

Vegetable Crops and Mango IPM in Asia Trip Report

Countries Visited: Cambodia, Bangladesh, Nepal

Dates of Travel: January 23- February 15, 2018

Travelers Names and Affiliations: E. Heinrichs, Amer Fayad, Megan O'Rourke, and George Norton (Virginia Tech), Cristina Rosa, Ed Rajotte (Penn State), Jonathan Jacobs (Ohio State), and Lawrence Datnoff (LSU and Chair of Technical Committee, IPM IL. R. Muniappan also participated in Nepal portion of the trip.

Purpose of Trip: To review progress on Vegetable Crops and Mango IPM in Asia program and plan for the next year for the target countries ,

Sites Visited: Nepalgunj (Banke) and Katmandu, Nepal; Gazipur and Jessore in Bangladesh; and Phenom Penh and Siem Reap in Cambodia.

Description of Activities/Observations:

January 21- 28: U.S. scientists left United States

January 25-30: Scientists arrived in Kathmandu, Himalaya Hotel.

January 30: Kathmandu – George, Muni, and Amer met with Luke Colavito to discuss budget and program for the week. Luke would like to see some research on estimating losses to viruses to help NARC with their virus assessment and virus diagnostics.

January 31: Kathmandu -- Planning meeting at iDE office (whole group plus several government scientists and representatives, NGO CEAPRED, and private sector such as AGRICARE). Luke Colavito gave an overview of IPM IL program strategy in Nepal, including scaling up. Presentations of participants were made. All presentations were provided to the participants. Nepal government is changing and the agricultural department is migrating down to the municipal level, since the central government is decentralized. This is creating a bit of uncertainty and the new system is going to have less technical capacity. The technical people could also move if they are not happy with the new situation. NARC is the government research institution that promotes its findings to the Department of Agriculture for adoption. NARC is also the pest and pathogen regulatory agency. We also watched a video on IPM IL work in Nepal via iDE. The promotional video was produced in 2017.

The *Tuta absoluta* package is being adopted. iDE has a grant to help the Indian private sector to expand in Nepal, especially to help promote IPM and *T. absoluta* products (ENBAITA). Collection centers can label their products for IPM, so this will be implemented via the “truthfully labeled products” mechanism for a couple of collection centers. iDE helped organized a *T. absoluta* symposium, where they had a session on fall armyworm, an incoming invading species. iDE is linking rural collection centers with DoA, PPD (for pest and disease identification), and they are also establishing the “last mile supply chain” with Community Business Facilitators (CBFs). Through KISAN, EMBAITA, and DFID funded projects, iDE has reached 100,000 households, with 3300 reached directly through the IPM IL. iDE also

has a partnership with the CABI Plant Doctor program to train 20 CBFs to become plant doctors. These people enter data that inform the government database on pests, abiotic stresses, and diseases in Nepal. There are now 290 CBFs (15 are directly linked to the IPM IL funded program) that average \$400 per month in sales. Plant Doctors are using the IPM IL recommended *Tuta absoluta* strategy. iDE reached 16,000 households with *Tuta* management strategies in 2017 and 40,000 lures have been sold. A pilot project has shown that SMS increases sales significantly.

Lalit Sah, IPM IL veg project coordinator for Nepal, also welcomed the IPM IL group to the meeting. He gave a PowerPoint to summarize the program and its results for 2017. This was followed by discussion. Current trials in the field include a *Tuta absoluta* package on tomatoes plus trials on chillis, cucumbers, bitter melon, tomatoes, onion, French bean, and anaerobic soil disinfestation. There was follow-up discussion with the group. Excellent progress is being made, protocols are being followed, and new young scientists are involved from NARC.

After lunch, the presentations and discussions focused on *Tuta*. Lalit had conducted a survey of 50 farmers in areas with *Tuta absoluta* and they estimated about a 50% loss due to the pest before any treatment. Tomato price is increasing due to *Tuta absoluta*. Vegetable collection centers are sending out SMS messages about its management. There is a national level *Tuta absoluta* working group that Lalit helps lead. Clearly Nepal is ahead of other countries and making rapid progress on *Tuta absoluta* management.

February 1: Traveled to Nepalgunj in Banke district. Field visits were made to three farms that collaborate with the project. IPM Field trials were reviewed for onion, chili, French bean, and tomatoes. One of the sites was a learning center where project personnel, farmers, and other stakeholders received training on IPM. We visited tomato fields where side-by-side farmer's practice versus pest exclusion net houses demonstrations for *Tuta absoluta* management were set. Not much difference was present as the pest level in the field was very low. Anaerobic soil disinfestation was also seen in the field. The group discussed the protocol being followed and made some suggestions. The second farmer visited was a member of a women's group of 22. An agro-vet input supply store was also visited. The store sold 1000 pheromone traps and 150 liters of *Trichoderma* last year. Twenty percent of the products marketed consist of biocontrols. All of these products are part of the IPM package recommendations of the IPM IL.

