

Summary

In 2009, 46 research projects, 27 demonstration plans and 43 commissioned projects from other organizations had been performed. The results were summarized as follow:

On rice: The rice breeding program was derived from cross breeding progenies surveying their rice quality, yield potential and agronomic traits. In 2009, HKY108 was selected from advanced yield trial to regional yield trail. The yields of all varieties in rice yield forecasting trial were less than last years. On the research of rice varieties for health purpose, 6 lines with lower protein and 14 lines with higher protein contents were obtained. One method of selecting low glycemic index varieties had been established, and 40 varieties had been analyzed. Six new varieties were demonstrated in Hualien and Yilan area. For organic rice production, a total of 328 and 95 hectares were grown respectively in Hualien and Yilan Counties. Six rice producing districts of good quality rice, a total of 2,940 hectares, were guided and established in Hualien and Yilan Counties.

On upland and special crops: The best sowing date of feed corn was from Dec. to Jan., and Tainan No. 20 performed high yield in Hualien area. Soybean Hualien No.1 performed high yield potential by spraying 500 kg/ha of organic fertilizer and Hualien No.2 performed higher yield potential by spraying 1,000 kg/ha of organic fertilizer in spring, Hualien No.1 and Hualien No.2 performed high yield potential by spraying 650 kg/ha of organic fertilizer in fall. The collection of the germplasm and the investigation of agronomic traits on black soybean for organic purpose were conducted, and the results showed that three lines black soybean including Santa Maria etc. in spring crop and two lines including PI 201422(G01770) etc. in the fall crop performed higher yield potential. The occurrence of weed were well inhibiting when twice of soil preparation were done in *Zinnia elegans* Jacq., and the best seeding rate of *Tagrtes erecta* was 8~10kg/ha. The yield trial of organic fertilizer for upland crop showed that soybean performed high yield potential in Shoufeng township in spring crop and Fuli township

in fall crop, respectively. In organic culture of peanut, the average yield of peanut variety Hualien No.1 had higher yield potential in Shoufeng township. The average hectare seed yield of Adzuki bean Kaohsiung No.8 was 733 kg/ha in the fall crop of 2009. In Yilan area, the soybean was adaptable planting in the late February in spring crop and the vegetable soybean was adaptable planting in the middle March in spring crop, respectively. In comparison of different crop season of *Salvia miltiorrhiza*, the fall crop season had higher yield and active ingredient than spring crop season. The effect on the different spacing treatments of *Scutellaria rivularis*, the space 30×20 cm had higher yield than the others. In comparison of the average root weight and active ingredient for *A. acutiloba*, the highest value was obtained from which cultivated in Yuli area. In different spacing trial of *S. baicalensis*, the space 100×45 cm had the higher mean plant weight, space 100×60 cm had higher mean root weight, and space 100×45 cm had higher active ingredient content than the other spaces.

On vegetables: 52 wild and foreign lines of bitter melon in spring and summer crops were purified. The combination ability of new lines 7153, 5572 and 2355 are better than other lines. FRAP value analysis revealed that the bitter melon fertilized with half-quantity organic fertilizer, and full-quantity organic fertilizer performs high antioxidant capacity. We've collected 51 species of pumpkin germplasm and commercial varieties from domestic and foreign areas. Among these accessions, 6 species with small fruits were worthy to be purified and were selected for further selection. Pumpkins cultivated organically in the PE-house by double vine training with three fruits performed higher productivity and quality. A preliminary conclusion was that leafy sweet potato cultivar 'Tainung No.71' fertilized with half-quantity organic fertilizer, and only using pre-planting organic fertilizer performed high yield, antioxidant capacity and phenolics. On green onion breeding, the results showed that new line HAF10490 have good performance with higher yield potential. On the study of green onion production and marketing system in summer season, the yield of green onion grown in green house covered with shady net were better than controlled treatment. Another kind of green house facilities was developed for reducing typhoon

damage, but the yield of green onion was lower than field culture. The microbial fertilizer was applied for green onion, and the results showed that the quality was better than controlled treatment. Establishing the knowledge integrated platform for high-quality green onion production via cooperation with Agricultural Research Institute, and it could provide farmers and extension-workers with integrated information on variety selection, production knowledge, suitable fertilizer, disease/pest diagnosis and climate-damage prediction. Water mimosa can be harvested 6 times annually from July to October when cultivated in Yilan area. The averaged monthly yield of cultivated water mimosa was 4,500 kg/ha. The harvesting interval should be longer than 14 days.

