

IPM Innovation Lab TAC Meeting Minutes

Day 1: May 28, 2018

9:00 am: The meeting begins. Muni welcomes everyone to the meeting in Cambodia and those tuning in from Blacksburg. This is the fifth TAC meeting, the last one being in Addis Ababa. Each of the TAC members are present except for Srinivasan Ramasamy, whose stand-in from The World Vegetable Center is Pepijn Schreinemachers. AOR John Bowman, the Principal Investigators from each project (Wondi Mersie, John Cardina, Tadele Tefera, George Norton, Nguyen Van Hoa, Pramod Kumar Jha, and Abhijin Adiga, who is tuning in remotely), the Management Entity, Cambodia Mission representative Dr. Theng, and several collaborators on projects in Cambodia are present.

Introductions by everyone at the meeting begin.

Muniappan introduces highlights and happenings of the past year.

The ME adjusted the program significantly with the lack of available funds from USAID, relationships/projects with City University of New York and CABI were terminated, and a new project with Pramod Jha in Nepal has begun in CUNY's place. Since the last meeting, three webinars were conducted (Neem, *Trichoderma*, *Tuta*) and three PERSUAPS were approved. The ME received a buy-in for \$50,000 from the Egypt mission to create a risk assessment for fall armyworm and also received \$50,000 from the Vice President of International Affairs at VT to carry out an impact assessment on *Trichoderma* and coconut pith in Bangladesh, India, and Nepal. There have been numerous press releases, articles, and success stories to have come out of the office and the *Integrated pest management of tropical crops* by Springer now has over 4,000 downloads in the last one and a half years, make it one of Springer's most popular e-books. Several manuscripts from the projects are being prepared to be submitted to journals and a booklet has been published on the last three years, 2014-2017, with major success. National, regional, and international workshops have been held, including the symposia at the Entomological Society of America in Denver, the 12th Arab Congress of Plant Protection in Egypt, the American Phytopathological Society Annual Meeting in Texas, and the International IPM Symposium in Baltimore.

In the future, the ME is looking forward to meetings in Boston for the International Congress of Plant Pathology, Switzerland for the XVth International Symposium on Biological Control of Weeds, and India for the First International Conference on Biological Control.

Muniappan announces plans for the upcoming year: develop and disseminate IPM packages for vegetables, fruit, rice, maize, and chickpea, address invasive species, study impact of abiotic factors on biodiversity in Nepal, conduct symposia in national and international venues, conduct webinars, specialized training, continue to submit PERSUAPS, and more.

Questions:

Lawrence Datnoff asks how the Egypt money is connected to the other projects. Muniappan answers that the project was specific to Egypt with a buy-in from the mission and it is specifically targeted to Egypt, so it wouldn't collaborate with other projects. John Bowman also answers that at the time of the buy-in there was no fall armyworm present in Egypt and it was important to get ahead of it so that assessment was an opportunity to build a justification from the mission for potential funding against the new threat and also to coax the government to put in more money for the potential issue. The assessment will be valuable to the mission in terms of putting more money against the problem and convince the government to invest in it. The mission came to the IPM IL first because of prior relationships Muniappan had built. What it did was show the potential for economic damage and potential damage in general to the country.

Datnoff responds this is an example of how information can move horizontally and vertically and how you can use resources to garner support. Muniappan responds that the ME cannot go to the mission and ask for funding, but the AOR can help in that area. The ME has been concentrating on how to get involved in FAW in Africa and are looking to participate with IPM technologies.

Dely Gapasin asks about the termination of the two sub-awards and how significant the money is and how it can be moved. Muniappan responds that the funding will be moved to Pramod's project. Muniappan says that if there are no more questions, then the meeting can proceed with presentations from the Principal Investigators.

9:30 am Presentation: Abhijin Adiga, Invasive Species Modeling for South American Tomato Leafminer and Groundnut Leafminer (remote presentation)

Abhijin begins with the objectives of his project. The goal is to capture the effect of trade and travel on pest dynamics, especially *Tuta absoluta* and the groundnut leafminer, to develop biological models of the pests causing damage and study possible spread of countries yet to be affected. He introduces the team working on the project including institutions at VT, INRA, Centre de cooperation international en recherche, NSF-NC State, and the Indian Council of Ag Research. He gives the summary of the project, especially the methodology and studies of CIRAD Senegal and NCSU. He introduces the development of the multi-network agent-based model and the need to integrate it with a physiologically based demographic model with human mediated dispersal. The pathways he's studying are region specific, so it's very difficult to model the entrance of species. As far as the economic impact model, this aspect of the project is more or less complete. Estimates depend on accurate knowledge of spread, damage, and intervention costs. A preliminary version of the model was applied to study pathways of entry and spread patterns in Nepal and the analysis shows a non-radial spread pattern, which is correlated with domestic trade of tomato and seasonal production. Part of the work was accepted in the publication *IEEE*.

In Southeast Asia, the study considers 10 countries in the region and several scenarios of introduction and spread have been studied. The analysis shows a non-radial spread pattern correlated with domestic trade and seasonal production of tomatoes. The key challenge is unavailability of quality data, despite contacting local experts. Now that datasets have been identified, an MoU has been signed with USDA/APHIS to access the pest ID database. INRA is studying the temperature and photoperiod effects on fecundity, nutrition effects on developmental time, potential of non-cultivated and thermal thresholds of juvenile development. In Africa, a preliminary analysis showed genetic diversity was low in Senegal. The groundnut leafminer has been collected from groundnut and soybean fields. Key challenges include not being able to find specimens in Malawi and South Africa. The North Carolina group is waiting for reference samples from Australia and India.

Questions:

John Bowman says there was a higher level of clarity in this presentation than the last time. He asks about what the MoU means. Abhjin responds that we will not be able to publish the results of the project without the MoU. To use that dataset you have to send the paper to USDA and we have to work with USDA.