February 2: We travelled back to Kathmandu and met all afternoon planning the activities for the coming year at iDE. We arrived in Kathmandu later than intended due to a flight delay and therefore missed the scheduled meeting with USAID. The activities laid out in the workplan for this year are on track and several HICAST students are also completing theses on the project. Several suggestions were made to Lalit Sah and iDE for next season's trials including the use of a non-treated control and refinements to the ASD trial. Discussions focused on using proper controls and well defined experimental designs. The team also suggested a quick assessment for virus effects on tomato production to be carried out by Lalit and his group in Banke in one of the tomato fields that showed a high incidence of viral symptoms

February 3: Team (E. Heinrichs, A. Fayad, M. O'Rourke, G. Norton, C. Rosa, E. Rajotte, J. Jacobs, and L. Datnoff) travelled to Bangladesh.

February 4: The group visited BARI in Gazipur for a planning meeting at the Horticultural Research Center. Yousuf Mian, Bangladesh IPM IL Coordinator, gave the welcoming address and introductory remarks were given by Dr. Rezaul Karim, former IPM IL Director for the Bangladesh site, G. Norton, IPM IL Asia Veg Site Chair, Dr. Abul Kalam Azad, BARI Director General; and by the Director of HRC, BARI. Presentations were made by the BARI project scientists that reviewed progress for the past year. The meeting was attended by 24 BARI scientists, including seven women. MCC, a major IPM IL outreach partner, was also represented by two staff members.

Dr. Shahadath Hossain presented the results of the *Bt* eggplant IPM trial. It went well although there was a virus problem. They conducted farmers' training. He presented the results of the *Tuta absoluta* monitoring and there was highest incidence at Panchagorh and Sylhet. He presented results for biocontrol for mango hopper (3 sprays with *Beauveria* is best) and for fruit bagging for fruit fly control. Dr. Goffar presented the results for the summer tomato trial and the rootstock screening for bacterial wilt. Dr. Nahar presented the results of the white mold research on country bean. Dr. M.A.T. Masud presented the results for the IPM package on bittergourd. Mr. Sadique Rahman presented some results on the economic impacts of IPM on brinjal, tomato, and all vegetables. There are high net returns for IPM on all vegetables. Dr. Mafruha presented the results of her dissertation on colonization of *Ralstonia solanacearum* in *S. sisymbriifolium* and tomato.

After lunch, Mr. Jahangir, a representative from the NGO: MCC described how they transfer IPM IL technologies to marginal, mostly tribal, farmers in 5 districts in the northern part of the country. MCC has worked with the IPM CRSP and IL since 2005 and also with GKSS. Dr. Nahar provides MCC inoculum for *Trichoderma* every 2 months. They have 400 farmers that produce about 300-350 tons of tricho-compost per year. They currently work with 550 farm families who produce pesticide free vegetables. They use pheromone traps, neem, and tricho-compost and sell vegetables in a supermarket after processing and packaging. They use an "organic village" brand but their products are not certified as organic. Poultry refuse and tricho-compost are replacing grafting in many areas except where bacterial wilt is severe. It is difficult to get the pheromones that they need. Availability of pheromone lures and biocontrol agents remain a challenge for farmers interested in adopting IPM practices.

Future planning with BARI scientists – *Bt* eggplant experiment went in the ground on Jan 20-21. They use grafted *Bt* eggplant seedlings. They are using pheromone traps for surveillance of *Tuta absoluta*. Mango hopper experiment is underway. While mold research on country bean continues and are conducting two trainings of 100 people each on Tricho-compost. They are continuing with grafting research and summer tomato trial. Suggestions were made by our team to introduce untreated controls in farmers' fields to measure the pest pressure and the efficacy of the IPM-package vs. farmer's practice in the bittergourd experiments. Another suggestion was made to set up the experiments so as to have a replicate in each location.

February 5: Rajotte, Rosa, O'Rourke, Jacobs, Datnoff and Heinrichs went with Dr Shahadath Hossain to Jessore to observe the field trials. The IPM IL group observed the *Bt* eggplant experiment. The plants were still young and showed no EFSB damage yet, although there was evidence of EFSB in older plants in the same area. Some of the plants seemed to have been grafted on different rootstocks or seemed to have lost the scion, since their color shape of leaves and number of stems was different than the ones seen in the rest of the plants. *Bt* eggplant trials can be evaluated in the next several weeks. Afterwards, the team visited another farm to view rice and eggplant production as well as visiting the BARI station in Jessore to see ongoing field research on wheat, tomatoes, and eggplant.

Norton, Fayad, and Mian met at USAID with Aniruddha Roy, EGO Deputy Director. There is no full time office director at the moment. Program progress was summarized by Norton. Roy said they are expecting two market system projects: 1) rice, oilseeds, and pulses, and 2) vegetables and fruits. He discussed the role of NAFCO (National Agricultural Fertilizer Company) in private sector pest management along with Isphani. He likes to see coordination across projects.

February 6: Team travelled back to BARI in Gazipur to plan with the BARI scientists. Each scientist presented their proposed workplan. Goffar will work on IPM for summer tomatoes and will include trichocompost in 1) sickbed and 2) farmer field in Bogra. Nahar will focus on field trials for white mold control on country bean using *Pseudomonas* and *Bacillus* + other IPM tactics. S. Hossain will complete the *Bt* eggplant trial, mango hopper trial, and mango bagging demonstration. Next year we will focus on impact assessment and include an adoption survey. The team flew over night to Cambodia.

