Summary

In 2006, 51 research projects, 21 demonstration plans and 16 commissioned projects from other organizations were conducted. The results were summarized as follow:

On rice culture: According to the results of higher trials, a promising rice breeding line HKY75 was selected to attend the regional trail of 2007 set. The fertilizer test on the new breeding line HKY69, 72 and 79 showed that the highest yield was obtained on the application of nitrogen at 120 kg/ha. In the yield forecasting trial, the yield was lower than the past years in all varieties. On the research of organic rice culture, the machine-weeding treatment had better rice eating quality than conventional. On the research of rice physiological index for high quality product, the result showed that the average of accumulated temperature and accumulated radiation was 1772.7℃-day and 1354.2mJ/m^2 in first crop, and 1672.1℃-day and 1456 mJ/m^2 in the second crop. In total, 220 varieties of upland rice had been collected. The demonstration of new rice variety was conducted in both Hualien and Yilan County, and four varieties TY3, HL20, KH145 and TN11 were used. To promote organic rice production, a total of 543 and 69 hectares were grown respectively in Hualien and Yilan Counties. To enhance the production of good quality rice, a total of 1,000 and 2,620 hectares were set up respectively in Hualien and Yilan Counties. And four rice producing districts of good quality rice, a total of 1,431 hectares were guided to be established in Hualien and Yilan Counties.

On upland and special crops: Peanut breeding lines Nan-Kai-SI 173 and Hua-Yu 18 in the spring crop and Nan-Kai-SI 173 in the fall crop performed high yield potential in the regional yield trails. The yield of taro-like sweet potato line TLSP-024 was 22,188 and 18,042 kg/ha respectively in the fall crop of 2005 and in the spring crop of 2006. In the study of landscaping green manure, the common Zinnia was suitable to sow in April and August, and the Niger was suitable to sow in August. The ideal seed sowing quantity was 8 to 10 kg/ha for common Zinnia and 10 to 12 kg/ha for Niger. On the selection of energy crops suitable for growing in Hualien area, the results showed that soybean variety India and Chung-Hsing #1 had the highest yield capacity than other varieties. The rape cultivar Taoyuan No.4 had the highest yield. Soybean cultured by a mechanical farming system can reduce the production cost by 23%. The effect to

prevent the damage of the Asia corn borer in the organic cultivation of green sweet corn was good by the 600x *Bacillus thuringiensis* w.p. The cultivation of organic soybean was better to plant in March 15 for the spring crop and September 8 for the fall crop respectively. On the research of special crops in the eastern area, the results showed the yield of yam cultivar Hualien No. 3 with plastic-pipe practice was higher than the deep-plow practice. The antioxidant capacity was higher in the *Saliva miltiorrhiza* among 9 medicinal plants species, and the processing products such as drinks and the product of Dang-gui crop had been successfully developed.

On vegetables: Ten F1 bitter gourd breeding lines were chosen to evaluate the general combing ability, and line 2653, 8153 and 5581 showed better performance than other lines. Ten bitter gourd samples were analyzed by PAGE-2D and DNA analysis, the similarity was between 84 and 99%. To compare the PPARγ activating capability of 24 wild bitter gourds inbreed lines, a transactivation assay was done. Line HM18 and HM 2381 had high activation of PPARγ. On the regional trial of nest fern, breeding line HA178 had the highest yield among three areas. For tomato breeding, one orange cherry tomato line CHT1417 characterized with resistant to tomato leaf curl virus (*To*LCV) had awarded the plant breeder's right and registered as a new variety "Hualien Asveg No. 21" in January 15, 2007. The yield of tomato breeding line FMTT1047 with resistant to late blight and tomato leaf curl virus was the highest. On the breeding of green onion, breeding line HAF10519 had good performance with higher yield and long blanched stems in summer season. On the study of the cultural regulation and export shipment of green onion, the results indicated that carbon dioxide storage under 5℃ could keep better quality.

