IPM Innovation Lab Trip Report

Names of Travelers: R. Muniappan, Director and E. A. Heinrichs, Asia Manager, IPM Innovation Lab.

Duration of the Travel: April 23rd to May 1, 2016.

Countries Visited: Vietnam (Ho Chi Minh City, Tien Giang and Hanoi) and Cambodia (Phnom Penh)

Purpose of the Visit: To conduct planning meetings of the Fruit Crops IPM in Vietnam and Rice IPM in Cambodia projects.

Description of Activities: We left U.S. on April 23rd and reached Ho Chi Minh City on April 24th at 11.30 pm. Mr. Mai Van Tri of SOFRI picked us at the airport and we reached Tien Giang at 1.30 am on April 25th.

April 26th: **Planning meeting of the project "Strengthening production and export of Vietnamese fruit crops through innovative and market-orientated IPM"**

Venue:

-Meeting: Conference Room at Southern Horticultural Research Institute (SOFRI)

-Field trip: Orchards in Tien Giang, and Dong Thap provinces

Present: Dr. Rangaswamy Muniappan and Dr. Elvis Heinrichs (IPM IL), Dr. Sivapragasam Annamalai and Dr. Wai-Hong Loke (CABI-SEA), Dr. Le, Xuan Vi (Plant Protection Research Institute), Dr. Nguyen, Tuan Minh (Fruit and Vegetable Research Institute), Dr. Ngo, Thi Thanh Truc (Can Tho University), Ms. Phan, Thi Thu Hien (Pest Surveillance Office), Ms. Orozco Romo (GIZ) and SOFRI staff Dr. Vo, Huu Thoai (Deputy Director), Mr. Mai, Van Tri (Deputy Director), Dr. Le, Quoc Dien, Mr. Nguyen, Thanh Hieu, Ms. Tran, Thi My Hanh, Ms. Dang, Thi Kim Uyen, Ms. Dang, Thuy Linh, Dr. Dinh, Thi Yen Phuong, Dr. Nguyen, Thi Ngoc Truc, Ms. Nguyen, Ngoc Anh Thu, Mr. Huynh, Thanh Loc, Mr. Do, Hong Tuan, Mr. Nguyen, Huy Cuong and Ms. Luong, Thi Duyen,

Not able to attend: Dr. Naidu Rayapati (Washington State University, Dr. Maria Elisa Christie (Virginia Tech), Prof. Russell Mizell (University of Florida), Dr. Quyen, Dinh Ha (Vietnam National University of Agricultural), Dr. Le, Dinh Don (Nong Lam University) and Dr. Nguyen, Van Hoa (SOFRI).

I. Meeting on April 25th, 2016

1. *Welcome and Opening Remarks* at 9.00 am

a. *Welcome:* Dr. Nguyen, Thi Ngoc Truc welcomed everyone to the meeting and introduced all attendees

b. *Opening Remarks:* Dr. Vo, Huu Thoai gave opening remarks and on behalf of SOFRI welcomed all participants of this meeting. He gave an overview of the Vietnam fruit production and export, highlighting the importance of the project. He also thanked USAID, IPM IL and Virginia Tech for funding this project and wished for a successful and productive meeting.

c. *Remarks from IMP IL:* Dr. Muniappan gave an overview of the IPM Innovation Lab. He mentioned about last phases of the IPM project and the seven participating countries of the current phase including Ethiopia, Kenya, Tanzania, Nepal, Bangladesh, Cambodia and Vietnam. There are eight major projects in the current phase: Vegetable Crops IPM in East Africa; Rice, Maize and Chickpea IPM for East Africa; Vegetable Crops and Mango IPM in Asia; Biodiversity and Climate Change; Modelling of invasive species in Africa; Asia and Central America; Rice IPM for Cambodia; and IPM for Exportable Fruit Crops in Vietnam.

He also mentioned about the meeting with agricultural officer in both the northern and the southern regions of Vietnam before establishing the major target crops for this project. This project is for resolving major problems of four target crops in Vietnam: fruit fly, anthracnose and leaf hoppers on mango; witches' broom and fruit borers of longan; fruit borers for lychee; and brown spot (*Neoscytalidium dimidiatum*), fruit fly and pesticide residue of dragon fruit. In addition, he stated four major aspects of IPM IL in Vietnam such as development of IPM components and packages for selected crops, monitoring and development of management technologies for invasive species, and long- and short-term training. Examples of IPM packages for vegetables and tomato were illustrated. Application of coconut pith, beneficial fungus *Trichoderma*, grafting, pheromones, NPVs, neem products and *Bacillus* sp. in Bangladesh,

Indonesia, India, Nepal, Uganda, Honduras and Kenya. Finally, he provided a summary of IPM IL impact assessment in different countries.

