

Asian Vegetable and Mango IPM Trip Report

Countries Visited: Cambodia, Bangladesh, Nepal

Dates of Travel: January 26- February 10, 2019

Travelers Names and Affiliations: Amer Fayad, Megan O'Rourke, and George Norton (Virginia Tech), Cristina Rosa, Ed Rajotte (Penn State), Jonathan Jacobs (Ohio State).

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

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

Description of Activities/Observations:

January 25- 26: U.S. scientists left United States

January 27-February 1: Scientists arrived in Phenom Penh, Frangipani Hotel.

January 28: Phenom Penh – Amer, Megan, George, Cristina, and Ed met with Mike Roberts to discuss progress and plan for future activities on the project. Future program needs to focus significantly on the private-sector and scaling up. Invasive species issues are growing. Need to focus on youth (15-29) entrepreneurship, ag systems (like rice-veg) rather than just single crop specific, and medium (commercial) rather than small-holder farmers. Scaling up should tie into the Harvest II project that iDE is implementing. Harvest starts with buyers and works back to farmers. For the future, need participatory appraisal to discuss needs. Can license app database for app development for IPM not just conventional pesticides, embed in multiple locations. Should review existing app landscape (PlantWise, PlantVillage, etc.). RUA can now produce and sell biocontrol agents such as *Pseudomonas* & *Beauvaria*, *Metarhizium*. Should develop new diagnostics capacity, perhaps with RUA & GDA collaborating. Can think of developing a small business for biocontrol products.

Potential Collaborations: ACIAR-net houses and covered agriculture, move to ready-for-market product with better design and lower price; 1yr program (Australia, U Adelaide); Cambodia quality horticulture: GAP, residue testing; CADF-CODES 5 yr extension, could incorporate IPM (NZ funding), have database on pests, diseases, and chemicals, could add the IPM steps into the database (license into various apps); HARVEST II buyers are organizing growers in a new cooperative model to organize growers for market opportunities but vegetable markets are weak because of high competition from imports from Vietnam (govt is funding boosting food production \$10 million for subsidies and extension similar to HARVEST I and GAP [ASEAN trade opportunities]).

Troubleshooting issues: We need CE-SAIN's data about the number and type of people who visit our CE-SAIN plots. Bt, pheromones, and trichoderma are no longer being sold by Khmer organic; Farmer's homemade pheromone traps didn't work well, but funnel-style works better because farmers don't need to replace the water.

Kim Hian made a powerpoint presentation to review progress during the past year. She summarized research trials at Siem Reap and student trials at RUA. She listed all the students and described their progress. She described interactions with other ILs, including IPM training to 34 vegetable growers in Battambang.

We travelled to RUA and Jonathan joined the group. We met with professors Socheath and Tho Kimeang of RUA. The latter is a new plant pathologist from Michigan State University. Eight students introduced themselves and five presented their research:

1. Ly Penghaing student: chemical and biological fungicides against white rot tomato
2. Seng Phanta: same as above on chili pepper
3. Eang Kimsrean: biologicals and chemicals to control insects on green bokchoy drip irrigation
4. Khoem Sopoch: same as 3 but with overhead irrigation
5. Nann vireak: mulching effects on insects and disease in chili pepper

Socheath, who is Director faculty of agronomy, said her five students are repeating what they did before due to flooding of their trials. We suggested that during the rainy season they just do pot experiments. Socheath liked the virus and Trichoderma production trainings, but has found Trichoderma difficult to store for more than 1-2 months.

January 29: Phenom Penh -- Megan, Amer, Kim Hian, and George met with Laura Cizmo, Deputy Director of USAID's Office of Food Security and Environment in Cambodia and with Vuty and Sam Ke from that office. We discussed the IPM IL program in Cambodia and the need to work with Harvest II. There is a new agribusiness assessment being conducted in the country.

