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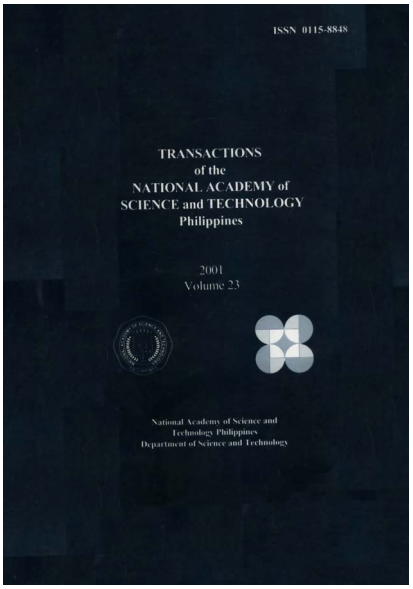

Farmer-Scientist R&D/E Training Program in a Corn-Based Production System for Sustainable Agricultural Development

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FARMER-SCIENTISTS R&D/E TRAINING PROGRAM IN A CORN-BASED PRODUCTION SYSTEM FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

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ABSTRACT

With the aim of empowering farmers for socio-economic progress, the Farmer-Scientists Training Program demonstrated its effectiveness in changing the farmers' outlook in life. The farmers gained confidence in making a business enterprise. Through their adoption of scientific methods and new technologies, they were able to increase their rice and corn production from 0.5 – 2.0 tons/ha before their training to 6.0 tons/ha. Through sales of their surplus rice, corn, vegetables, and other produce, the farmers generated an increased income of P100,000 or more per cropping season compared to their original income of about P6,000.

Improvements in the farmers' quality of life are shown by their construction of new concrete houses to replace their old nipa huts and the purchase of refrigerators, TV sets, radios, motorcycles, and other home fixtures. Above all, they were able to support their children's college education.

This innovative program produced not only a new breed of agricultural scientists who could conduct participatory R&D directly with the farmers in the latter's farms but also a new breed of farmers who are technically equipped with scientific methods of farming and trained as community leaders and businessmen.

The program has also strengthened the research and extension capabilities of SCUs and LGUs to render better services to the farmers.

INTRODUCTION

Corn is the main source of food in the form of milled corn or corn grits for 20% of the 78 million Filipinos. It is second to rice as a staple crop in the Philippines. People eating milled corn are mostly in Cebu and Mindanao provinces such as Davao, Bukidnon, Misamis, Agusan, Surigao and Cotabato. Likewise, the Ibanags

of Cagayan as well as natives in the highlands of Luzon, Visayas and Mindanao depend on corn as a source of livelihood. In time of rice shortage or scarcity, corn is used instead of rice or in combination with it. It is more nutritious than rice and is therefore a good supplement, complement or substitute for it. About 3.005 million hectares were planted to corn in 1994 producing 4.51 million metric tons or an average yield of 1.50 tons/ha (Logroño *et al.*, 1995)

Problems and Constraints in Corn Production

Aside from being the staple food of more than 14 million Filipinos, corn is also a major ingredient of animal feeds. With the rapid expansion of the country's poultry and livestock industries in recent years, there is an increasing demand to produce more corn for animal feeds. However, the country cannot produce enough corn and with this big demand for corn as food and feeds, it has to import thousands of metric tons per year. In 1996, over 500,000 metric tons of corn were imported and it may take many more years before the country can attain self-sufficiency in corn production. Among the constraints identified for low productivity and marginal profitability of corn is the very low adoption of modern production technologies like the use of high yielding varieties/hybrids (Logroño *et al.*, 1995)

Most corn farmers live below the poverty level especially those in upland communities. According to Celestino (1983), the Philippines has more than half a million hectares of hilly farmlands dominated by slopes higher than 18% and are cultivated by over 300,000 farmers. They grow mainly corn, vegetables and root crops for survival. Many of our upland farmers are still the poorest of the poor.