On flower crops: Among 9 hybrid lily lines, the earliest emergence line was FLME2-5, and emergence ration was 83.4%. On the other hand, the breeding line 92FA3-2 was evaluated suitable for a pot plant based on the growth habit, flowering characters and stability. There were six varieties of lily introduced from the Netherlands cultivated and evaluated in the observation trials. Good cultivation techniques could help to enhance the quality of lily cut flowers, and the quality could be maintained after stored in 4 ℃ for 3 and 7 days. The hybridization works of daylily varieties were conducted, and 32 crossing combinations had been done. There were 91 matured capsules harvested. The hybrid seeds were sown in August, and 362 plantlets were obtained thereafter. Different mint essential oils from 15 varieties were analyzed by

GC-MS to compare their composition. The results showed that α-pinene was the first component detected, and all varieties contained this component. The relative amount of α-pinene was between 0.12 and 2.2%. The comparison of Cat-tail Willow clones were conducted, the average survival rate for cuttings was 85.7%. The plant height lies between 181.7 and 198.5 cm, and the number of branches lies between 4.1 and 6.6. For flowering-quince, the result indicates that seeds of variety Shi-Er-Yi-Chong would be better to sow in humid media. With 5℃ low-temperature stratification over 8 weeks, the germination rate was increased significantly. For cutting testing of *Phyla nodiflora*, *Hedyotis strigulosa* and *Clerodendrum kaempferi* in three different media, the cutting survival rate of *Phyla nodiflora* was the highest, 100% in all three media. For *Hedyotis strigulosa* and *Clerodendrum kaempferi* cutting, it would be better to use perlite with vermiculite and sand. The shoot cuttings of variegated giant bacopa (*Bacopa lanigera* 'Variegata') cultivated in April to October regrew apparently faster. For cutting of herb-of-grace (*Bacopa monnieri*) cultivated during April and November, it needed only 2-5 days to start to grow. The survival rate of variegated cattails (*Typha latifolia* 'Variegata') cultivated in July was 100%.

On fruit tree: The 100℃ paraffin solution treatment on buds could increased the fruit number and yield of top-grafted pear, and the yield of top-grafted pear that flower buds protected by rain shelter umbrella was significantly higher than the unprotected control. The shelf life was extended to 10 weeks when fruits stored at 5-7℃. In Yilan area, Fremont and citrus line P158-2 showed higher sugar content, 13.5 and 11.9 °Brix respectively, than other cultivars. Some healthy bud-lines of kumquat were grown in Yilan area for trials. In average, line HF-1-3 had the largest fruit weight of 18.4 g, and line HF-1-9 had the highest yield of 17.5 kg/tree. It was shown that the soluble solid content and hardness of pitaya were not affected by maintaining the stem section, but the cross section area could keep fresh when the fruit was stored at 5℃ after 28 days. Training the excessive growing shoots of Wentan pomelo after physiological fruit drop stage could decrease acidity level and increase sugar/acid ratio significantly.

On biotechnology: To improved the accuracy of PCR assay for GM papaya, primers CPMO, PRSV322, PAPA215, PAPAIN157, 35S463 and P4441/P4837 were designed. The PCR assay could only detect the sample DNA concentration above 0.5ng/μL by the CPMO primers, but it could reach the 0.2ng/μL level by using the other primers. The stephanotis of *chrysanthemum* were used as explants and BA 2mg/L,

NAA 0.1 or 0.5 mg/L were used as cultural medium to set up the regeneration system for chrysanthemum gene transformation. The results showed that 1/2MS and 20 to 30g/L sucrose concentrations treatments were fit for *Spiranthes sinensis*. The explants of *Spathoglottis plicata* grew well in MS medium without any plant growth regulator. In seed germination trial for *Cymbidium*, the results showed that seeds germination was observed 6 months after cultured *in vitro*. The germination rate is 5.67% after 10 months cultured on media with lower salt and higher sucrose content. The rhizomes of *Cymbidium* were grown well on media with high salt and high sucrose content. Medium supplemented with BA and coconut milk could induce shoot formation of *Cymbidium* rhizomes.

On processing of agricultural product: To develop the processing technology and manufacturing procedure for millet porridge, it was packed into standing retort pouches (PET/Al-foil / CPP) with ingredients as: glutinous millet, bulbils of Chinese yam, purple glutinous rice and so on. The advantage of the product were food hygiene, safe, convenient, easy storage and transportation.