2. *An overview of the IPM project in Vietnam*

Dr. Dinh, Thi Yen Phuong presented project overview, summary of project proposal and activity plan for each year. This project is led by the SOFRI, Vietnam under the supervision of the PI, Dr. Nguyen, and Van Hoa.

Dr. Phuong introduced collaborators in the project, project background, fruit production and export status in Vietnam, strength and barriers of fruit production, and IPM activities at SOFRI. She explained the project objectives, pilot testing, formulating and implementing the ecologically sound and innovative IPM technologies and packages for dragon fruit, longan, mango and lychee crops. The specific objectives of the project are determination of the current status of pest management in fresh fruit production for export, development IPM technologies and packages for lychee, longan, dragon fruit and mango that meet U.S entry requirements; determination the impact of IPM technologies and packages through economic, ecological and gender impact evaluation; improvement communication and education to promote transfer of IPM through a dynamic technology transfer program; capacity building to reform and strengthen policies and local and national institutions that influence pest management; development and intergration sustainable resource based local enterprises into national regional and global markets.

Also Dr. Phuong provided project strategy of six different components: *i.)* assessment of current fruit production; *ii.)* implementation of IPM packages for 1ha model with determination of the economic, ecological and gender impact of the IPM technologies for each model; *iii.)* research and development of new, bio-rational IPM technologies on study of Longan Witches' Broom, the diversity of *Collectotrichum* spp. on dragon fruit and mango, study on fruit bagging and new bio-pesticides including entomopathogenic nematodes, parasitoids, plant extracts and entomopathogenic fungi; *iv.)* putting research into use through resource- matching and site specific packages and addressing/fulfilling market (USA) needs incorporating GAP procedures and SPS

compliance, *v.)* technology transfer and extension and *vi.)* monitoring and evaluation IPM approach including economic, environmental and gender evaluation.

For the activity plan, Dr. Phuong said that, the 2016 plan will be concentrated on the assessment of current status of target fruit production in Tien Giang, Long An, Vinh Long, Dong Thap, Dong Nai, Ba Ria – Vung Tau, Binh Thuan, Bac Giang, Hai Duong and Hung Yen. For 2017, the project will continue to build up the models that are adapted and implemented and continue to research and develop new bio-rational IPM technologies. IPM approach including economic, environmental and gender impact will be evaluated and monitored. In 2018 and 2019, the project will continue on research and development of new bio-rational IPM technologies as well as transferring technology. In the last two years of the project, putting research into use will take place in 45 ha dragon fruits (Tien Giang, Long An and Binh Thuan), 30 ha mango (Dong Thap and Dong Nai), 40 ha longan (Vinh Long, Tien Giang, Ba Ria – Vung Tau and Hung Yen) and 30 ha lychee (Hai Duong and Bac Giang). In these two years, the impacts of the IPM approach will be monitored and evaluated.

The roles of all collaborators: Plant Protection Research Institute will conduct surveys in Hai Duong, Bac Giang and Hung Yen as well as build up models (both 1 ha scale and 10-15 ha scale) for longan in Hung Yen and lychee in Bac Giang. Fruit and Vegetables Research Institute will build models (both 1 ha scale and 15 ha scale) for lychee in Hai Duong. Survey and building models in other provinces in this project will be carried out by SOFRI. IPM package will be developed and in consultation with collaborators led by SOFRI. Can Tho University, Vietnam National University of Agriculture, Virginia Tech, and Pest Surveillance Office will assess and analyse the economic, social and gender impacts of IPM strategy. Washington State University has been carrying out studies on Longan Witches' Broom. Nong Lam University will contribute in transfer technologies. CABI-SEA will play a consultant role to conduct surveys, develop IPM strategy, establishing models, assessment and evaluation of this project.

