/l kinetin and 0.02mg/l NAA. Tomato Hualien AVRDC 5 was successfully transformed by *Agrobacterium tumefaciens* with a PBI121 plasmid. After a kanamycin selection, the transformation rates ranged from 33.1 to 74.3% and the number of regenerated shoots ranged from 1.8 to 3.4. The GUS gene expression was detected in some shoots. An *Agrobacterium* mediated transformation protocol was employed to transfer foreign genes into lily callus-line LG41. After a hygromycin selection, the browning rate of callus lies between 32.9 and 49.8%, and some calluses have shown GUS expression. The supplement of picloram (10mg/l) in the medium could enhance the proliferation rate and reduce the browning rate of lily callus. Using tissue culture together with irradiation techniques, 44 mutants of ornamental pineapple were obtained and grown in a greenhouse. In addition, the irradiation was investigated to find the best dosage. It showed that the exposure dose of 75 Gray caused the highest mutation rate (5.8%). On tissue culture research, the best result for the propagation of *Lobelia nummularia* was on the medium supplemented with 5 mg/l BA, and 2.5ppm BA for *Bredia oldhamii* and *B. hirsute* var. *scandens*. For *Phalaenopsis*, media supplemented with organic additives, such as sweet potato and banana paste, could enhance the growth rate. It showed that sweet potato paste taken from cultivar Tainong 66 was better than that from Tainong 57. The best proportion of sweet potato and banana mixture was 40:60 or 50:50 (g/l). The results of identification trials showed that there were 12 primers that could anneal with 20 green onion cultivars. A total of 35 Randomly Amplified Polymorphic (RAPD) DNA markers were obtained after Polymerase Chain Reaction.

On plant protection: The major pests and diseases of bird's nest fern have been identified. The more effective pesticides on scale insect are malathion, neem oil and bifenthrin. The most effective pesticide on snail and slug is metaldehyde. The major pests and diseases of Chinese yam are mirid, anthracnose, root-knot nematode and root-rot nematode. Imidacloprid, bifenthrin and acetamiprid can control mirid bug effectively. For the control of anthracnose, benomyl, prochloraz and carbendazim-dithianon are effective. Studies on disease management of organic farming of rice and cucumber shows that the most effectively material for the control of downy mildew and powdery mildew is ferric chloride. By using base fertilizer, which composed of rice husk, chicken excrement and organic material, the root disease of cucumber can be effectively lowered. *Bakanae* disease can be prevented by using phosphorous acid on rice seeding. Rice blast on leaf can be control by clove oil. Rice blast on tassel can be control by neem oil. Tribasic copper sulfate and dimethomorph are effective for control of gummosis on kumquat. Six breeds of anti-late blight of

tomato are selected. Experiments on non-pesticide control of bulb mites of leek shows that the best control material is azadirachtin. Spraying kasugamycin-copper oxychloride on spring water spinach or applying sour soil improvement material to field may decrease the incidence of bacterial wilt on spring water spinach. Application of the improved formula of *Bacillus amyloiquefaciens* B190 can inhibit the powdery mildew of cucumber.

The extension and services for the farmers were to incidence of bakanae disease and damping-off of rice seeding can be controlled by spraying fludioxonil cyprodinil. Sanitation of seeding of rice by using etridiazole can control damping-off of rice. The fusarium wilt of purple sweet potato can be control by using healthy seeding and applying dolomitic limestone in field before planting. It will increase yield by 52 percent. The monitoring on *Rattus exulans* and field mouse reveal that long-term poison trapping gives a control rate of 93.2 percent. The control rate of field mouse is 90.9%. The cooperative control of oriental fruit fly gives a control rate up to 90%. The service of diagnosis and control consultation identified 350 pests on 70 crops at Hualien and 141 pests at Ilan. The consultation on good agricultural product (GAP) and pesticide safety area in Hualien and Ilan covered 1200 ha.

Seven commissions of control effects of pesticide, fungicide and herbicide have been accomplished. They are downy mildew of cantaloupe, downy mildew of cucumber, sheath blight of rice, anthracnose of wax apple, beet army worm of cantaloupe and weed on pear field.