Glen asks about the collaborators involved in the project. Abhijin responds that they are all in the process of incorporating the project into other models. Glen asks if Abhijin can explain the molecular analysis for the groundnut leafminer. Abhijin responds that NCSU is doing the analysis.

Dely says congratulations on the report. She asks if the 7 students undergoing degree programs are all funded through IPM IL or if they are being jointly funded. Abhijin responds they are jointly funded.

Lawrence says that one thing he keeps seeing about key challenges is the unavailable qualitative data. He asks how Abhijin is resolving that challenge. Abhijin responds that if you look at the models that are similar, they usually are studying regions that have had the pest for a long time, which means they can do evaluation easily. But with this study, the problem is emerging which means there are few points of location. Long time experts are used in estimating the *Tuta* spread in small regions as well as host presence. Because the information cannot be validated in a usual way, the team has to make original conclusions.

10:00 am Presentation: Pramod, Jha, Modeling for Climate Change and Biodiversity

Pramod introduces an outline of his project, its objectives, focus, and team. Major activities include 5 students doing PhDs and 12 students supported for their Master's. So far, many papers have been published and submitted. He shows the project study area and altitude map, slope map of CHAL districts, and that the Nepal temperature trend is increasing. He explains that average temperature dynamics in CHAL area according to elevation. Pramod goes through photos and descriptions of each of the students working on the project, and their goals and objectives. He reports that 6 students have completed dissertations, 4 papers have been published and 4 have been submitted. Over 2 dozen research papers will be produced, at least, by the end of the project. He discusses that the past project in Nepal that was terminated is now rewritten. There will be application of satellite imageries to test the invasive species in the CHAL region. It will map major invasive species from 1990 to 2017 and draw trends of climate change and species. A few major and dominant invasive species will be mapped. He offers the proposed activities and an estimated calendar.

Questions:

Wondi asks if Pramod thinks there is any correlation of the warming and *Parthenium*. Pramod responds that there is not only a correlation with heat but also the moisture as well.

Dely asks for clarification. She cannot see how Pramod's objectives relate to the PhD and Master's students projects. She asks if the data collection is done by students. Muni responds that when the ME terminated the City University NY students, the ME continued with the students in Nepal. So, they will complete the papers for their projects and the new students will follow the new objectives. Dely asks if the TAC can have a copy of the proposal. Muni responds yes.

10:30 am: Coffee break and photo

11:15 am Presentation: John Bowman, AOR, Welcoming Remarks

John welcomes everyone to Cambodia. He says he has been thinking about the high priorities for the Lab so far and what should be on everyone's minds as the team approaches the final year of the phase and begins to look toward the next five years.

John explains that on top of the incremental delay, USAID has had difficulty getting money to Cambodia and Ethiopia, which is often out of their control because of Congress. On top of that, the BIFAD is undergoing a complete restructuring. It's created a difficult atmosphere, so he's not sure who he's going to supervise, or if he will have to give up control. All of the AORs are under a timeframe of uncertainty and it may be uncertain for 6 months or so. On top of that, agriculture research has been under extreme scrutiny. Agriculture research and development has helped keep the Bureau for food security alive. Within the bureau, we have had to contend with forces within the space itself. He says there will be four new centers of excellence.

John says that he's not sure where the IPM Innovation Lab is going to end up, but it will most likely be in the agricultural productivity center. What he thinks IPM IL should think about is relationships between IPM and systems agronomy. Over the next year and five years, IPM IL needs to think about leaving behind packages and think more about agriculture systems using better use of land.

There's a nutrition center of excellence and the connections there are minimal and more indirect. The big thing driving the nutrition center is delivery of diverse diets and IPM work is spread out over vegetables and fruit but in general he doesn't think IPM has a major link to nutrition. The most important thing will be diet diversity and micro nutrient delivery. He advises to think about what IPM can do for indigenous crops in Asia and Africa. He says IPM doesn't have too much of a relationship to water but IPM IL should be thinking more about high tech solutions to IPM delivery instead of conventional delivery of IPM. This will tie in with this idea of youth engagement and food security that USAID is pushing. Youth are going to be more attracted to high-tech thinking.

Finally, there is going to be a renaming, Bureau for Resilience and Food Security. So, there is a resilience team now but that team will be operating at a higher level of importance and priority and it needs to have more consideration for IPM. IPM should advertise and promote how biological control will give much more resiliency to a system of food production over time than other systems. We should think about how biocontrol delivers resiliency to enable a smallholder to adjust better to shocks in terms of weeds, natural disaster, etc. Of all the centers, John thinks the focus should be the agriculture department with a strong bid with what can be offered with resiliency.

The ability to service the missions has not had a lot of consideration in the past. Now, it seems to be back in favor. The basic reason there is restructuring is that the bureau will be broken up into the different centers to give better service to missions. Some of the breakup though, is because the bureau was seen too much as a monolithic center of funding, and people want the assets broken up. Collaboration with other labs and government agencies will be very important, as well as collaboration with the US private sector. It is really a stretch to show what IPM IL has done for the US private sector but the new administration wants to see that as well as impact analysis. IPM IL should have their own custom indicators and do a significant level of impact analysis. IPM is in good standing with impact analysis because of George's work.

John says he has been more involved with Youth engagement and IPM should think about how to make the work attractive to rural and urban youth. IPM should do a better job at tracking early adoption by missions, NGOs, and how to take credit for the diffusion of technologies. The packages have to be so good that they spread out naturally. Early adoption needs a greater focus. Research can't just be done, but everyone should be involved in early uptake. Labs getting a typical five-year extension is not so easy now. Any kind of extension is now looked upon with a very high level of scrutiny. In terms of what not to worry about, is the new 12 priority countries. The bureau has not been told to shut down projects that exist in non-priority places.