Lunch at 11.30 am

3. ***Project progress*** at 1.00 pm

Mr. Nguyen, Thanh Hieu reported the project progress from October, 2015 up to April, 2016. In this report, Mr. Hieu said that no training activities were carried out. The lesson learned from designing survey questionnaires was that it is not good to have too many questions in the survey sheet. Ms Dang Thi Kim Uyen started her PhD program under this project. There were 240 households were interviewed, including 90 dragon fruit farmer households, 60 mango farmer households and 90 longan farmer households. The insvestigation showed that the major labor force in the investigated orchards was male at the age of 41-60. Majority of farmers have cultivated their orchards for the past 9-15 years. Fruit production in the investigated provinces was not uniform in planting scale and age group. Majority of mango and longan orchards are small scale (less than 0.6 ha) while dragon fruit orchards were normally more than 1 ha. Dragon fruit production was by monocropping while about 20-30% longan and mango orchards were intercropped. Mr. Hieu talked about major pests and diseases on target crops as well as about current pest management approaches. Dr. Muniappan, Dr. Heinrichs, Dr. Sivaprakasam and Dr. Loke asked some questions about Longan Witches's Broom experiment and other major problems such as seed borers in mango, canker and pesticide application in dragon fruit, collection of anthracnose isolates from mango and dragon fruits, disadvantage and advantage of fruit bagging, the ability of large-scale production of *Trichogramma*, application of neem products, and the availability of NPVs. SOFRI staffs including Mr Tri, Dr. Dien, Dr. Phuong, Mr. Hieu and Ms. Hanh answered those questions.

Tea break at 3.00 pm

A discussion of project planning was carried out. Dr. Phuong prepared four tables (one for each target crops) to sum up the major problems of each target crop, current control methods and IPM strategy for each problem and assigned responsibilities for collaborating scientists to develop tactics.

Table 1: Major pests and IPM strategy for dragon fruits

Dragon fruit	**Current control**	**IPM package**	**Major Responsibility**

Canker *(Neoscytalidium dimidiatum)*	chemical pesticide application	Pruning, canopy management, orchard sanitation as well as application of plant extracts, and safe chemicals	SOFRI
Anthracnose *(Colletotrichum gloeosporioides)*	Chemical pesticide application	Pruning, fruit bagging as well as application of plant extracts, *Trichoderma*, *Bacillus*, *Streptomyces* and safe chemicals	SOFRI
Bacteria soft rot *(Erwinia chrysanthemi)*		Fruit bagging and sanitation	SOFRI
Sunburn		Shading and nutrient management	SOFRI
Thrips		Pressure washing, sticky trap, sanitation and application of plant extract	SOFRI
Fruit flies	Chemical pesticide application	Fruit bagging, pheromone-like traps, and application of SOFRI protein, and entomopathogenic nematode	SOFRI

Table 2: Major pests and IPM strategy for mango

Mango	Current control	IPM package	Major Responsibility
Bacterial black spot (*X.campestris* pv *mangiferae*)	Chemical pesticide application	Plant extracts, *Bacillus* sp., fruit bagging,	SOFRI
Anthracnose (*Colletotrichum* spp.)	Chemical pesticide application	Pruning, plant extracts	SOFRI
Fruit fly (*Bactrocera dorsalis*)	Chemical pesticide application	SOFRI protein, pheromone-like traps, entomopathogenic nematode, fruit bagging	SOFRI
Leaf hopper (*Idioscopus niveosparsus*)		Smoking out, *Beauveria*, permitted chemicals	SOFRI
Thrips (*Scirtothrips dorsalis*)		Pressure washing, sticky trap, sanitation, plant extract, *Metarhizium*	SOFRI
Fruit borer (*Deanolis albizonalis*)	Chemical pesticide application	Light traps, *Trichogramma*, parasitoids, fruit bagging, entomopathogenic nematode	SOFRI, CABI

Table 3: Major Pests and IPM strategy for longan

Longan	Current control	IPM package	Major Responsibility
Longan witches' broom disease		Nutrient, pruning, mite control	SOFRI
Mite (*Eriophyes dimocarpi)*	Chemical pesticide application	*Hirsutella thompsonii,* plant extracts	SOFRI, PPRI
Stink bug (*Tessaratoma* sp.*)*	Chemical pesticide application	*Ooencyrtus phongi*	PPRI
Fruit borer (*Conogethes punctiferalis, Conopomorpha sinensis*)	Chemical pesticide application	*Heterorhabditis* sp., fruit bagging	SOFRI