On soil and fertilizer : The highest yield of bird's-nest fern was found by applying with organic fertilizer 2 kg/plant/year and nutrition solution of nitrogen : phosphorus : potassium = 200 : 50 : 450 mg/l /week. The mixtures of chicken dung manure, rice bran, and rice hull as base fertilizer and four tons of rice bran were spread for dressing. Results showed that the sugar content of the muskmelon was similar with conventional fertilization method. The residue effect of this compost is more than half year, and it can save 60% fees of fertilizer. For the seedless guava, the results indicated that it got the highest yield of seedless guava for five-year old trees was pot by treating with organic fertilizer 20 kg/plant and chemical fertilizers nitrogen : phosphorus pentoxide : potassium oxide =120 : 120 : 180 g/plant/year to the soil under crown and foliage dressing six times with 1% potassium sulfate solution 2g/plant/week during young fruit stage. For the *Chaenomeles* saneness, the result indicated that loam, perlite and peat mixed at the ratio 5:2.5:2.5 had the best performance, and organic manure mulch significantly enhanced the effect. In bag culture medium study, the pseudo-composted rice hull have the same effect on vegetables yield and quality comparwd with imported medium. For establishing the soil database in this district, the grid survey with 250 meters has been conducted. In the past decade, more than 10,000 samples of grid survey have been sampled and data will be to establish the soil information system in the future. In 2002, there were 1,774 samples of soil and plant tissues were analyzed, including 921 samples of plant tissue, 804

samples of soil, and 49 samples of organic materials. Those data were used to assess the soil fertility and the plant nutrition for farmers.

On agricultural machine : A multiplicity of the vegetable seeding machine has been developed. It is more convenience for change different vegetable seeding disc. The vegetable seeding machine has been conferred the national patent in 2002. At fertilizer applicator and ridge making machine, a head of oil has been changed the fixity ridge making mechanisms. The work current is fertilizer applicator and churning with the land, then making ridge in the time. The roller Wentan pomelo sorting machine has been developed. Application four levels roller with different height, it can dispose 22 tons Wentan pomelo one day. For the Wentan pomelo process machine, it is the power source of 2Hp air compressor. Dependent on the Wentan pomelo size, there are set three size circle blades. It can dispose 3.8 tons Wentan pomelo one day.

On agricultural extension : To improve agricultural human resource and farmers' association development, the following training courses ; one class as -Specialized agricultural training for young farmers, one conference as Conference of agricultural village wine-brewing law and regulations, two sessions of Advanced knowledge of agricultural villages wine-brewing skill in Hualien district, and total five session courses as Educational training for agricultural product-cum-marketing groups in management system, also two product-cum-marketing groups in the district how to proficiently use the information in practical sense. There were about 305 people attending the educational training courses in this year. To improve the management efficiency, there were total 598 product-cum-marketing groups been guided and assisted . The agricultural management consultants had chosen Fuli Shiang farmers' association rice mill and Ilan flower association as the targets for diagnosis and developing projects. The implementation project of the integrated farmland utilization planning and relative development projects were conducted to improve the product-cum- marketing groups' basic production environments and 27 groups' facilities. To promote the area's agricultural strategic coalitions, developed promotions on Wentan pomelo, and leisure agricultural strategic coalitions. At the same time, also assisted to set up Ilan flower produce strategic coalitions and Hualien-Ilan nest-fern produce strategic coalitions. The purpose of these strategic coalition is to combine the advantage resources, strengthen the developing management abilities, establishing coalitions trademarked reputation, and increasing the competition ability. The station assisted Ilan Sanshing district Farmers' Association successfully to establish earned the SanShing General Pear trademark, also been given the National Produce qualification. To deepen into the basic agricultural society, the managements also offer agricultural technology information conference with total 139 farmers' involvement. To establish the direct communication between the government and farmers, the station conducted Hualien agricultural development conference, Listening to farmers' voices conference, also conduct agricultural policy

promotional conference in both Hualien and Ilan to gather the local general understandings. On rural Living and Agricultural culinary research, assisted the agricultural associations to conduct 6 classes for senior rural living, 11 classes for health and nutrition, 3 Agricultural managing classes for female farmers and 7 Home economics start-up courses also for female farmers; at the same time, developed organic recipes, monascus cooking DIY, research for cuisine development, and held exhibitions and taste conference twice, also published 5,000 stylish designed promotional brochures. In order to construct and develop the new and improved agricultural villages, the station also devoted its study in evaluation on development of the organic agricultural village in Hualien Area. In order to promote this station's extension and projects accomplishments, the station published the research accomplishments by way of COA and mass media, the magazine Hualien District Agriculture Monthly and another quarterly magazine Agricultural Extension Bulletin of Hualien District are issued by this station and distributed to the researchers, core farmers and key staff of production-cum-marketing groups. Furthermore, the home page of this station was developed to provide more agriculture information resources for agricultural workers and general public, and yet has almost 40,000 visitors to the site last year. It also combined the Hualien agricultural services information system and agricultural database to create the agricultural information management system. By setting up Service Center, offered to answer every aspect of agricultural question and provide the service of information, hospitality for the agricultural associations, farmers, and foreign visitors for about 2,421 people.