Why the corn farmers particularly in the upland communities remain poor has been the subject of research studies over the past 20 years by agricultural scientists in the country (Librero, 1977; Valencia, 1994). Results of these studies indicate that there were basically failures of technology transfer and utilization by the farmers due to a number of factors. Among them were the farmers' low level of education, their limited access to markets, roads, and transportation system; slow and inefficient delivery of technical services by government support agencies due to lack of funds and technical manpower; and the absence of farmer's organizations and credit facilities (Celestino and Elliot, 1986; Davide, 1991; Arboleda *et al.*,1994). In short, the majority of our highland farmers are still living in isolation without access to passable roads, markets, water, electricity and to new technologies. Moreover, they have no opportunities for college education. Thus most of the highland farmers are deprived of the keys to socio-economic progress.

Need for a Farmer-Scientists RD/E Training Program

To address the above mentioned causes of poverty among highland farmers, a Corn-Based Farmer Scientists R &D/E Training Program (FSTP) was piloted in Colawin, Argao, Cebu which started in July 994. This was initially funded by the

P500,000 Research Grant from DA-NAFC as a part of Dr. R.G. Davide's award as the 1994 Outstanding Agricultural Scientist. This project was in partnership with the different government and non-government agencies concerned with poverty alleviation of our farmers and the country's food security program. Among these agencies were: the UPLB College of Agriculture, National Crop Protection Center, the Institute of Plant Breeding, National Institute of Molecular Biology and Biotechnology, the Department of Agriculture (DA-NAFC, BAR, ATI), DECS Region 7, DOST Region &, LGUs, SCUs, Colawin Technical School, East West Seed Company, Colawin Education Foundation, Inc., UPLB Pahinungod Program and others.

The program started in 1994 in Colawin, Argao, Cebu not only because Dr. R.G. Davide was born, raised and finished his elementary education there but also because Colawin is one of the depressed barangays in Argao. Cebu is also given the priority to pilot the program because it is one of the poorest provinces producing the lowest average yield of corn at 0.50 tons/ha, yet majority of its total population of 2,841,568 people eat milled corn. It has hilly or mountainous farmlands where about 135,051 hectares were planted to corn in rotation with vegetables, root crops, legumes and others. These are cultivated by more 122,000 small farmers, majority of whom could not even produce enough corn to feed themselves. Due to this poor production capacity, Cebu can only produce about 50% of its total corn needs. However, if the corn yield could be doubled or tripled, Cebu would be self-sufficient in corn or even produce a surplus for export.

Framework and Objectives of the Program

The Farmer-Scientists Training Program is based on the assumption that there is no such thing as barren soils, only barren minds; and that farming is business. Its theme is empowering farmers for socio-economic progress.

The FSTP promotes sustainable agricultural development in a corn-based production system integrating crops and animal production system in upland and lowland communities. The program encourages and challenges agricultural scientists, especially from the academe, to do research and technological development with upland farmers. Likewise, it aims to produce students in agriculture who will engage in farming as a business enterprise.

Generally, the main objectives of FSTP are (a) to give highland farmers in Cebu a direct training contact with agricultural scientists to develop their technical and scientific capabilities in growing corn and other crops utilizing appropriate farming technologies; and (b) to strengthen the research and extension capabilities of local government units and state colleges in Cebu so they can render better services in their areas of responsibility. Specifically, the FSTP aims to:

1. Cultivate the minds of the farmers through value formation activities that will change the attitudes towards teamworks and sharing of technical information, emphasizing love of God, country, and people;

2. Equip farmers with scientific knowledge and technologies on hillyland farming in a corn-based cropping system;
3. Apply integrated pest management (IPM) using biological control agents and natural enemies of pests and disease-causing organisms and the proper use of less toxic pesticide when necessary;
4. Make farming a business enterprise through formation of farmers' organization, cooperatives , and marketing networks;
5. Develop self-reliant and self sustaining farmers and communities through maximum production of corn and other economic crops to supply market demands; and
6. Strengthen leadership among farmers in their respective communities.

MATERIALS AND METHODS

Venue and Participants

To achieve the above objectives, a pilot area was established and based at Colawin Technical School (CTS) located in Barangay Colawin in the highland of northern Argao, Cebu. It is surrounded by large agricultural hillylands planted to corn, root crops, vegetables, banana, mango, coconut, and others. The training started on July 15, 1994 and was attended by 77 farmers together with some students and faculty members of the CTS, local government officials, and other guests.