Questions:

Van Crowder asks about resilience. As USAID puts more emphasis on resilience, it might be good to know what practices are related. In terms of building human and social capacity and capital, it would be nice to know what USAID is thinking in those terms. With Youth, what specifically can be done to mitigate some of the issues around that? There are some interesting things going on in YIA that could help with IPM. John Bowman says that he doesn't know what can be done in the remaining year and a half. In terms of resilience, the current thinking seems to be is that Labs should be focused on strengthening institutions, as the fellowship programs are falling by the wayside. Foreign governments are eager to give people opportunities in the states.

Dr. Theng, from the Cambodia mission, welcomes everyone to Cambodia. He discusses how the IPM IL has worked in Cambodia for ten years and IPM is integral to increasing capacity for smallholder farmers, especially for rice and veggie production. He says Cambodia requires more training to turn ideas into reality. Student training will be a good opportunity for students to meet with others from all over. He thanks

everyone for coming and says he is proud of what has been accomplished with IPM research and scaling up best practices.

Pepjin asks if the relationship between CE SAIN and IPM could be explained. Kim Hian explains that there are students at the university doing IPM research and CE SAIN has five technology parks, one at RUA, one in Siem Reap. Amer Fayad says that it is apparent that there are some issues with availability of resources to demonstrate technologies. There seems to be some misunderstanding about expectations of technology parks and Kim hasn't discussed the challenges she came up against with resources. To demonstrate a technology, they will create a scientific committee for technologies to be demonstrated. How realistic is that model? Kim says she was asked to fund field labor and import of technology, which costs a lot of money and it cannot be covered in the budget.

Buyung says that IRRI collaborates with CE SAIN. IRRI supplies rice seeds. Labor and management belong to CE SAIN. Dr. Theng says that regarding payment, all projects have to budget for research. CE SAIN cannot cover all research costs so we touch on technologies already taking place so we can scale up. For trials, CE SAIN cannot afford to pay.

11:45 am Presentation: Van Crowder, Introduction

Van introduces CIRED, explaining the goals of improving livelihoods and standards of living in developing countries, to build capacity for faculty and students to engage globally, identify leverage for VT's excellence and expertise, and create policies for international engagement. The Center has a 70 million current portfolio, has managed 37 subawards, and manages the IPM Innovation Lab, ERA Senegal, InnovATE, Armenia, YIA, and Catalyzing Afghan Agricultural Innovation.

12:00 pm: Lunch

1:30 pm Presentation: Tadele Tefera, Rice, Maize, Chickpea IPM for East Africa

Tadele introduces his project, which partners with icipe. Objectives: Developing IPM Options for three crops. For rice Stem Borers, the project tests the effect of biopesticides and botanicals, controls rice blast with *Trichoderma* and *Bacillus subtilis*, blast incidence and severity reduced by *Trichoderma* and *Bacillus*, and disease tolerant varieties. For chickpea, screening of local virulent strains against *Helicoverpa armigera*, pathogenicity of *Beauveria bassiana* and *Metarhizium anisopliae* isolates against *H. armigera* larvae, wilts, *Trichoderma* against wilt, raised bed against wilts, seed dressing against wilts, resistant varieties against wilts, and spraying neem. For maize, integrated termite management trails at Bako using cropping systems, mulching and manuring at 2 sites, evaluating effect of intercropping, plants damaged by termite in different treatments, demonstration of push-pull technology against stem borers in Hawassa. As a success, in Tanzania, now 30 farmers practice push-pull. Since 2017, 27 meetings, 37 trainings, 11 field days have taken place. For fall armyworm, IPM components have been tested. Botanicals have also been screened and have come up with effective technologies. Parasitoids against FAW are being reared.

Questions:

George Norton asks how the parasitoids for the FAW will be released. Tadele answers augmentative release.

Pepjin asks how Tadele keeps track of who is adopting technologies and who it is reaching. Tadele answers that every year the project does monitoring and evaluation to see how much farmers are adopting every year and follow-ups are done with the farmers. Pepjin asks if they adopt. Tadele answers that there is farmer-farmer transfer technology. There are direct farmers, and then farmers copying from them. Pepjin asks what systems are in place to show how much farmers have adopted. Tadele answers that when farmers are trained, they are counted.

Dely responds that she is very impressed with the push-pull technology in Ethiopia. She has two points, one being pest diagnostic assessment. It helps institutions develop capacity. It will show you the weaknesses. Second, unless products are available to the general farmer public, then it will have limited scaling up and cannot be commercialized. Tadele responds that there is only one private sector between the three countries. It is very important to engage the private sector. In some of the countries, the private sectors cannot move easily because of regulations from country to country.

John Bowman asks that if you have a host farmer, to find out the spillover effects to neighboring farmers, how is that information attained? Do you ask farmers who have come and studied at the host farmer field? When is the follow-up? Is a simple way of fixing the problem a GPS system? Do you have a systematic approach to evaluating adoption? Tadele answers that each country has an extension system and extension agents monitor the day-to-day activities. They have the list of the farmers who have adopted push-pull. Pepjin asks how exactly the information is provided. Tadele answers that it is done on paper.

2:00 pm: John Cardina, Vegetable Crops IPM in East Africa

John introduces the overall goals of the project: building capacity of host country institutions. So far, IPM packages have been developed as well as baseline survey completed. In Ethiopia, there is interesting work with thrips and experimenting with pheromone traps. Netting impact on virus symptoms. The first drafts have been done for French beans and brassicas and still to come are for peppers, chilies.

John says that he has been working with NGOs to reach farmer audiences, develop materials in multiple languages, plant health network using WhatsApp technology for diagnosis. Five meetings with value chain partners have occurred to discuss work plans and areas for MARI's participation. Joint activities have yet to happen, however. As for IPM Communication, at least three publications in Swahili have been created. With the East Africa Vegetable IPM Plant Health Network using WhatsApp, over 1200 messages have been shared so far, with a significant participation by women. He is seeking more participants and is now working on a Real IPM and OSU searchable database of Plant Health. They are also working to put together a website people can contribute to. Train the trainer workshops and farmer training workshops have occurred, but political issues in Ethiopia interrupted several activities. One of the main activities is to put seedlings out in the field that are as pest free as possible. In efforts to "breathe new life" into the project, John has created a revised workplan, follow up visits, and redirection of funds. As far as improvements, the goal is to improve communications and motivate the next generation, possibly with the concept of organic.