Table 4: Major Pests and IPM strategy for lychee

Lychee	Current control	IPM package	Major Responsibility
Stem end borer (*Conopomorpha sinensis)*	Chemical pesticide application	Sanitation, *Trichogramma*, *Chelonus* sp., preventative sprays at early stage of the fruit	PPRI, FAVRI
Stink bug (*Tessaratoma papillosa)*	Chemical pesticide application	Beauveria, Metarhizium, *Ooencyrtus phongi*, *Trissulcus*???, permitted chemicals	PPRI, FAVRI
Powdery mildew (*Peronophthora lichii*)	Chemical pesticide application	Sanitation, plant extracts, soft and permitted chemicals	PPRI, FAVRI
Anthracnose (*Colletotrichum gloeosporiodes*)	Chemical pesticide application	Prune of infected branches, plant extract, permitted chemicals	PPRI, FAVRI

4. ***Wrap up/ Closing comments*** for the meeting by Prof. Muniappan

The meeting ended at 5.00 pm.

II. Field trips on April 26th, 2016

1. Visit to lychee production sites in Bac Giang Province

On April 25th at 18:00 Dr. Heinrichs flew to Hanoi. On April 26th Heinrichs, John Bowman, IPM IL AOR USAID Washington, and Le Thi Thanh Binh, Development Assistance Specialist, Office of Economic Growth and Governance (EG^2), USAID Mission IPM IL POC, Hanoi, a provincial ag officer, and a PPRI scientist visited lychee production sites in Bac Giang Province.

Stop 1: Visit to Viet Trung Co., Thon Moi-Nghia Hp-Luc Ngang-Bac Giang Province. Manufacture styrofoam boxes for shipping litchi.

Observations:

1. Pack lychee (*Lychee sinensis*) fruit in dry ice in the styrofoam boxes for shipping to the USA.
2. Pack lychee fruit in regular ice for shipping to China. China is the major importer of Vietnam lychee.
3. Follow GAP standards.
4. Irradiate fruit to destroy the lychee fruit borer (aka the lychee stem-end borer) *Conopomorpha sinensis* (Gracillaridae) prior to exportation. The irradiation process was developed in China and is used for exporting lychee from China.

Stop 2: Visit to a lychee producer, Mr. Dang Van Thang

Observations:

1. Leader of a group of 25 lychee producers.
2. Group has one code for traceability purposes provided by the FAS and the PPD.
3. Pests and diseases- a) Downy blossom blight of lychee *Peronophythora lychee*. It is also a pest on longan. Symptoms- Diseased flowers turn brown and become covered

with whitish masses of sporangia and sporangiophores. Young and ripe fruits, pedicels and leaves are also infected and their tissues turn brown and die, especially in periods of heavy rain. b) Anthracnose, *Colletotrichum gloeosporioides,* attacks both leaves and fruit of the lychee tree. It also attacks dragon fruit. longan and mango. Anthracnose of lychee fruits is characterized by internal and external brown circular lesions with well-defined margins on the pericarp. Anthracnose is the main disease causing postharvest decay (a white mycelial mat grows over the fruit during storage) and its pathogen comes mainly from the fruit with latent infection before harvest. c) Stink bug *Tessaratoma papillosa (*longan stink bug; lychee stink bug) is a pest of lychee and longan. On lychee *T. papillosa* nymphs and adults suck the sap of the flowering and fruiting shoots, causing flowers and fruits to fall, the necrosis of young twigs and the blackening of the fruit exocarp. d) Buzura (*Biston suppressaria*) (Geometridae) oviposits on and damages small fruit and destroys flowers.
4. Current control procedures- Spray insecticides ca 7 times during a season of 5.5 months. Insecticides are purchased from dealers and are imported from China and other countries.

Stop 3.Visit to the lychee farm of Mr. Do.

1. Area of lychee ca 2 ha.
2. Production – 6.3 tons.
3. Price = VN 26,000/kg ($1.18/kg)
4. A demonstration farm that collaborates with ANSAF in testing biological fungicides (e.g. TN 4).
5. Exports to USA and Australia. A purchaser from Australia left as we arrived. Farmer gets an advanced payment when signing a contract.
6. Farmer is willing to collaborate with the IPM IL via the PPRI or SOFRI in the evaluation of IPM components with the objective of minimizing insecticide applications.
7. Comments and recommendations on visit to lychee production sites in Bac Giang Province

I. Lychee producers spray on a calendar basis, up tp 7 x/yr., without any monitoring, and farmer profit is minimal.

II. The IPM can have an impact by minimizing the inputs (pesticides sprays).

III. Exports are expected to increase in 2016. We need to understand the USDA involvement and their main concerns. It seems that any fruit going to the US is going to be irradiated. Can our IPM work result in less frequent irradiation needs?