On flower crops: Two lily breeding lines FA3-N1 and 92FA3-2 were shown significantly different from those two commercial varieties. Fifteen superior daylily breeding lines and 7 commercial varieties were investigated. The main investigation focused on evaluating leaf-rust and leaf-streak diseases, and DUS (Distinctness, Uniformity, and Stability) tests. One superior breeding line was named 'Happy Smiling' as a new variety at May 5th. SPME with GC-MS was used to detect the volatile compounds for 29 hybridized *phalaenopsis*, it revealed that the Supelcowax-10 column was better than the ZB-5MS. With this method, Neryl acetate, β -citronellol and *Cis*-Geraniol were detected in the Phal. Kung's Roth-Fairy flowers. Using high-efficiency plate heat exchanger could cool down osmosis water and created 19-20 °C cooling air for seedlings incubated. There were 15 clones of Cat-tail Willow investigated, and the results showed that the plant height of Cat-tail Willow clones were shorter than Chinese Shanghai variety. The number of branches over 90 cm in length of Cat-tail Willow clones and Chinese Shanghai variety was not different. The flower bud width of Cat-tail willow clones lies between 0.85 and 0.95 cm, which was wider than Chinese Shanghai variety. More than 100 flower-quince varieties were collected in 2009. Different flower-quince varieties had considerably different fruit and seed production. The germination rate of seeds treated by low temperature stratification varied tremendously from 0% to 91%. More than 350 varieties of native ornamental plants were collected. Giant bacopa were treated with different chemical reagent and then

cultivated in water to investigate the performance and display life. The height control treatments can create more compact and higher quality appearance and keeping quality.

On fruit tree : The shelf life of Minneola tangelo was 4 weeks when stored at room temperature. The deterioration of fruits was induced by disease and decayed. PP plastic bag packaging could maintain the hardness of Minneola tangelo, but the influence of other quality was not significant. The quality of Wentan pomelo in Hualien area increased during the period of fruit development and the main quality increasing period was 22 to 24 weeks after flower dropping. 'Hongjiang' orange and 'Honey' tangerine were the two better cultivars than other citrus cultivars tested in Yilan area. Top-grafted pears that were sprayed with calcium five times per season produced fruits with higher sugar contents and fruits with significant lower percentage of watercore as compared with the control. Top-grafted 'Taichung No. 2' pear harvested at 185 days after full bloom had the highest sugar content. In the study of accommodation of the new pear cultivars to the climate of Yilan area, the 'Taichung No. 2' grew faster than others at the juvenile stage. Wax-apples that were treated with "Agri-Sc" soil opsonin into the heart-layer to facilitate drainage produced larger fruits. Wax apples treated with 3.6 kg per tree of potassium chloride had the largest fruit. The date of flower forcing treatment of wax apple at November 23th resulted in the fruit-set ratio of 100%. The yield of this treatment was 12,000 kg /ha which resulted in a net profit of NT\$ 1,050,000. It is concluded that this flower forcing treatment was very profitable and is worth introducing to the growers.

On food processing: The organic processing technology had been developed by using the organic rice and soybean which were cultivated in Hualien area. The results showed that cereal drink had good quality in color and flavor. The *Angelica acutiloba* and the other medicinal plants were used in processing porridge retort food product. The organic soybean sauce product was made by fermentation process. The extraction and processing condition were established and a citrus tablet product was developed in this year.