Questions:

Lawrence says that he is delighted to see the progress. He asks why IITA is not engaged in Kenya. John Cardina says that IITA were highly recommended because of their nematology expertise. However, in their first reports, they weren't doing anything on vegetables. Van says that he is happy to see some work on policy. With the younger generation, is the work you're doing getting back to curricula? John Cardina says that he doesn't take any credit for the policy piece. As far as getting into the classroom, many of the collaborators are not as connected to the university.

Dely says that in Ethiopia last year, there was work on pesticides. How does it compare to now? The other question is with the policy issue because it pushes back with the acceptance of biocontrol agents. John Cardina says that screening of pesticides is not a big focus. Two graduate students are working on pest exclusion and getting away from an emphasis on pesticides.

3:00 pm Presentation: Wondi Mersie, Biological Control of the Invasive Weed *Parthenium* in East Africa

Wondi introduces partners and collaborators and describes the impact of *Parthenium*: it remains a major pest in Ethiopia and Africa in general, taints milk, displaces pasture species, invades land used for veggie production, which is a major threat to food security. It takes over the land around the houses. The objective is to abate its spread using natural enemies. The goal is to scale up and evaluate the establishment and impact of biocontrol, which means obtaining permits.

There are three rearing sites for biocontrol agents. The rearing is going well, with locally trained people who do this. It is 24/7 labor intensive work and most of them are women. A new release site was established in the southern part of the country which is highly infested because of its long rainy season. A relationship with EIAR has begun. We want to evaluate new *Parthenium* biocontrol agents for their safety to non-target plant species and obtain permits and release *Z. bicolorata* and *L. setosipennis* in Kenya and Uganda.

In terms of collaboration, we have met with several people including the H.E. Dr. Eyassu Abrha, State Minister Ethiopian Minist. of Agriculture. Collaborations continue with Dr. Christie and Daniel Sumner who have done work on the intersection of Gender and IPM. They presented their findings at the Annual Meeting of the American Association of Geographers. From their findings, we find that not only do women pay laborers but they have to prepare food and take it to the laborers which is time consuming for the laborers and then they often stay there and do the weeding.

Questions:

John asks what the sustainability aspect of the release agents is. Wondi responds that in a few years time, we are hoping that the release agents won't be needed to be reared anymore but we still need to bring new biocontrol agents because two biocontrol agents may not be sufficient. John asks if a 10-year period is enough time for it to be self-sustained. Wondi says that it took ten years in Australia but only three in India. Pramod asks if the species may have success in Asia. Pepjin asks how areas are prioritized. Wondi says that there is a climatic model that shows places at greatest risk because of the longer rainy season and we will look at the soil as well.

Lawrence said that last year we saw the rearing, and you mentioned there's predator issues with release, so how much do you have to rear in order to have an impact? Then a follow-up, are the results in South Africa related to the predators feeding on the agents? Wondi says that through the last phase, we gained a lot of experience. We release now in thousands in order to be successful. For *Listronatus*, we don't have the problem. The selection of the site is also very important.

Dely said that last time we were in Ethiopia, we talked about the policy of the government of Uganda and not allowing the release agents. Is it true there is now a policy signed by the minister? Wondi said they are allowed to bring into the country but we will see how the permit for the release goes. They are doing the host testing under quarantine. Amer said that just as a reminder, IPM IL didn't spend money for Uganda. The bioagents were not brought in by IPM IL. John Cardina asks were you just looking at one household? Wondi responded targeted households. There are many households. The one we just showed, the release agents have moved to the neighboring field.

3:00pm Presentation: George Norton, Vegetable Crops and Mango IPM in Asia

George introduces the project, including countries involved, partnerships, priority crops. So far, trials at RUA focus on student activities, long bean IPM package trial. In Bangladesh, mango fruit fly and mango hopper management. Now completed two seasons. IPM package trial for bitter melon, screening for resistant rootstock, monitoring of *Tuta*, testing IPM for white mold, tested performance of IPM and non-IPM for eggplant. In Nepal, tested lures for fruit fly control on cucumber and bitter melon, tested IPM packages on

chili, onion, French beans and eggplant. Evaluating various carbon sources for anaerobic disinfestation of seedbed, monitoring *Tuta*, study of temporal and spatial distribution of major insects.

In Nepal, IPM Diffusion: “last mile supply chain” approach working with rural collection centers, 3,300 farmers directly trained. In Cambodia, there was an IPM farmer field day in Siem Reap. In Bangladesh, involvement with NGOs, 750 farmers trained. Baseline surveys completed, focus group discussions completed in Nepal, Kaitlyn Spangler’s work presented successfully, supporting implementing new bio pesticide policy in Cambodia. Challenges have been budget delays and he wishes the student currently in Nepal could have started earlier. Future plans: continue IPM package trials, diffusion of IPM packages is accelerating, working with government, NGO, private sector.

Questions:

Pepjin asks if the training of IPM is knowledge intensive—in your impact assessment are you able to assess other aspects? George responded that we did baseline surveys in sizable districts. We randomized farmers. We tried as best we can to see what’s going on in the district instead of just in our farms. If we do a baseline, do we need to go back and do an end line? In Bangladesh, we did a three-year panel and learned the difficulty of randomized control. Pepjin asked how often do you need to train to get adoption? George said our strategy has been complex over time. We have looked at components in the package and you work with the private sector to scale those up. In Bangladesh, we looked to see how do you scale up activities. A lot of training is not as effective as field days with follow-ups. It’s best to do field days and then some training. The augmentative one is different because you have to multiply every year and you have to look at small businesses to see the cost effectiveness of that.