The farmers were selected by a committee based on the following criteria:

1. At least three years of actual experience in growing corn on his/her own land which should not be less than one half hectare;
2. Able to read and write;
3. Good communication skills;
4. Law abiding with a friendly disposition;
5. Good moral character and about 18-60 years old; and
6. Willing to share and transfer acquired or developed technologies to his/her fellow farmers.

In addition to the selected farmers, there were also observers from the local government units (LGUs) such as the municipal agricultural officer (MAO) and technicians of the municipal government of Argao, and some faculty members and students from Argao State College of Science and Technology (ASCST) and CTS.

The program has three phases that are described in the following sections.

Phase I: Value Formation, Research Exposure and Technical Empowerment

In Phase I, the farmers had actual experiences in the conduct of research on corn production, postharvest handling, and marketing. They also had exercises for value formation such as expressing their love of God through opening and closing prayers during meetings, and love of country by singing the Philippine National Anthem at the start of meetings.

To gain research experiences, the farmers and the scientists together, set up experimental plots of corn to compare the effects of bio-fertilizer (Bio-N) with those of chicken manure, organic fertilizer, and inorganic fertilizers. The same experimental corn plants were also used by the farmers and the scientists to study the occurrence and control of various pests, diseases, and weeds through IPM strategies. The farmers were in their experimental areas every Friday to make observations and gather data on the status of plant growth and on the presence of insect pests, diseases, weeds and other. They were taught by the concerned scientist to identify and classify harmful and beneficial insects and weed problems. During the lecture, the scientist discussed topics relevant to actual problems on plant growth, pests, diseases, weeds and others.

In separate experiments, the farmers with the scientists evaluated the growth and yield performances of 12 different hybrids and varieties of corn. A plant breeder taught the farmers how to observe and gather data on the agronomic characters of each hybrid or variety at harvest. They also taught how to breed new corn varieties and produce hybrid corn.

The farmers were organized into groups of 5-7 members, each with a group leader, and worked together as a team. Each group was required to make and present an oral report of their observation on the experimental plants and the assigned activities given by the scientists. This was done every Friday when the scientists from NCPC and other UPLBCA units were present to react to and join in the discussion of their report. The report mainly covered the group's observations of the experiments, problems identified, causes, and actions taken to solve the problems. During the discussion, the scientist explained the scientific basis of their observations and recommended the necessary remedy for the situation. This is where the farmers would learn more about science and technology of corn production.

After the group's report, one or two scientists would give about 1-2 hours lecture on the principle and application of relevant technologies that had to be employed to improved corn production. Such topics as soil fertility determination using the soil test kit, seed selection and varietal improvement, use of IPM in pest and disease control, storage, and marketing problems were thoroughly discussed.

Towards the end of Phase I, there were lectures on marketing strategies through formation of cooperatives and market network. After six months of training, a graduation program was held at the CTS where farmers with 75-100% attendance were given a Certificate of Completion and those with less, a Certificate of

Attendance from the Dean of College of Agriculture, University of the Philippines Los Baños. The farmers are considered alumni of the College.

Phase II: On-Farm Experimentation and Technology Adoption

Right after Phase I, majority of the farmers continued with Phase II which was formally launched on February 24, 1995. In this phase, the farmers replicated their on-station research experience in their own farms. They conducted experiments in groups and as individuals on IPM for corn borer and corn weevil control, comparative study of organic fertilizer (like chicken manure) vs. inorganic (urea or 14-14-14 complete fertilizer), and trials of different corn varieties and hybrids. The experimental design used was randomized block with 2-3 replications per treatment. They were supervised by the scientists in the laying out of their on-farm experiments. They were also given instructions on how to gather data required in the experiments similar to what they did in Phase 1.

The farmers were required to meet and give reports every Friday of the month at the CTS to discuss the results and problems encountered during the conduct of the experiments. The scientists, involved, together with DA technicians and the UPLBCA project development officers (PDOs), discussed and interacted with the farmers to explain further or clarify their findings. Here the farmers and the scientists shared their views about the outcome of the study. After completing Phase II, the farmers received their Certificates of Achievements from the UPLB College of Agriculture during the graduation ceremony held at the CTS on April 28, 1996.