On biotechnology: The results of PCR, southern blot and northern blot assay

revealed that 5 tomato transgenic lines were transferred with CryIIIC gene truly. ISSR markers were obtained for thirty seven bitter melon cultivars and breeding lines. There were 121 of 238 fragments generated from the 27 ISSR primers were polymorphic bands. These markers were sufficient to differentiate these material. The UPGMA analysis showed that these material could cluster to two major groups. The *Paphiopedilum* orchids Maudiae type cultivar with green flowers were collected as research material, and the aseptic shoots propagation system was established with high efficiency. The results of *in vitro* seed germination of *Nervilia argoana* Gaud showed that the fittest medium was low salt-base strength and low sucrose concentration. Middle salt-base strength and middle-to-high concentration of sucrose combined treatment had best fresh weight rate of *Nervilia spp.* rhizome. The results showed that complex plant growth regulators with organic additions could advance rhizome growth and induce bulb formation. In rhizome induced shoots formation experiment of *Cymbidium*, the results showed that the best treatment was low concentration of plant growth regulators with coconut milk. In shoots elongation of *Cymbidium*, the results showed that the best treatment was plant growth regulators with organic additions.

On plant protection: Controlling rice leaf roller is efficient with the garlic oil and neem oil (azadirachtin) on organic rice. The powdery mildew of pumpkins could be controlled by clove oil and cinnamon oil. Planting milkweed (*Asclepias curassavica* L.) as a hedge could be good for abundant nature enemies which include ladybugs (*Cheilomenes sexmaculata*) and stinkbug (*Cantheconidea furcellata*). The controlling effect is the best for the leaf spot disease of zinnias by treating seeds with hot waters, and the *Alternaria* leaf spot of sunflower by coating seeds with Myclobutanil. The highest yield of green onion was treated by the combination of Bromopropylate and Fosetyl-Al, and by the composition of Profenofos and Kasugamycin + Copper Oxychloride on the integrated control test. The nematode-infected guava tree revived the yields and sugar content increased with integrated control after 6 months. Spinosad, Abamectin, Acetamiprid and Clothianidin revealed significant lethal effect for melon flies. The long-term monitoring points of

oriental fruit fly and melon-fly in Yilan and Hualien are established by GIS and GPS system. The high peak of oriental fruit fly population density was from July to Oct. and melon-fly population density was from May to June in cucumber field. The highest density of beet armyworm was 24.8 adults/trap occurred from June to Aug., and *Spodoptera litura* was 93.4 adults/trap from Oct. to Nov. in Yilan. The highest density of *Spodoptera litura* was 207.5 adults/trap occurred from June to July and Oct. to Nov. in Hualien. The *Psylla* spp. was not detected in Yilan County pear orchards in 2009. The density of wild mouse and little Burmese rats were respectively down to 4.3 and 8.9 mouse/ha after baiting. In order to control plant disease and pest at suitable time, the plant pest forecasts were issued 12 times, the pest warning, prediction report and meteorological information were issued 6, 8, and 28 times respectively. There was no quarantine pest in Hualien area after surveying. A total of 572 cases of diagnosis and prescription were conducted. There were 81 times of seminars for farmer in Hualien and Yilan for pest control and safety use of pesticide. The chemical residue qualified rate was 94.3% in this year.

On soil and fertilizer: Site-specific nutrient management (SSNM) and the leaf color chart (LCC) could assist farmers to optimally supply their crops with essential nutrients, and the yield of rice could be enhanced. Applying the specific organic fertilizers making by rice bran, soybean cakes, wasted vegetables and fermented sugars to leafy vegetable could make the constant yield. The best sampling periods were the middle ten days of August for kumquat, and April or May for *angelica*. The best sampling positions were the third to fifth leave of young branches for kumquat, and the second leaf of the branch top for *angelica*. The amounts of each elements and antioxidant capacity of organic culture rice decreased as following: rice bran > brown rice > polished rice. A new type of rice hull charcoalizing device with husk burner was designed and built, which will be applied for a patent. Sixteen soil maps and 200 places of soil sampling of Hualien and Yilan counties were finished. One hundred and ninety four courses of training activities and presentations for the promotion of appropriate fertilizer utilization were held. A total of 2,617 plant diagnosis and soil fertility analysis

were made, and 467 farmers were served in 2009. These data were used to adjust fertilizing dosing.