Muni said that you cannot compare IPM in developing and developed countries. Amer said recently he was told that when we think about scaling, we should think about the millions, which is startling. What is the practicality of reaching millions? John said that the research projects aren’t expected to affect millions, but that the projects are taken up by value chain projects and then taken up by NGOs and the private sector. If you’re thinking millions, you’re thinking about value chain.

3:30 pm Presentation, Buyung Hadi, Ecologically-based Participatory Packages for Rice in Cambodia

Buyung introduces the project. There have been 2-3 season field experiments completed, 30 farmers involved in testing, 900 farmers visited, 800 students visited EPIC exhibit. With Weeds, there has been land leveling, row seeding using drum seeder, low seed rate, use of certified seeds, paddy seed sample contamination. It was found that 100% samples that reused seeds were found contaminated by weeds and 34 weed species were found as contaminants in farmer’s saved seeds. EPIC recommends seed cleaning prior to seedling, especially sieving that could separate majority of weed seeds from paddy seed. The effect of *Trichoderma* and host plant resistance on blast incidence has been significant and there is research on *Trichoderma* vs. fungicide in blast management application on leaf blast incidence. For community based rodent management no electric fencing/rodenticide and 115% increase in net income has occurred. Of 984 farmers reached, 377 were women farmers. Of 7 students, 3 women. Proposed research is to find the most significant barriers for women to attend trainings. For reaching youth, Cambodian STEM fair, 848 students stopped by IRRI booth and engaged in EPIC exhibits. For leveraged funding, Rica Joy Flor, half of salary from Post Doc Talent program. He says he wants to try to avoid redundancy in the work. Moving forward, he thinks crowdsourcing outbreak info in collaboration with VIAMO, and capacity building on implementation of registration policy on biocontrol products would be a good idea.

Questions:

Muni says that we are still behind in getting PERSUAP approved and USAID won't allow us to pay for pesticides until approved. We won't be able to reimburse for pesticides for that reason. Buyung responds that thus far we have been able to use other funds to pay for those pesticides. Pepjin said that you showed impact assessment complete, what are the details? Buyung responds that the baseline survey is complete but we are working with George for the fourth year. For people who attend our training, we do a quick snowball survey. In our baseline survey, we evaluated all of our technologies.

John asks are you surprised by the *Trichoderma* results? Buyung said that if you compare *Trichoderma* with resistant variety, resistant variety wins. If the only variety is a susceptible variety, *Trichoderma* works on leaf blast. We have data on brown spot that *Trichoderma* doesn't do as much for those diseases. Lawrence asks do you have severity data with incidence data? Buyung responds that we have problem estimating the severity. If you're only eyeballing it, people have different perspectives of the severity.

4:30 pm Presentation: Nguyen Van Hoa, IPM for Exportable Fruit Crops in Vietnam

Hoa introduces the project, including SOFRI as the lead institution. There has been research and development of new, biorational IPM technologies, especially the effect of different treatments and beneficial treatments, local registration and market requirements. Natural enemies on demonstration models, applications of beneficial organisms and botanical pesticide on control pests. For mango: 2 IPM demonstrations have been finished and fruit bagging/sleeving has had major success. Lychee pests are being controlled, provided facilities for these models applying IPM and VietGAP standard, bagging is good for control of fruit flies, technology transfer and extension. There have been trainings, workshops, and a tv talk show. Two presentations and 6 articles have been produced.

Questions:

Muni said that since Vietnam didn't ask for irradiation, did you take steps to request USAID office not using irradiation? Hoa responded that when we apply to policy people, it takes a long time, which is why we made the request ourselves. For example, dragon fruit is very important which is why we made the request.

Van says that before you select a host farmer, you can get a sense of the communication networks of households and communities. I'm curious if those approaches have been used, as a predictive modeling of who you collaborate with on farms, could be a way to accelerate or expand diffusion. George said that we don't select our farmers to maximize adoption. We are working in feed the future districts. The purpose of the projects are in areas where we want adoption. Within IPM there's a farmer field day approach, but given the complexity of the practice, farmers don't spread much to their neighbors. And if your goal is to maximize practice, it would be much shorter term and messaging.

Amer asks what parameters did you use to measure? I had a difficulty understanding what you were trying to explain. Hoa says that when we use IPM, it costs more because some of the biocontrol products are hard to find and we have to use them regularly so sometimes it increased costs. We have not yet analyzed the economic impact over a long period of time, however.

5:00 pm: Meeting ends

7:00 pm: Group Dinner

Day 2: May 29, 2018

8:30 am: General Discussion about Day 1

Muniappan goes over housekeeping materials. He tells the group that for ME to turn in annual reports October 30, we need to receive PI reports by Oct. 15, so now the deadline has changed. The other reports we

need from PIs are the workplans, which is also tied up with the travel matrix. If you need, we will send you a POPs manual that will give you the management of the program. Workplan is due July 21st and we will need a travel matrix with that. With the travel matrix you should list the number trips you want to take in the next year must be listed and we will send it to the agreement officer so he can approve it before Oct 1. Muniappan asks if there are any questions on travel matrix, workplan, annual report. He says that if people want to make travel requests, they need to be one month before the start of the travel date and a trip report is needed 30 days after the trip. He adds that USAID has come up with new indicators and not all of them are applicable to IPM IL. He asks John if there is anything he'd like to add.

John says that IPM IL will be grandfathered in for this cycle, but not exempt for the next. He recommends to keep things as they are but begin to learn about the new indicators. Buyung asks about publications and if he should send them to Sara. Amer responds yes, with 500 words and with pictures to help the focus. Dely asks if there is an overall publication explaining the progress of the projects. Muni responds that the PIs need to contact us about news for news releases. He asks if there are questions about the TAC meeting the previous day.

Amer asks Tadele about the collaborator from Minnesota. Tadele responds he has a subgrant with Minnesota and the initial plan was to contribute to capacity and with mobile applications. However, over the one and a half years, nothing has happened. Icipe is working to end that relationship. Muni asks for a copy of the agreement if there is a termination.