Our whole group met with Alexis Elliott, Chief of Party of Harvest II. Harvest I was implemented by a different company and different team and was producer focused. Harvest II has a buyer-led approach. Buyers purchase from producers, so need to find a balance. Buyers complain because producers don't meet their need for quality and quantity (quantity is big issue). Harvest II helps buyers to work with producers of high value vegetables, fruits, and cashews. Looking at whole ecosystem of actors — not buyer alone, not producer alone, also want to overlay market systems. Gives up to \$100,000 as seed money (\$1.8 million available). Alexis Ellicott is a plant breeder by training, has worked in Bangladesh in aquaculture and leather footwear. She says it is difficult to get buyers and producers to commit to consistently get products to expat buyers. IPM IL could work with Harvest to transfer Trichoderma/Tricho-compost, etc. RUA has expertise to produce small amounts for buyers consistently. Harvest II grants to disseminate technologies are NGOs or private companies, although the project struggles to find recipients that might produce IPM products. Harvest II identifies a need and writes an RFA. It is a rolling application process. Wants commercializable and sustainable...not training for training sake. Perhaps with Tricho-compost or IPM, if farmers could see it was working, they could convince the seller to get the product to them. Buyers don't have much time to invest in producers. Questions on our end are what motivates a farmer to implement IPM. Also student and scientist training (e.g. Trichoderma workshops). As a start could we bring together input supply companies? Bring them in to have a discussion, workshop or meeting to chat about what IPM practices are available out of this project and RUA. USAID is interested in scaling up; our project isn't tasked to do that. Perhaps an input supply grant could draw student from RUA to get into an agribusiness; if students know about biopesticides, they'd be a step ahead. Perhaps hire fresh graduates to use as field agents. East West wants to expand market share here; generally they have a good product; Can we market Trichoderma with East West products? Only a handful of companies selling quality seed; Mostly have

companies selling imported pesticides and not easily traced. No info about safe use and dosing; always perverse incentive to sell more; no good guarantee on quality or good plan about useage.

Next steps:

- Develop points of collaboration with companies (e.g. East West Seeds)
- Workshop to find a company that might want to market biopesticides
- If a company wanted to commercialize a biopesticides, Harvest II would consider them for their rolling proposal and grant
- Give USAID a concept in how our two projects can collaborate
- Clearest next step: Have a workshop to spark imagination

In the afternoon, George presented a seminar on IPM impacts and impact assessment at RUA under the auspices of CE-SAIN. Well attended.

January 30: Traveled to Siem Reap. Spent day at iDE office planning for rest of year and potential next phase. Need to 1) coordinate with World Vegetable Center, 2) Hold workshop for biopesticide businesses with Harvest II. 3) hold introductory workshop w/stakeholders, e.g. universities, input suppliers, produce buyers, restaurant association, facilitated in small groups. RUA students could do a survey to identify and form consensus on problems related to IPM; 4) Conduct participatory appraisal: reliability of inputs and attitudes of consumers about low-pesticide produce (i.e. branding of produce) (can HARVEST do this?). 4) Training on invasive species: tuta and fall armyworm, govt and stakeholder (esp. private sector) workshops; 5) Scaling up: work with HARVEST II, incubator collaboration at RUA for youth development and provide seed grants (like GKSS/small scale and Ishpahani/medium scale did in Bangladesh 6) CE-SAIN coordination for scaling: RUA and Siem Reap demonstrations with maybe paying student to maintain new RUA small plot; 7) Biocontrol Production and training for scaling: Workshops for training to produce other biocontrol agents, centered at RUA: beauvaria, pseudomonas, etc (small equipment grants); should market product in small packages; 8) Gender: break down barriers to women, and using our gender knowledge to promote scaling up; 9) Research: Leafy green vegetables – brassicas, etc. as budget allows; virus research on management and virus-free periods and area-wide management, use students in US to produce work related to project with focus on Cambodia; 10) Policy: HARVEST II has 17 different policy initiatives & GIZ has finished biocontrol policy. Problem of enforcement of laws like pesticide and fertilizer law of 2011.

Potential Quick Starts: stakeholder workshop, participatory appraisal, invasive species workshop, IPM production training

January 31: Siem Reap: Field visits: 4 farmers plus input supplier plus CE-SAIN.

Farms: Mysterious necrosis. Unclear what is causing it and maybe it could be a bacteria that is spread by pruning or seed borne. The disease is vascular with pith necroses and begins with wilt and browning at the growing tips. The fields are almost completely infected but there is some plant-to-plant variability. Probably yield losses of >50%. There seems to be an interactions with heat/light. Plants in the shade have considerably fewer symptoms than those in the shade. There also appeared to be dual virus infection in some plants, especially the second farm, and bacterial wilt was found in the third farm that we visited. At the third farm, there was a circle of dead plants across three rows that was presumably caused by bacterial wilt.

Input supplier: Did not sell biocontrol products and did not work with HARVEST I previously

CE-SAIN: problems with CE-SAIN demonstrating IPM without consulting with IPM IL in Siem Reap technology park. CE-SAIN never asked IPM IL about IPM packages, but just came up with practices used in demonstrations that are not solving many pest problems.