On agricultural Machine: A green manure seeding machine had been developed to alleviate the hard work of sowing and raise the degree of sowing uniformity. The successful renovation of ridge making and holing machine for green onion had achieved the requirement of integral work for ridge making and holing concurrently. An anti-typhoon facility was developed with simple net and movable parts, which was easily assembly and disassembly. A foldable joint pillar was developed basing on the original fixing pillar. There are up and down combining foldable joints at the lower part of the pillar. The upper part can be laid down before a typhoon comes to attack, which will let the crop fit perfectly on the ground surface. It had an obvious effect on reducing the loss from typhoon. The continuous seed warming and sterilizing machine is sterilizing the seed with continuous warm water to replace the use of chemicals in sterilization. It can tremendously reduce the use of pesticide and pollution on the environment, lower producing costs, increase farmers' profit, and provide healthy and excellent quality seedlings. The continuous seed warming and sterilizing machine is sterilizing the seed with continuous warm water to replace the use of chemicals in sterilization.

On agricultural extension education: In order to assist farmers to learn modern business management and utilize new techniques, three professional agricultural training courses were held with 91 participants. To push lifelong learning for farmers, 5 core-technique courses had been held with 146 participants. To enforce agricultural training plan and encourage the youth to take part in agriculture, 4 teams of advanced Wandervogel camp had been carried out with 120 participants. To offer an opportunity for those who are older than 35 years old and still interested in agriculture, the Gardener course was held with 30 participants. To assist the unemployed to learn basic skills and take part in agriculture, the agricultural short-term vocational training course was held with 30 participants.

On agricultural management: To promote the development of agricultural

producing and marketing works, a total of 406 farmers' groups were organized and assisted in Yilan and Hualien Counties. Sunshin, Dongshan and Shoufong Farmers' Associations were assisted to promote the 'Center-Satellite Network System' project. Sunshin and Shoufong Farmers' Association were assisted to promote the 'Small Landlords and Big Tenant-Farmers' project. To promote the 'Specific District of Agricultural Management' project, Sunshin Farmers' Association was also assisted to manage agricultural cultivation and management affairs. To carry out Safety Agriculture policy, there were 45 production units and 436 farmers been assisted to get TAP certification, and the certificated land areas were 639.97 hectares.

On improvement of rural life: To promote the quality of rural life, all the farmers' associations were assisted to push rural activities, and there were 213 workshops been held. To help rural women to run their own business, 23 courses including cooking and handicraft making were held. Moreover, 2 workshops of 'Business Management and Cooking Sanitary' had been held for Tian-Mama with 157 participants. A competition of 'Boxed Lunches of Energy and Health in Yilan and Hualien Counties' had been conducted, and a recipe book had been published. The farmers' associations had been assisted to develop 6 kinds of local specialty gifts, and a workshop of developing local specialty gifts was held. An activity of '2009 Breadfruit Festival of Hualien' was held, and a recipe book had been published. Nine communities had been assisted to promote the innovative development of humanities in the rural areas. To extend the areas of organic cultivation and expand the benefits of organic industry, one research had been conducted, which is about the evaluation and planning of organic-industry clusters surrounding Loshan organic village.

On agricultural information distribution: To release the news about our research achievements and promotion activities, one press conference had been held in Council of Agriculture. There were 22 items of marketing news been broadcasted on TV ; 104 items of local news releases been sent to the media, and the media had issued 147 times of those. Agricultural extension magazines had been published including 4 issues of 'Hualien District Agricultural Special Proceedings', 12 issues of 'Hualien District

Agriculture Monthly' and 4 issues of 'Hualien District Agricultural Technique Pamphlet'. To offer all kinds of information concerning agricultural technology to the public, 'Hualien District Agricultural Research and Extension Station Worldwide Web (www.hdais.gov.tw)' had been timely updated and continuously enriched, and 436 documents were updated. To compile and classify latest information of Typhoon Morakot and assist farmers to restore as soon as possible, a column of 'Technical Services Team of Typhoon Morakot' was added. The contents of agricultural theme museums were enriched. The museums of aquatic plants ,cat-tail willow and green onion were awarded the excellence prizes.

On public services: To promote a single window service system of 'the needs of the people as the center', 61 E-mails about agricultural inquiries had been answered. To offer the guide of agricultural technique visiting, the Station had received 43 times of visiting with 1,747 national and international visitors. Besides, 35 farmers came to the Station asked for agricultural promotion books and information. One 'Open Day' activity had been held in 24th, Apr. to show the achievements to the public, and there were more than 3,000 people attended this activity.