Pepjin asks John Cardina if he has thought about other Apps for his project other than WhatsApp, like a German company that identifies pests and diseases. He asks if this kind of App communication could be used on the other projects at all. John Cardina responds that there has been some talk about that with Tadele's project. Amer asks John Cardina how many inquiries there are made in the messages. John Cardina responds that metadata will help to see that, also if they are male, female, whether the issue was resolved, etc. Part of the building capacity is that someone will have a picture of damage and it's the going back and forth that's valuable. Amer asks about the role of Real IPM. John responds that the idea is to create a spreadsheet that is a searchable database so that if you want all the info on *Tuta*, you can search for it there. It will take a while before we have a large volume. Muni responds that similar databases exist so there needs to be something that sets it apart. Amer says that these databases are very important but the in person diagnostic workshops are the most helpful, which shouldn't be forgotten about. John says people building relationships is most important to him. Muni asks if people could report on transferring technologies so that a publication could be made.

Buyung says that in his project they are mapping information networks, because our thinking is that our methods are not the only ones. The problem with IPM is there's always a chance for other tech. We have been collecting some data on where our farmers are getting their other data and it should be done sometime next year. George says that for our baseline surveys, we have a page of where farmers get their sources of info. Tracing how a tech moved and how people heard about it is one step beyond that. Van says that he thinks it should be for predictive purposes so that it can be assessed how transfer can be accelerated. And predictive power to show pathways that could be tapped into for greater spread. George said that there was a student in the past who showed where people got info and his thesis about the importance of trust in networks. Van says that extension may not always be the most common source, but they are seen as the honest broker because they don't always have a stake. Muni says that George has done a good job for impact assessment for about 15 technologies. If we study how scaling up happened, that would be very useful and we could get some support from the AOR and come up with an assessment.

John says that his concern is relationships with missions. There seems to be a big demand for plant diagnostic services. One thing we can offer is good plant disease and pest diagnostics. Should we build something into

the next phase that can be that service? If you say you have a component of plant diagnosis, that might be one way to get a track record. George says that in the previous phase, there was a plant disease service from Sally Miller. She put on workshops and they were effective but it was only diseases. We could consider doing that again as a broader service and you should include more than diseases but insects as well.

Lawrence says that in the U.S there are plant disease networks. We always talk about capacity building: couldn't there be capacity building instead of an adhoc service? Muni brings up John's earlier point about working with the value chain project. He had spoken with Mike Roberts and is trying to see how to do joint work and highlight that area. In Nepal, Evan Myer was the AOR for the value chain and he was very helpful. We gave technical training to the technicians of the value chain projects and that worked very well. The problem is the farmers got the info, but couldn't get the *Trichoderma*. So we started to work with Agricare and they trained the agrovets to get the product to the farmers. Kim says that we want the buyers to have their own field staff. John says that the way he wants to do it is too expensive. You need more than the ambulatory service that tries to upgrade needs but you have to do more longer term institutional capacity building. The one-off workshops don't add lasting effects. Muni says that to an extent our hands are tied. There is a major problem with witches broom but we cannot get involved because we are not working on fruit trees in Cambodia. With papaya mealybug, same thing, which is also what CABI is doing. So more flexibility would allow us to do that. Same with FAW. Van asks John if he sees the diagnostic service as fee-based? John says you don't want to charge people, you're going to just do it for them. Dely supports John's idea and discusses her personal experience. Kim brings up the language barrier for many people and how diagnostics should be translated into native languages. Amer says that in this phase, we ask each project to direct some funds to diagnostics. There is high turnover and in Nepal we did do specialized trainings because these are people who are going to be there for several years. Having service labs is a different story and I'm not sure we have the resources to do that. John says each place is going to have a different need so it's customized and has to be more than a one-off workshop. My thinking is to train extension systems, but I don't know if there is enough money for that. But if you work with 10 value chains, that's somewhat of a success. Whatever it becomes, it has to be flexible. Tadele says that we have done some studies on this but the major issue was lack of facilities and lack of manpower. In the IPM IL projects, we have one objective and yes we can offer trainings, but looking into the future, it requires facility development and the information has to be sustainable.

Muni asks that everyone separate into either TAC or PCC for individual meetings.

9:30 am: PCC Meeting

George is leading the discussion and asks if anyone has issues to discuss. John Cardina asks about when we will know about an extension. Amer says John doesn't know and these decisions could be made at the last minute. We expect to know sometime by January. John Cardina asks when we get that info, will there be changes to countries? Amer says it could be no IPM, it could be a noncompetitive renewal, or it could be competitive. The countries are another layer. There could be new or subtracted places. George says that the one thing we do know is there will be an external review. Amer says a couple of months ago, we were told there would be no external review, but in Uganda I was told something different. It will most likely be about a \$50,000 review, but we're not sure who will be the reviewers. John asks if they decide a no cost extension, what would happen? Amer says that the current trend is not to do a no cost extension. After the first five years, if we have students to graduate, that would be the reason for a no cost extension. George says that last time we were given a no cost extension but it was very difficult to get that.

Buyung asks about gauging the parameters of what was discussed on Day 1. Van mentions that the CIRED program YIA could be helpful. Amer says the focus is on resiliency and youth. Enabling environments. Tadele asks for clarification about the new youth engagement requirement. Does it mean youth engagement, or gender? Kim says the definition of youth is 15 to 29 and many of the villages in agriculture are older, so

how can you attract younger people to work in the villages and not go to the city? How can you get those with degrees to return to their towns? Van says that the question is also where are they? And does it mean working in ag high schools? Vocational schools? The question is what is the context in which you're going to find youth? VA Tech has been successful at a 4H club; the question is how do you engage them and what are their needs for training? There are multiple dimensions to youth. George says that youth refers to up to 20s and 30s; one of the issues is scaling up and networking. We had good discussion this morning about diagnostics, but clearly, the new proposal will need to say more about that. What you should think about is finishing up students just in case there is a no cost extension. Each regional project needs to think about an end-line survey to wrap up their projects. If you do an end-line, it's like a baseline for the next phase, which could be helpful for the next phase. We all need to go back to our sites and think about if there is something policy-related to discuss. Publications are important and trying to get things out before the end of the phase is important. You might want to think about the final year and if there should be a final workshop, which is sometimes done in the final year.