Phase III: Farmer-to- Farmer Technology Transfer and R and D

The farmer-scientists in Phase III are expected not only to apply on their own farms the technical knowledge they have gained or the farming technologies they have developed in Phase II but also to share them with their fellow farmers.

During this phase, the farmer-scientists were assigned to perform extension activities for technology transfer and utilization by their own fellow farmers under the supervision of the Municipal Agriculturist, the Agricultural Technicians, AIDP-PDO and the scientists. The farmers "adopted" by the farmers-scientist set up group experiments, as in Phase I, to acquire technical knowledge in corn production. The farmers themselves decided on the best fertilizer combination to use, best varieties/hybrids of corn to plant, and the integrated pest management technologies to apply in order to insure maximum production of corn. In this extension activity, a farmer teaches another farmer with the scientists behind them.

The farmer-scientists in Phase III conduct weekly field work and meetings to discuss the data they have gathered, problems encountered and actions they have taken. Once or twice a month, a scientist would meet the group and discuss with them some results that need further clarification. Sometimes a scientist with expertise in IPM or plant breeding would be invited for additional explanation of

principles in plant breeding particularly in developing a hybrid corn. All these are in relation to their experimental results which would be applied in their own farms in the succeeding cropping season.

Two models are being used in Phase III, namely: the Adopt-A-Barangay and Adopt-A-Farmer models. Farmer-scientists who finished Phase II can opt to adopt a large number of farmers in their barangays or to adopt only 2-5 neighbor-farmers.

After completion of Phase III, the farmer-scientists involved are given Certficates of Recognition and their trained/adopted farmers would each receive a Certificate of Participation from the College of Agriculture, University of the Philippines Los Baños.

The farmer-scientists who completed Phases I, II and III of the training program can serve as the community's link to the scientists and extension workers of the GOs as well as NGOs engaged in agricultural and rural development in the countryside through collaborative research studies, particularly when a technology is tested for farm adoption.

To evaluate the impact of the entire training program, a benchmark survey was conducted that focused lengthily on the socio-economic status of the farmers.

Expansion of the Program

After the successful operation of the FSTP Phase I on corn production at the CTS, the rice farmers in Argao requested a similar training program on rice at the Cebu State College of Science and Technology Agro-Industrial and Forestry (CSCST-AIF) Campus in Argao. Phase I of the rice-based FSTP was started on February 23, 1995 with 40 rice farmers, some teachers, and 20 students participating. A corn-based FSTP was also opened in Barili, Cebu on October 24, 1995 upon the request of Cebu Governor Pablo Garcia and the Mayor of Barili, Hon. Librada Pace. It started with more than 60 corn farmer participants. This was coordinated by Mr. Antonio Arnejo, the AIDP-Cebu Project Development Officer (PDO) and the MAO of Barili. The training in Argao was coordinated by another PDO and the MAO of the municipality with the assistance of the municipal agricultural technicians and a teacher from CSCST Argao.

The Farmer-Scientists Training Program for Backyard Milk Production and Processing started in August 1995 at the Colawin Technical School, jointly sponsored by the Department of Science and Technology, the UPLB Pahinungod Program, and the Research Grant of P500,000 as part of the 1995 PCARRD PANTAS Award to Dr. Clara L. Davide, Professor of the Dairy Training and Research Institute (DTRI), who coordinated the project.

The Backyard Milk Production and Processing Project was followed by the Vegetable Farmer-Scientists Training Program which was launched on February 2, 1998 by UPLB Chancellor Ruben L. Villareal at Colawin Technical School with about one hundred farmers attending. This was on time for the launching of his book on vegetable production translated from English into Cebuano.

With the success of the FSTP in Cebu, the Department of Agriculture, through its Bureau of Agricultural Research decided to expand the pilot sites of FSTP not only in Cebu but also in some parts of Luzon, Visayas and Mindanao under FSTP Part III starting August 1999 as a part of the DA-BAR-UPLB National Corn RDE Network Program. Thus far, it has already started Phase I expansion in Sudlon II, Cebu City and in barangays Mangarin, Mabini and Magbay, San Jose, Occidental Mindoro. Its plan to start it in Cotabato is on hold status because of the MILF problem in the area.