On plant protection: The research projects and demonstration plans of organic cultivation, non-chemical controlling, biological pesticide preparation, and safety using of chemicals in crops were conducted in 2006. Under the tunnel protection with UV absorbent plastic sheet and transparent plastic sheet, the incidences of gray mold on strawberry were reduced to 30 and 28.8%, respectively. Application of oyster shell powder and castor cake could control the damping-off disease and increase production 60% on cucumber. Spinach downy mildew was controlled by spraying of Mancozeb together with Fosetyl-Al 10 days after germination. The cost for leek pest control on standard model area was NT$ 9,050 lower than that on farmer customary practice area. Beet army worm larvae were still sensitive to pesticides Emamectin benzoate, Tebufenozide, *Bacillius thuringensis* and Indoxacarb. The highest effect was found in the treatment which mixed with castor cake, oyster shell powder, and antagonist in the culture medium. The medium could reduce the incidence of the *Pythophthora* disease of tomato 13.3 to 40%, and increase survival rate of cabbage seedling about 30 to 40%. *Phyllotreta striolata* was effectively controlled by treated with tobacco extract. In order to prevent the pear rust disease, Triadimefon, Fenarimol and Bitertanol were applied alternatively; the result showed that the pear rust disease was controlled effectively. For non-chemical controlling on rice, *Trichoderma harzium* got the highest controlling ratio

for leaf blast in the first crop, and *Bacillus subtilis* could get the highest controlling ratio for blast on panicles and on spikelet in the 2nd crop. The control rate could be up to 60% on 6th day by using 10^8 spores/mL of *Beauveria bassiana* on adults of striped leaf beetle. By whole area controlling scheme in Yilan County, the density of oriental fruit fly and damage ratio was reduced, and the density of beet armyworm of green onion was also reduced 50%. The population of Brumese mouse and wild mouse were surveyed before and after baiting, the controlling rate was 75.1%. In order to control pest at suitable time and monitor plant epidemic, the plant pest forecasts were issued 12 times, and the pest warning report and meteorological information were issued 5 and 28 times, respectively. More than 8 samples of suspected red imported fire ant were identified and control guidance was recommended. There were 271 cases of diagnosis and prescription conducted among 50 kinds of crops. In total, there were 118 product-cum-marketing groups using of GAP mark in Hualien and Yilan been assisted.

On soil and fertilizer: In organic culture research of chayote, two treatments with TFC No.1 bio-fertilizer and Shin-nung No.2 fertilizer together with soybean cake had higher yield. Nineteen cucumber cultivars were tested for organic culture. It showed that cultivars Chin-Tsuei, Chin-Yu, and HA-1236 had higher yield than other cultivars, and are suitable for organic culture. In the study of producing suitable compost for organic agriculture, the result showed that Zn and Cu content were decreased in both pig manure and goat manure with compost time. In the research of the medium for horticultural crops, the results indicated that the germination rate of cucumber and cabbage was the highest with the medium of carbonized rice hull: soil: rice hull compost (1:2:1), the growth of cucumber seedlings performed the best with the medium of carbonized rice hull: soil: rice hull compost (1:0:1), and the growth of cabbage seedlings performed the best with the medium of carbonized rice hull: soil: rice hull compost (1:3:1). The best processing procedure and baking time of the fragrant tea mixed with pomelo flower was found. More than 90% consumers like or like very much, the fragrant tea has high commercial potential. In total there were 1840 samples of soil and plant tissues from 322 farmers analyzed this year.

On agricultural machine: A ridge making and holing machine for green onion has been developed, it combines concurrently the holing, ridge making and fertilizer applying all in one. A fold joint pillar was developed based on the original regular type pillar. The fold joint pillar includes two parts. The upper part could be laid down before

the typhoon comes to attack, which let the crop fit perfectly on the ground's surface to reduce the typhoon disaster. In the mold development of vegetable seeding machine, it includes seeding case, seeding case lid, seeding channel, seed box, seed box lid, and seed discs. The seed disc has been developed to match the different vegetable seeds in Taiwan. A light self-propelled vegetable seeding machine, and a vegetable seeding machine combined with fertilizer applying and ridge making have been developed as well. A green manure seeding machine has been developed to alleviate the hard work of sowing, and raise the degree of sowing uniformity. A vegetable transplanting machine with the functions which can cross the bed and adjust the height and width of operation has been developed.