George discusses the upcoming edition of *Crop Protection*. He says there might have been some misconception that in the special issue there would be no reviewers, which isn't the case. Buyung says that among the guest editors, we have a shared drive, and what we can do is to look at that again and see which papers are done, which are reviewed, etc. Amer reiterates that for students, we really need to look at peer reviewed journals. Hoa advocates for translated materials for the purposes of diffusion of information. He wants to establish a team to translate. George says that over the years, we have come up with fact sheets, and every site should think about that. George says that we're required to have our data in open access. Amer reiterates that this is a federal requirement. We will have to do it at some point, usually when the data is mature. George says that this has been a developing issue in the US. People are concerned about replication and some of it has been political. Amer says that when we have data sets, we should remove any personal identifiers for privacy. John Cardina asks if all data is subject to restriction. George says the hardest part about making data available, is putting a code in it so people can understand it, the metadata. Amer says we need to store the data either in the IPM server, or your own, and it will only be public by your digression. We cannot say we've been working for four years and we have no data.

Buyung says that we talked about youth, gender, policy, and in my mind there is supposed to be a difference between research and engagement. In development projects, there is usually private sector youth engagement. But with projects like ours, is that also the expectation or is it more research on these topics? There is such a thing as policy research, and is that sufficient or should it be policy application? George says I think some if it is impact on youth, but to do that is research. Amer says that for the next phase, we could reshape how we approach these concepts. Buyung ask if research is expected for youth or application. Van says that John made a comparison between old school and new school IPM. There was a subtext there to engage the youth that way. Amer said that at some point there was a focus on entrepreneurship—is it to create jobs, bring people to rural areas?

Tadele says that in Africa, it will be about job creation. Typical example at icipe was with bee keeping; we recruit youth and give them bee hives with skills and training. And then they contribute to the market. But in IPM, we could think of creating IPM products and how to attract them to young people.

John Cardina asks to come back to the final survey. Will that be a part of the upcoming workplan? George says it will vary by project. The surveys will be a smaller sample and we have talked about focusing on particular areas. For rice, we think it should be done in January so that the data can be complete. Each one is going to take a separate conversation because each region will be different. Tadele says that survey work can be very expensive. John Cardina says that what's frustrating is that we didn't get funds in time, so now we really only have one and a half years to really do anything. To do a follow up after only one and a half years, is a little absurd. Amer says that it's really important you share your concerns. We really need to present these

challenges to John because he's the one we will need to convince USAID of what we need. Zara tries to give the money as quickly as possible. She was advised to only give 50% by USAID. We have to use the money judiciously but be prepared for delay. That's why we didn't release the full amount. George says you want to make sure not to keep too much in the pipeline. Amer says usually if there is a pipeline, the money has to be returned. Wondi says the rainy season is coming up which is when most of the work takes place. It's peak time.

2:00 pm: Lawrence Datnoff Presents TAC Meeting Notes

Lawrence reminds the group that only one and a half years is left so focus is necessary.

For IPM for Vegetable Crops in Asia, he recommends verification of biocontrol and measuring the impact of managing of *Tuta* with biocontrol. For the Strengthening of Export of Fruit Crops in Vietnam, the TAC is happy with the progress, but he didn't feel that the IPM treatments were effectively explained in the presentation. For the next presentation, he recommends bringing along one of the IPM specialists next time, to add a cost-benefit analysis of IPM and to increase publications. For IPM Packages for Rice in Cambodia, the TAC recommends to proceed with progress with rat management, rice disease management, exposing youth to STEM, and using leverage for funding. There needs to be more clarity with avoiding redundancy. It was mentioned that some relationships were waning, but it's worth strengthening the partnerships or revisiting them. For the Biological Control of Invasive Weeds, the TAC wants to know what the expectations are for successful for the next 1.5 years, and if there is going to be a significant impact of weed destruction. For Rice, maize, and chickpea IPM in East Africa, it's a good thing to drop Minnesota. Some of the biocontrol work last year seemed so long term that it might not come to fruition. The students will continue on, of course. For Vegetable Crops IPM in East Africa, it is recommended to discuss with George's group some of the IPM packages that have been successful in Nepal for *Tuta*. IITA should be dropped. For John Cardina's project with WhatsApp, see if it's worth continuing on, and consider the other diagnostic tools mentioned. For Modeling for Climate Change, keep the focus on that and see what can be delivered with it.

2:30 pm: George Norton Presents PCC Meeting Results

George begins to review the PCC meeting results by saying that the transitions to another phase and data were discussed. There should be more emphasis on diffusion and working with partners on that. We discussed the end line surveys; in some cases we need to bigger surveys and we need to focus on areas where we feel we will have the most impact. We don't want to do our baseline if we can't analyze the data.

We discussed putting emphasis on policy and there is an issue of doing research on policy questions. There was an issue as well with publications; we need fact sheets, and translated fact sheets. We raised the issue of considering a final workshop at each site and we might want to do it for a large workshop for the project. Toward the next phase, we took a cue on what John said. We discussed what youth engagement is: there's engagement and then research and also how to reach youth. What's the goal? Job creation? Involvement? Context varies from country to country. There are many possibilities and there's info on USAID website on what they're thinking.

We discussed the issue of pipeline and how you have to be careful that the money might be late, but you also can't hold money back. We discussed open data issues; all government projects need to make data available but the question is what does that look like? Raw data? There are different databases out there, so where it is stored is the issue and ultimately what you need is a significant metadata code so that someone can actually use it. There's a question of when to make the data available as well.