February 7: Phenom Penh – The team met at iDE with Seng Kim Hian, IPM IL Cambodia site coordinator, Mike Roberts, iDE Director for Cambodia, and Ratha, field assistant to Kim Hian. Kim Hian reviewed the results of the past year, specifically the cucumber IPM trial from March to May and the long bean trial from Aug to November, and the long bean trial from November to now. These trials are in 12 farmers' fields in Siem Reap. There is also a long bean trial in the CESAIN Technology Park in Siem Reap. Two seasons of cucumber and Chinese Kale have been completed by students at RUA. Four students have graduated and 5 are working on trials now.

February 8: Group traveled to RUA. Ed Rajotte gave a seminar on integrated pest and pollinator management to 18 RUA students, half male and half female. The team visited the long bean IPM Field Trial at RUA. The Treatments – IPM package (*Trichoderma*, transplanted, plastic mulch, BTs, *Beauveria* and yellow sticky traps), business as usual (Directed seeded, pesticides, and the Control. The team listened and commented on RUA undergraduate student presentations that included Bioefficacy evaluation of *Trichoderma viride*, *T. harizianum* and *T. koningii* for controlling damping off disease on tomato; The efficacy of plant extracts and *Trichoderma harzianum* against *Alternaria solani*; Comparison of the effectiveness of IPM and farmer's practices in controlling insect pests on yard long bean; Effects of *Bt* on diamondback moth under net house conditions; and effect of *Ocimum sp.* (pest repellent crop) on Chinese kale pest infestation in the dry season. After the presentations, the IPM IL Team met with Karen Legrand of the HORT IL. She discussed their leafy vegetable work in net houses. Insects and diseases are the main production challenges they face. The two groups discussed the use of IPM such as sticky traps, traded further information on what each Lab is doing and agreed to meet in the future to further discuss how the two ILs might collaborate. The IPM IL might help them with training on *Trichoderma* and they might be able to conduct a vermi-compost trial for us.

February 9: The team spent most of the day at iDE planning activities for the next year. There will be one more year of the cucumber trial; finish up long bean trial; evaluate tomato rootstock for BW and virus resistance (J. Jacobs will help with obtaining seeds); tomato IPM Trial next year; test *Trichoderma*. Under the Harvest project, Kim Hian is doing a radio drama every week and if it works, we will send a script for IPM that she can use. Mike Roberts discussed an organic business (Lors Thmey) that was begun and spun off by iDE. He mentioned the issue of Kim Hian being paid a smaller fraction of her time on the IPM IL than was budgeted because the IPM IL money for this year has not yet arrived. The money available must be used to pay for the fieldwork of Ratha. Kim Hian will increase her time on IPM IL once

USAID provides this year’s IPM IL funds to pay for her. Kim Hian will organize a farmer field day for each experiment when the crop is near its peak in the trial. The first field day will occur at the end of February. The team visited an organic vegetable store.

February 10: George Norton, Short Heinrichs and Amer Fayad met with Rica Flor to discuss Rice IPM. Chou Cheythyrieth is now Country IPM coordinator for GDA in Cambodia. Megan O’Rourke, Ed Rajotte, Cristina Rosa and J Jacobs travelled with Kim Hiam up to Siem Reap. Norton left to return to the U.S.

February 11: M. O’Rourke, E. Rajotte, C. Rosa and J. Jacobs visited the long bean trials in Siem Reap. The team evaluated long bean trials on 13 farms along with Ratha, the field technician. This evaluation allowed the team to further train Ratha in the recognition of virus symptoms and to calibrate his pest and disease assessment. In general, the IPM package was doing well, improving yield and quality and extending the harvest season, but on a couple of farms there was a general decline due to unknown reasons. One farmer reported receiving higher prices because of better quality and reduced pesticide use. Farmers were interviewed on the test farms and generally agreed that the IPM IL interventions were useful, and they would be willing to pay for the technologies for their long beans even after the IPM IL project ends.

A. Fayad and E Heinrichs returned to the U.S.

February 12: The remainder of the Team left for the U.S.

Suggestions, Recommendations, and/or Follow-up Items:

- Need to think more about how to move *Tuta absoluta* management information to all parts of Nepal and to other countries. Maybe send Lalit to Cambodia to set up *Tuta absoluta* trials.
- Must be sure there is a control on each experiment (not just farmer’s practice)
- Next year we need a local impact assessment budget for adoption surveys and impact assessments for each site in wrapping up this 5-year phase of the project.
- Should consider linking to HORT IL with vermi-compost in next year’s workplan
- May need to send someone from Cambodia to BCRL in India for training
- Grow rootstocks under IPM conditions.
- Starts drafting manuscripts for publications
- Discuss expanding vegetable trials to tomato in Cambodia and partner with private partners (such as East West Seed) to define disease and pest resistant tomato varieties adapted for Cambodia agriculture

List of Contacts Made:

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