More than 25 agricultural scientists from UPLBCA and other research institutions/organizations were involved as co-researchers and co-learners with the crops and livestock hillyland farmers in Cebu to give them the training in appropriate farming technologies and to develop their technical skills in corn, rice, vegetables and other crops and animal productions.

RESULTS AND DISCUSSION

Thus far, the FSTP objectives have been significantly achieved, a clear indication that if government agencies and the private sector concerned with agricultural and rural development work together with the farmers, more can be achieved to ensure food security of the country and prosperity of the people in upland communities.

The significant achievements of the FSTP with regards to the specific objectives of the program are discussed below.

Cultivation of the farmer's mind – For sustainability of the project, the FSTP gave high importance to the importance to the cultivation of the minds of the farmers through value formation activities designed to develop love of God, country and people. The farmer-scientists can now easily work together as a team to share and discuss among themselves the knowledge gained from the training program. Many of them are already volunteering their services to teach fellow farmers under Phase III of the program.

Empowerment through learning how to learn – All the farmer-scientists especially those who finished Phase II, have actual experiences in research work to determine the applicability of the researcher's technology like the Bio-N microbial fertilizer compared with organic and inorganic fertilizer; IPM strategies like detasseling and use of biological enemies of insect pests; local varieties compared with introduced varieties and other. Results of their studies gave the farmers ample knowledge to base their decisions on production technologies adoptable in their farms (Tables 1-4).

Table 1. Results of the Farmer-Scientists group experiment (Phase I) on fertilizer usage in corn production in Malabuyoc, Cebu, May 2001

Fertilizer Treatment	**Yield (tons/ha) VM2**
Chicken manure alone	4.10
Urea alone	4.10
Chicken manure + Urea	4.60
Complete 14-14-14 fertilizer alone	4.47
Urea + 14-14-14 complete	4.25
Chicken manure + Bio-N	3.19
Hog manure + Bio-N	3.73
Cow manure + Bio-N	3.73
Chicken manure + Bio-N + Urea	4.84
Bio-N alone	3.73
No fertilizer	2.98

Note: The plants were affected by a short period of drought.

Table 2. Results of the Farmer-Scientists group experiment (Phase I) on detasseling for the control of corn borer pests done in Malabuyoc, Cebu, May 2001.

Treatment	**Yield (tons/ha)**
A. Using IPB 911	
Without Detasseling	3.33
Detasseling 3 rows for every 4 rows	4.97
Detasseling 2 rows for every 3 rows	3.19
B. Using USM Var 10	
Without Detasseling	3.33
Detasseling 3 rows for every 4 rows	4.35
Detasseling 2 rows for every 3 rows	4.35

Note: The corn plants were affected by a short period of drought.

Table 3. Results of the Farmer-Scientists group experiment (Phase I) on the use of different corn varieties and hybrids done in Malabuyoc, Cebu, May 2001.

Variety/Hybrid	**Yield (tons/ha)**
Tinigib	1.49
C 818	4.56
IPB Var 4	4.32
IPB Var 1	4.24
USM Var 5	4.07
VM2 4.07	
CMU 9904	3.16
USM Var 10	3.13
USM Var 12	3.13

Note: There was no rain for 2-3 weeks so the farmer-scientists had to install a bamboo irrigation system to get water from a nearby spring. The yield could have been higher had it not been for the short drought.

Table 4. Results of some Farmer-Scientists individual experiments (Phase II) to test different varieties and hybrids of corn in their own farms done in Argao, Cebu, 1996.