Ideas for improvement: 1) The barrier for flea beetles appeared to be effective but caterpillar damage with ~50% losses. Could spray Bt. 2) Spacing on intercropped bitter melon and other vegetables had tomatoes spaced too closely. 3) Bacterial wilt found throughout the site on tomatoes, eggplant, bitter melon, and long bean. Symptoms on eggplant are stunting not wilting. Bitter melon appears to be latent host with no symptoms. Could promote grafting.

February 1: The group met at the iDE/CODES office (with Kim Hian and Bruce Todd). CODES has a new 5 year project on climate change, market systems, safe farmers, consumers and environment. CODES database and booklet of pests and management. Done within next couple months and database updated every three months. Markets: still 90% of produce through “wet” markets (not supermarkets), little product differentiation, preference for Cambodian product, supermarket sales focused on quality and food safety. Next Steps: Tomatoes: plant May-June, 12 new farms BaKong, consider a rain barrier, add data about which farmers are roguing, plant half Roma/half row cherry tomato. Try to determine the new disease of tomatoes: Grow tomato plants in pots at RUA with mesh screen to determine if this is seed-borne disease; Jonathan will try to take seeds back to US and culture from the leaf while he stays in Cambodia. Ultimately Jonathan will determine way forward with identifying the mystery disease. We will not hold field day because tomatoes have problem. Synergies with CODES: promote technologies under the heading of climate change (e.g. invasive species), 3S program would be good coupled to IPM technologies (“soft” pesticides), they will work largely with farmers. J. Jacobs stayed in Cambodia to work on plant pathogen issues, Cristina Rosa left for New Zealand, and E. Rajotte, M. O’Rourke, A. Fayed and G. Norton travelled to Dhaka, Bangladesh.

February 2: The group met with Yousuf Mian, Site Coordinator to discuss the plan trip and any issues related to the Bangladesh site. Tuta is in the country but not a major problem. Why not? Resurgence of soft-bodied insects like white flies and aphids. Six new leaders at BARI in January after many retirements. Problem for possible next phase: We don’t have MOU with government and IRRI’s support to us is unclear and they are unresponsive.

February 3: The group visited BARI in Gazipur for a planning meeting at the Horticultural Research Center. Yousuf Mian, Bangladesh Coordinator IPM IL, gave a 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, the BARI Research Director, the Director of HRC, and the Director of Training and Communications, BARI. Presentations were made by the BARI project scientists that reviewed progress for the past year. The meeting was attended by 16 BARI scientists, including five women (3 of whom are research leaders). MCC was also represented.

Dr Shahadath Hossain presented the results of the Bt eggplant IPM trial in Jessore and Bogra. They did farmers’ training. Four varieties released by BARI, with BARI Begun 4 and 6 used in trials. Field day held in April for local farmers. He presented results for biocontrol for mango hopper (3 sprays with Beauveria is best) and for fruit bagging for fruit fly control, the first fruit bagging demonstration in the hill area of Bangladesh. Farmer training for 150 farmers in 3 districts plus 3 field days for 300 farmers (also on TV plus newspaper articles. One publication on bagging. 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.

After lunch, a representative from the NGO: MCC described how it transfers 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 gives MCC inoculum for Trichoderma every 2 months. They have 400 farmers that produce about 220-300 tons of tricho-compost per year. They currently work with 550 farm families. They produce pesticide free vegetables. They use pheromone traps, neem, bait traps, botanicals, trap crops, nethouses, and tricho-compost and sell vegetables in a supermarket after processing and packaging. Three “super shops”. Also contract with some consumers. They use an “organic village” brand but are not certified as organic. Only 100 farmers are organic (150-160 kilos per day). Sales of pesticide shops are declining based on their survey. Poultry refuse and tricho-compost are replacing grafting in many areas except where bacterial wilt is severe. Hard to get pheromones they need.

Future planning with BARI scientists – Discussed topics for possible future phase, including scaling up ideas.

Field visit in Joydebpur – Visited Bt eggplant farms near Joydebpur where BARI has demonstrations of IPM with Br eggplant.

February 4: Norton, Fayad, and Mian met at USAID with Aniruddha Roy, EGO Deputy Director. Program progress was summarized by Norton. Discussed Tuta, Fall Army Worm, and current status of IPM IL program.

February 5: E. Rajotte, M. O’Rourke, A. Fayed, and G. Norton travelled to Kathmandu, Nepal. Met with Luke Colavito and Lalit Sah at iDE before flying to Nepalgunj in Banke district. CABI plant doctor program has trained some of the CBFs (20) to raise their skills. Climate change project with DIFID being used to scale commercial pocket approach. Plant Protection Society has task for to advise the government. Government is restructured and now have “Plant Quarantine and Pesticide Management Center” as official body endorse pest management protocols.