IV. There are a few very progressive farmers in Bac Giang employing bio control products (cocktails of herbal extracts). PPRI knows these farmers - they are thirsty for IPM techniques based on good research and can probably be important field collaborators. We need to evaluate these "cocktails" for efficacy, cost and environmental effects.

V. On the next trip, we need to establish a strong relationship with MARD/PPD in terms of our major initiatives, and provincial MARD officers on more ground level stuff. As in the trip we took, any visitation of a foreigner to our project provincial field sites should be accompanied by a provincial MARD/DARD

VI. SOFRI should keep Steven Berlinguette, USAID/Vietnam Section Chief HCMC, informed of all events in the South. Le Thi Thanh Binh, Development Assistance Specialist, Office of Economic Growth and Governance (EG^2). USAID Mission Hanoi needs to be informed of any major events anywhere. They will attend activities when able.

VII. USAID Mission/Hanoi suggests we have a formal "launch" ceremony for the project when SOFRI is ready. This means a press release and maybe a ceremony with the Ambassador or Consul General in attendance. Before this happens, we need to be sure this project is properly registered with the GoVN and hopefully we can have some impact to report (e.g. the identification of the causal agent for'witches broom' of longan.

2. Visiting IPM demonstration site for dragon fruit (8.00 – 10.00 am)

Dragon fruit is considered as one of the most important tropical fruits in Long An province. Current growing area is approximately 7,200 ha with production about

210,000 tonnes (≈ 10,000 m^2) and average yield 30-40 tonnes/ha. It is in second position in the country behind Binh Thuan province (26,000 ha). In the past, dragon fruit was considered as a "hunger eradication and poverty reduction" fruit for the local people, but in recent years it has become one of economical crops enriching farmers in Vietnam.

The average yield of dragon fruit is approximately 35 to 40 tonnes/ha production is 210,000 tonnes/year. There are 4 cooperatives for dragon fruit in Chau Thanh district which work closely with farmers in crop production, marketing and service areas. With the support of SOFRI, the district got about 33.43 ha of Global GAP standard certification. Hoang Huy Company in Long An province has invested in vapour heat treatment to meet quarantine regulations for dragon fruit and mango in Japan, Korea, and New Zealand.

I**nformation of the farm visited:**

Name of farmer: Vo, Trong Diep (Mr.)

Place: Song Tan hamlet, An Luc Long village, Chau Thanh district, Long An province.

Total area: 1.2 ha

Average yield: 45-50 tonnes/ha

Age of the crop: 9 years

Dragon fruit farming experience: 23 years

Expected time to build up models: May 2016

3. **Visiting SOFRI laboratories** (10.00 -11.30 am): molecular lab, microbiology lab, entomology lab (observing Longan Witches' Broom samples and longan mite)

4. Visiting IPM demonstration site for mango (1.00 – 7.00 pm including travel time)

In the Mekong Delta, mango growing area is approximately 43,000 ha, occupies 49% of total area of the country.

mango crop is grown in about 9,200 ha in Dong Thap province. Among them, there are about 80 ha mango in **compliance** with VietGAP and GlobalGAP standards. In Tan Thuan Tay village, Cao Lanh city, Dong Thap province, mango growing area is about 665 ha.

Cat Chu and Cat Hoa Loc are known as the most popular varieties grown by the province and are exported to Japan, South of Korea and New Zealand.

Mango is often harvested in two cropping seasons with production in main season and off-season at about 11.64 tons/ha and 9.88 tons/ha, respectively.

Out of 13 pests recognized in mango orchards, majority of pests and disease such as anthracnose (*Collectotrichum gloeosporioides*), bacterial black spot (*Xanthomonas campestris* pv *mangiferae*), fruit borer (*Deanolis albizonalis*), fruit fly (*Bactrocera dorsalis*), leaf hopper (*Idioscopus niveosparsus*), thrips (*Scirtothrips dorsalis*) were considered as the most ipmortant pests of mango.