On agricultural extension, education and training: In order to enhance the agricultural manpower and the farmer organization development, 5 sessions of farmer's professional training courses had been handled, and 218 people had been trained. To impel the farmer lifelong learn plan, 4 classes of the core resource education and training program had been conducted, and 159 people had participated in. Also, 3 classes of the agricultural TGAP guidance education had been held, and 73 people had been trained. One set of digital teaching material of organic vegetable postharvest technology had been made. The COA New Agricultural Movement were animated by encouraging the youth to undergo agricultural experience and input new agricultural power. There were 6 teams of the Wandervogel camp been carried out, and 120 students had participated in. To accelerate the movement of modernization and commercialization for farmers, two advance courses on vegetable and fruit management were conducted, and 126 farmers were trained.

On agriculture management: To impel organization training and guidance, 403 agricultural production and marketing teams, in Hualien and Yilan Counties, had been integrated. To develop the Loshan organic village, counsel and training of organization and management had been provided. And build the Loshan organic village on “Production Function, Living Function and Ecology Function”. To promote pomelo industry's competitiveness, the pomelo strategy alliance had been impelled continuously. The pomelo flower season and the series activities had also been held to prolong the marketing cycle and create the add-value for pomelo. To listen attentively the farmer’s voice and establish the communication channel to understand the problems when impetus agriculture policies, 18 “Agricultural Consultant Meetings” were held in both

Hualien and Yilan Counties, and 1,815 people had participate in. There were in total 176 items of farmer's questions and commends been collected and answered.

On improvement of rural life: Plans of the rural healthy life and the production supporting system had been conducted. To improve rural women managing knowledge, economic ability, and aged person's life quality, the farmers' associations in Yilan and Hualien Counties had been assisted and guided. And 160 class about "Strengthening Home Economics Team Function", "Life Quality Improvement for Aged Person", and "Recycling Usage of Organic Waste" were conducted. To enrich the knowledge of home economics extension agents, the professional training "Rural Development and Agricultural Product Marketing" had been conducted, the number of participant was 22. To create the rural employment opportunity, and increase the rural household income, 8 home economics improvement clubs in Hualien County, 7 home economics improvement clubs in Yilan County had been counseled and guided to develop the sideline production. To increase the diversify usage of lily, a competition "Creative Cook of Lily" had been conducted in Hualien. And a book "The Creative Ingredient Recipes of Lily" had been published. It is available for the leisure agriculture managers, the pension industry managers, and the consumers.

On agricultural information dissemination: The information about the recent research achievements, and the production and marketing promotion activities were offered to the media for broadcasting. In this year one press conference had been held in Council of Agriculture. In total there were 15 items of research achievement, 7 items of TV marketing news, and 72 agriculture news had been released to COA and the media. The media had adopted and issued 130 times of the news. Agricultural extension magazines had been published including "Hualien District Agricultural Special Proceeding" 4 issues, "Hualien District Agriculture Monthly" 12 issues, and "Hualien District Agricultural Technique Pamphlet" 6 issues. To expand the service and promote the computerization application of agricultural information, "Hualien District Agricultural Research and Extension Station Worldwide Web (www.hdais.gov.tw)" had been set up, and 50 thousand people had accessed.

On serve for the people: To strengthen the service for the populace and farmers, a one-stop information counter service system had been set up. The Station had received 55 themes of visiting and 2,117 people this year. Two "Open Day" activities had been held respectively in spring and autumn, which were conducted to introduce the

achievement to the public. Two symposia “The Development of Green Onion Industry” and “The Management and Development of Safety Crop Production and Marketing” were held as well. As a result, the demonstration of the achievements and the activities was generous and vivid, and 6,000 people had participated in.