Name		**Variety/Hybrid**	**Yield (tons/ha.)**
1.	Marcos Camarillo	IPB 9204	5.6
2.	Rosario Espina	Cargill CPX 3007	5.5
3.	Zoilo Manzanades	CPX 3007	5.0
4.	Joseph Montañez	IPB 9204 (F9)	6.5
5.	Leonito Manzanades	CPX 3007	5.0
6.	Fernando Embudo	CPX 3007	5.0
7.	Eugenio Daugdug	CPX 3007	5.0
8.	Marcelo Ybañez	IPB 9204 (F9)	4.0
9.	Abelarda Sejuela	IPB 9204 (F9)	4.8
10.	Lucia Decierdo	IPB 9204 (F9)	4.3
11.	Eleuterio Embudo	IPB Var 4	4.0
12.	Gliceria Fuentes	IPB 9204 (F9)	4.1
13.	Madalino Rivera	IPB Var 4	4.0
14.	Roque Sartagoda	IPB Var 4	4.5
15.	Matea Mamalias	IPB Var 4	4.1
16.	Aurelio Lar	USM Var 10	3.8

Table 4 (continued)

Name		Variety/Hybrid	Yield (tons/ha.)
17.	Jesus Artiaga	USM Var 10	3.5
18.	Filomena Monton	IPB 911 (F2)	5.0
19.	Anecita Albarando	Tinigib (local)	1.2
20.	Necitas Bajenting	Tinigib (local)	1.0

Using the technologies they found appropriate for their farms, the farmer-scientists are now producing 4-6 tons of corn per hectare compared to 0.5 –1.5 tons/ha before the training. They now use high-yielding varieties, organic fertilizer like chicken manure with Bio-N microbial fertilizer followed by urea 25-30 days after planting, and detasseling their corn plant 40-45 days later to control corn borers. Likewise, the rice farmer-scientists are now producing 4-6 tons/ha compared to 2-3 tons/ha before training. Farmer-scientists in the Backyard Milk Production and Processing Program are now knowledgeable about management of their cows, goats, and carabaos, milking them, and processing the milk for drinking or converting it into cheese, yogurt, ice cream, and others.

Applications of IPM - In addition to detasseling, the farmer-scientists are now using bio-control insects (*Trichogramma* sp.) to control corn borers. They also use coir dust/sawdust for *"kohol"* (golden snail) control in rice paddies, and botanicals like neems, hagonoy (*Chromolaema* sp.) and dried citronella leaves for control of corn weevils and other pests. When pesticide spraying becomes necessary, they usually spray only once compared to two or more spraying a week before their training.

Farming as a business enterprise – Most of the trained rice farmer-scientists are already members of the Argao Rice Farmers Association. Those in corn production in Argao have registered their Upland Farmer-Scientists Multipurpose Cooperative in July 1998. Most of the corn farmer-scientists in Barili are now members of the Barili Multipurpose Cooperative which was organized in 1987. Many of the corn farmer-scientists have already started marketing their surplus corn. In Argao, In 1996. they sold 6 tons of corn grains to NFA and about 5 tons to local traders. In 1999, about 10 tons of corn grains were sold to NFA and about 5 tons were sold to local traders. Likewise, those in Barili were able to sell about 7 tons, This clearly indicates that the farmers can produce more than enough rice and corn and other food crops if given the proper technical and market support.

Self-reliance and self-sustenance - Because a good number of the farmer-scientists are now producing more than enough rice, corn and vegetables, they have ventured into selling their surplus corn and other farm products making it possible for them to earn more than P20,000 per harvest season of corn. Others who are also in vegetables and fruit production as well as poultry, swine and

livestock raising have also increased their annual farm income to over P100,000 (Table 5-6). These are indications that they are now on the road to self-sufficiency in food production.

As a result of their improved farm income, a number of the FSTP trained farmers have constructed new houses replacing their old nipa huts; purchased refrigerators, TV sets, radios, motorcycles, and others. Above all, they were able to support the college education of their children.

Table 5. Sales of surplus corn generated by some farmers trained under the Farme-Scientists Training Program in Argao, Cebu, October 1998[1].