Information of the farm visited:

Name of farmer: Ha, Van Sang (Mr)

Place: Tan Dan hamlet, Tan Phu Tay village, Cao Lanh city, Dong Thap province.

Total farming area: 0.8 ha

Average yield: 21 tonnes/ha

Tree age: 15 years old

Mango farming experience: 15 years

Expected time to carry out demonstration: May 2016

April 27th 8.30 am: Drs. Dinh, Thi Yen Phuong, R. Muniappan and E. A. Heinrichs visited USAID Consulate at Ho Chi Minh City and and briefed Mr. Stephen Berlinguette on the IPM Innovation Lab activities in Vietnam.
12.30pm: Heinrichs and Muniappan traveled to Phnom Penh.

April 28th: **Planning meeting of the project "Development of Ecologically-based Participatory IPM Package for Rice in Cambodia".**
Venue: CARDI
Welcoming remarks were given by Dr. Vang Seng, Deputy Director, CARDI, Dr. Sang Lee USAID mission, and Dr. Grant Singleton, IRRI. Muniappan presented an overview of the IPM Innovation Lab and Buyung Hadi gave an overview of the project.
Later the following presentations were given.
Cambodia – Rice IPM experience – Nigin Chhay, General Directorate of Agriculture
Vietnam – Rice IPM experience – Nguyen Douc Cuong, CLRRI
China – Rice IPM experience – Lu Zhong Xian, Zhejian Academy of Agricultural Sciences
Thailand – Rice IPM experience – Chanya Maneechote, Weed Science Society of Thailand.
FAO policy advice and initiatives in support of up-scaling rice IPM in Asia – Jan Ketelaar, FAO, Thailand
IFAD portfolio in Cambodia – Sakphouseth Meng, IFAD
Plantwise – A. Sivapragasam, CABI Southeast Asia
ASTV – Dule Zhao, IRRI
In the afternoon working groups were formed to identify top three invertebrate and vertebrate pests, weeds and diseases of rice. Accordingly rats, stem borer and golden apple snail for invertebrate and vertebrate pests; *Echnochloa*, *Leptochloa* and

Fimbristylis for weeds; and blast, brown spot and bacterial blight for diseases were identified. There was also some discussion on extension methodologies.
April 29: In the morning, Buyung Hadi and George Norton presented on M&E and Impact Assessment, respectively. Later the following presentations were made.
Adaptive research cycle – Alexander Stuart, IRRI
Nagoya University programs in Cambodia – Akira Yamauchi
Collection of rice pathogen strains in Cambodia – Ricardo Oliva, IRRI
Bio pesticides – Thomas Jakel, GIZ
Pesticide KAP survey among rice farmers – Keam Makarady, CEDAC
Rice health survey – Nancy Castilla, IRRI
Analysis of rice health survey data – Adam Sparks, University of Southern Queensland.
Closing remarks presented by E. A. Heinrichs.

Comments and recommendations:

The planning meeting of the Vietnam fruit crops IPM project was very satisfactory.
The planning meeting of rice IPM in Cambodia was less than satisfactory as it failed to plan for activities for the coming year except the plan to implement a canned module of health survey and to reinvent the wheel. The first portion of the planning meeting was occupied by a review of rice IPM activities in the countries surrounding Cambodia and regional projects. The time spent on the identification, role and importance of rice pests in Cambodia was a waste as the PI was not planning to use it and he was depending on the Rice Health Survey to identify the pests.
There were three possible surveys to be conducted by George Norton, Harvey Reissig and Nancy Castilla and these were not coordinated. George Norton's baseline survey should be implemented and should incorporate parts of the other two. Nancy Castilla's proposed survey is a canned program of little value to the project.
The IRRI Virologist was of the opinion that there is no rice viral disease problems in Cambodia and as such his involvement in the project should be terminated. The participants had no idea about nematode problems of rice in Cambodia even though *Meloidogyne graminicola* was reported as a serious pest of rice in Southeast Asia in

the literature. There is a need for survey of nematode pests of rice and possibly vegetables in Cambodia.

After the planning meeting, we met with Buyung Hadi and recommended that he plan on conducting some experiments such as application of *Trichoderma*, planting of flowering and/or vegetable crops in the borders, use of *Trichogramma, Sarcosystis* etc.