February 6: Field visits in Banke and Surkhet – In Banke, visited with eight farmers who have IPM trials and demonstrations, a learning center established by IPM IL and plant doctor (who is a female CBF). The CBF also helps with pest diagnosis and in plant clinic. The coop has 100 farmers. Pesticide levels are down. People come from all over the district to the learning center (15 groups in last month with 50 people each, about 1000 in past year). Most important pest now id Tuta although water traps, and lures, neem and Bt help. Farmers worried that our program might end. In Surkhet (Chinchu), visited a farmer group with 20 female and 2 male farmers. Using lures and traps, neem, nets. Government program helping them with partial subsidy for net houses. Net house costs \$1000 (12m x 6m). Growing tomato, cucumbers, cauliflower. With IPM, less than 5% loss to Tura this year (before 40%). One farmers sold 4000 cauliflowers seedlings this year. Planting Roma type tomato that is resistant to Ralstonia.

Visited Agroviet who has 2 plant doctor CBFs (young) among 7 CBFs. Four partners in his business, which sells IPM technologies (30% of business) in addition to seeds, fertilizers, vet meds. Gets IPM products from Agricare. Also supplies materials for plastic houses. \$1 million in sales last year. 5% of business is chemical pesticides. Plastic trays and pheromone traps are popular. Now wholesaling to 20 other

agrovets in the region. Had grant from KISAN to pay for CBFs but feels they will continue afterwards on just their commissions. The KISAN money pays them to conduct training. 1 CBF for 300 households.

February 7: Surkhet – Visited mayor of a municipality and local ag. officer. 70% of 50,000 people in his municipality live on farms. One ag tech and 10 CBFs for whole area. 4 collection centers. Visited agrovets and plant doctor. Agrovets sold 235 kilos of Trichoderma last year. Sales of IPM products are growing, while pesticide sales are declining. He has 7 CBFs. Has seen a 30% sales increase since using CBFs. Uses manual from PPD to identify diseases. Flew back to Kathmandu.

February 8: Kathmandu -- Met with Carol Jenkins, SEED Director, Navin and others at USAID. Carol stressed scaling up, links to KISAN, digital technologies. Luke discussed importance of private sector helping to train CBFs. Could link to Seed producer and other groups. Gap because of Federalism.

Planning meeting at iDE with about 20 public and private partners. Luke gave a presentation on commercial pocket approach and IPM. Community collection for vegetable products with CBFs being “last mile supply chain” for inputs. iDE developed about 200 commercial pockets with scaling to date to 153,000 households. 300 cbfs (7180 hhs through IPM) and \$200/yr increase in income for hhs using IPM. IPM supply chain developed in Pokhara, Bhairawa, Nepalganj, and Dhangadhi. Activities: Short term training, demonstration sites, CBFs trained as plant doctors (CABI global program). 20 plant doctors trained. USAID Data driven agriculture prize: collection centers use sms to share info about pests/diseases. FAW workshop Nov 30: Plant Protection Society fall armyworm taskforce. PCI (manufactured in India) FAW lures cutting price substantially. Reached 30,000 with IPM for Tuta. Way forward: labeling, plant doctors, sms pest info through commercial pocket approach, private sector loans for IPM products.

Lalit’s summarized the IPM IL program: Tomato, coles, bitter gourd, French bean, onion, and chilly; Verticillium lecanii (insecticide), neem, and bacillus subtilis discussed. Additional discussion: PPQMP: they have collected adult moths of FAW in lures and larvae are being identified from Jappa Focus on eastern Nepal for invasion potential, large invasion potential after this recent storm Strategies: work with training CBFs, IPM for food safety, verify IPM technologies and use “truthful labeling” to get consumer premiums Strategy meeting: Training new plant doctors (tablet method not working well); Marketing and business skills needed; communication and explanations of CBFs could be improved. Megan O’Rourke left for the US.

February 9: Norton and Rajotte left to return to the U.S.

February 11: A. Fayed visited NARC plant pathology Department with a focus on virus issued. He later flew back to the U.S.

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

- Potential for USAID buyin in Nepal for scaling up CBF and IPM diffusion approach.
- Needs to coordinate in Cambodia with Harvest II on workshop on biopesticides to stimulate IPM product supply businesses.

List of Contacts Made:

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