NAME	VOLUME (tons)	SALES (P)
1. Bernardo Solis	10.410	125,000
2. Joseph Montañez	1.971	43,797
3. Julian Generola	6.00	30,000
4. Dionesio Ortiz	3.00	15,000
5. Charina Paller	2.50	12,500
6. Roger Quinto	2.00	10,000
7. Vito Albiso	0.695	4,865
8. Felicidad Ortiza	0.650	4,550
9. Jesus Montañez	0.620	4,350
10. Leonito Manzanades	0.579	4,056
11. Virginia Sitoner	0.537	3,759
12. Camelo Ramos	0.513	3,591
13. Marcelina Bugtong	0.476	3,322
14. Sergio Ybañez	0.378	2,646
15. Zoilo Manzanades	0.310	2,170
16. Teresita Davide	0.400	2,800
17. Roel Cortez	0.158	1,106
18. Vivencia Sarona	0.250	1,750
19. Eugenio Daugdug	0.250	1,750
20. Josefa Fernandez	0.163	1,141

[1] *Because of the fear that El Niño weather conditions might stay longer, most farmers did not sell their surplus corn for food security reason.*

Table 6. Income generated by some of the FSTP trained farmers from their sales of vegetables planted as a rotation crop to corn in 1998, Argao, Cebu.

NAME	SALES (P)	TYPE OF VEGATABLES
1. Eduardo Torres	130,000	Tomato
2. Guillermo Lacticsi	90,000	Cauliflower
3. Romeo Geargonia	80,000	Tomato, Cauliflower
4. Jovencio Lacticsi	69,500	Tomato. Cauliflower
5. Elijah Comaling	60,000	Sayote, Tomato, Cauliflower
6. Agustin F. Sejulla	55,000	Okra, Squash, Pepper
7. Evangeline Remolino	52,000	Eggplant, Pepper, Squash
8. Agustin D. Sejulla, Jr.	51,000	Squash, Tomato, Pepper
9. Silveria Amatong	37,830	Ampalaya, Pepper, Eggplant
10. Teresa Comaling	31,000	Cauliflower, Tomato, Sayote, Squash
11. Michael Comaling	30,000	Cauliflower, Pepper
12. Leonarda Payusan	29,400	Cauliflower, Tomato
13. Gloria Roman	27,400	Eggplant, Squash
14. Trifona Enalba	25,750	Squash, Eggplant
15. Remedios Flores	24,425	Okra, Eggplant, Pepper
16. Teodoro Lanticsi	24,000	Pepper, Cauliflower, Tomato
17. Consolacion Roman	23,295	Squash, Sikowa
18. Seria Llego	21,000	Cauliflower, Squash
19. Teodulo Aballe	20,000	Squash, Pepper, Cauliflower
20. Roque Sartogoda	17,760	Eggplant, Singkamas

Note: Many other FSTP trained farmers have also generated income from sales of vegetables ranging from P2,000 to P16,000.

Strengthening leadership among farmers - The leadership abilities of the farmers have been strengthened through the lectures on how to become good leaders. A number of the farmer-scientists are now serving as barangay officials, either as members of the Barangay Council or as Barangay Captains. They are actively involved in many livelihood and development projects in their respective communities. These farmers easily gained the respect, cooperation, and support from the people in their respective barangays.

Strengthening LGU and SCU Research and Extension - Significant improvements in the research and extension capabilities of LGUs and SCUs of Argao and Barili have been achieved. The MAOs and ATs of Argao and Barili are now more knowledgeable and articulate in giving lectures and field demonstration to farmers. Through the FSTP, one Agricultural Technician in Argao, Dr. Leonila Dayaganon, obtained her PhD degree at the CSCST last March 2001 with PhilRice scholarship funds. A faculty member of Colawin Technical School, Mr. Alberto

Llena, is now working on his MS thesis on the use of Bio-N in corn as part of the FSTP experiment.

The SCUs have shown great improvements not only inresearch and extension capabilities but also in instruction. For instance, at the Cebu State College of Science and Technology Agro-Forestry and Industrial College in Argao where the rice Farmer-Scientists Training Program is based, a Research and Extension Director has been appointed. It has also established a 2-hectare rice experimental demonstration farm with PhilRice support where more than 15 new rice varieties have been tested. Many rice farmers who have adopted the high-yielding varieties obtained high yields up to 6 tons/ha.