Muni brings up the PERSUAPS. PERSUAPS have been getting approved, but one condition is that even though approved, the pesticide applicators must have enough training to apply. We have not been conducting

any training in that area, so I'm wondering if any PIs have been following up. John says he believed people were discouraged from that because it encourages pesticides. George says that pesticide safety in the past took a lot of money. But certainly people who apply pesticides in our trials need to have some kind of training. To be honest, we haven't been doing much training. I assumed BARI was doing that but we shouldn't assume, I suppose. Does the ME have a set of materials? Muni says that the USDA has manuals for self-training which we can distribute. Lawrence says that people have to be recertified every year with the safety training because you can't go into a greenhouse without that training. Every institute ought to have it. Muni brings up the difficulty of training in developing countries. John mentions Crop Life and FAO as solutions as well. George asks Kim what she does with iDE. Kim says she uses a training manual developed by another project of iDE and makes sure farmers use correct personal protective equipment. HARVEST I produced a leaflet and booklets to make sure they are done safely. George says that the first thing we need to do is find out what's going in each of our countries and we may find that the problem is being addressed. Kim mentions that the problem is with disposal of pesticides. We cannot burn it or bury it. We advise farmers to empty sachets and containers in a big bag and keep it away from children. Dely says that many of the people applying pesticides are women and there are gender issues related to the training. Hoa says that people in Vietnam are allowed to burn it, but we advise for farmers to store it.

John asks to return to policy. The research at IRRI several years ago was focused on training and farmer field schools but no one invested in good policy. The hope was that we could do something in policy to act as a deterrent to companies selling pesticides. We want better common sense and safety with laws that are enforceable. There's not time to do this project, but we should be thinking about it. The real challenge is making sure there's no selling of pesticides next to food products, but the government has to demand it. Perhaps the policies written already could be rewritten. Kim, do you have any ideas on policy to serve as a better deterrent? Kim says that Cambodia does have policy on management of pesticides and fertilizers, finalized in 2011. In the law, all the pesticides have to be in Khmer but in reality, they are still written in other languages. They should also not be repacked locally and they have been. Counterfeit products are also an issue. George asks everyone to look back in the history of the project, how there were no regulations of pesticides in 1993 in the Philippines. A surprising number of countries had no policy to maintain pesticides. The difficulty we come into is with biopesticides and how to handle them versus the chemical pesticides. This is a very complicated area and we need to identify the pressure points. Hoa says that in Vietnam, normally the policies depend on the demand of the customer. Everybody has to follow the list that is created each year. Muni asks that everyone put forward their ideas on youth. John says that it's not just informing youth about IPM, but getting them jobs. I recently went to Tanzania and the idea was that the kids would go home with skills in IPM. Before they even start businesses, they are linked with buyers who already has trust in them. There's the training at the center that links them to a buyer and that's the most important thing; IITA has similar programming.

3:00 pm: Coffee Break

3:30 pm: John Bowman, AOR Remarks

John introduces this session as a brainstorm. In terms of the three themes that currently exist, resilience should have some real emphasis. How can we work more with companies? With companies we already have connections with? Mission relationships still need to be worked on. The Holy Grail is if we can embed our research into the value chain projects. He says that there's a high likelihood for creating a center of excellence in West Africa, and the person setting that up would be keen for having IPM involved. He recommends to scale one or two of the top IPM technologies to facilitate early adoption, support all projects with impact analysis. George suggests that there needs to be some flexibility dealing with invasive species. So, if a new invasive species comes along, we should be able to prepare for that as well. Kim says that we work with RUA and the common problem is youth doesn't see that agriculture is a way to make money. Certain technologies

are not available because the demand is so low. I want to think about how we can start making *Trichoderma* at the RUA level, to make a business, use the facilities.

Muni says he supports what George said about invasive species. Augmentative biocontrol could be used on a larger scale that could be used for pests that are invasive and that are already existing. The production of these could lead to the development of businesses in these countries. Wondi says he hopes that includes weeds. Amer mentions a certificate to show that produce is “IPM.” John Cardina says that he doesn’t feel there should be any fear surrounding “organic.” George reiterates that IPM should always be sold to others, language-wise, as resistance. Van says that if you don’t understand the vulnerability that farmers face, then you don’t know what to address. What practices reduce vulnerability and how are they listed? Muni says we can give examples on how risk reduction happened with *Tuta*. When it showed up in Africa, we gave training ahead of time in countries so that people could produce pheromones ahead of time. Van says that this should be documented, especially with how toxic chemicals were reduced. Buyung says there are two kinds of resilience, reducing shock and then community resilience. We are gathering data on natural enemies and long term we want to know how cropping systems experience frequency of outbreak over a long period of time. There are direct ties between IPM and resilience but another way to tie it is cropping systems, especially in the face of climate change.

John says that there was a criticism in the first five years of Feed the Future that they worked with farmers too small and with low potential for success. If they worked with farmers who could easily access new tech then maybe we could achieve new results. Not necessarily larger farmers, but farmers with greater potential for success. The idea is to improve the efficiency of production in areas closer to cities, and so that this stuff can get out to the more rural areas. George says that working with iDE Nepal, they’re organizing in villages for veggies with groups of farmers coordinating their production to bring in IPM, irrigation, etc. to make subsistence farmers more commercial farmers. That approach is something we should think about in other countries as well. Muni says that there is room for the promotion of neem in small-scale use. Tadele says that in Africa, neem is widely available. But the challenge is that there is no private sector involved in processing and packing and sending to farmers. It’s not available in all places. Private sectors are engaged in pesticides rather than biopesticides. John says there still may be room for thinking about how to do some pilot work with smallholder communities. That would bring in the private sector and it could be a scaling activity. Glen asks the group if the companies should be American or non-American.

4:30 pm: Van Crowder, Closing Remarks

Van thanks everyone for their time and commends the project progress.

Day 3: May 30, 2018

The group visits RUA and Prey Veng.