Some members of the CSCST faculty who attended the Phase I of the Dairy and Vegetable FSTP are also now conducting R&D/E projects on vegetables and preparing to start the dairy program of the school. They now have three milking cows and a milking parlor and milk processing laboratory. An on-going corn and vegetable FSTP Phase I training program in South Argao covering six barangays with more than 60 farmers participating is now being coordinated by the RDE staff of the school who were previously trained in the program.

The research and extension capabilities of the Colawin Technical School in Colawin, Argao, which served as the home base of the corn, dairy, and vegetable FSTP, have also been greatly improved. A number of its faculty members and students have attended the Phase I of the program. The school has established its own 4-hectare corn-based research farms that includes vegetables, bananas and coconuts. It has also its poultry, swine, cattle, carabao and goat raising projects which are being operated by its multipurpose cooperative store.

Colawin Technical School obtained good support from DECS Region 7 and DOST Region 7. DOST 7 provided some dairy processing equipment and facilities to process milk and milk products into fresh milk, cheese, yogurt while DECS-7, through its Regional Director Dr. Eladio C. Dioko, built a dairy processing laboratory and three separate buildings for the technical school. Later, DECS Secretary Dr. Ricardo T. Gloria donated a one-classroom building to serve as the Farmer-Scientists Training and Information Center together with 10 sets of computers for the teachers, student, and farmers' use.

Technical support has been extended by the FFSTP to the Balao Agro-Industrial Institute, Balao, Barili, Cebu since the program started in October 24, 1995. A number of its high school teachers and students also attended the Phase I of the program. The AIDp PDO has been assisting the school in its curricular development and voluntary teaching of basic courses in agriculture. The school has established a 2-hectare demonstration farm donated by Cebu Governor Pablo Garcia. Most of its teachers and students have visited Colawin Techincal School to study its agri-business curriculum and see the livelihood projects.

With the transfer last year of the Cebu State College of Science and Technology College of Agriculture from its Lahug Campus in Cebu City to Cagay, Barili, Cebu, the FSTP expansion program in Barili is now based in this campus,

occupying a room in its 2-storey building. Dr. Hospicio Saniel, the College Executive Dean, and Dr. Jose Sal Tan, the President of the CSCST System, are fully supportive of the FSTP in Barili as the school's main RDE program. Some of its faculty members are now participants in Phase I of the training program that covers four barangays around the school campus with more than 50 farmers participating. They plan to develop the college as the Training Center for FSTP in DA-Region 7 to cover Cebu, Negros Oriental, Bohol, and Siquijor.

CONCLUSION AND RECOMMENDATIONS

The Farmer-Scientists R & D/E Training Program has demonstrated that farmers can be technically empowered through direct contact with agricultural scientists to equip them with scientific methods of farming in order to improve their living standard. That farmers can easily adopt new technologies proven to be beneficial by their experiments in Phases I and II, has been clearly shown in the impact assessment of FSTP as presented in Table 7 (Seminiano *et al.*, 1998).

It was also shown in this program that the farmer – scientists were not only more prosperous but also shown substantial improvement in their quality of life and became effective technicians under Phase III of the program as they voluntarily teach and share their technical knowledge to fellow farmers under the Adopt-A-Farmer(s) scheme.

Through the program, the research and extension capabilities of LGUs and SCUs in the project sites have been greatly improved and strengthened. They are now rendering better services to the farmers and their communities.

The program has further demonstrated that a joint multi-agency approach to sustainable agriculture and industrial development in the countryside can be more effective with less expenses and duplication of work. This approach should be encouraged.

For the Farmer-Scientists R & D/E Training Program to be more effective in other areas of the country, there should be adequate financial support. More agricultural scientists and resource persons from UPLBCA, DA, DOST, SCUs, LGUs and other agencies should be involved at minimum expense emphasizing the spirit of voluntarism in serving the program.

Finally, for the farmers to be prosperous in their farm business, they should be provided with liberal credit facilities, good postharvest technology, and passable farm-to-markets roads. When asked what they need now, our trained farmers would readily say "abuno and mercado" or fertilizers and market. For them, it is useless, to grow more corn, rice, vegetables and other crops when there is no good market price for their products. The government therefore must respond to these needs of our farmers especially the market need which is the most important key to the success of the farm business.

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