Country Visited: Kenya


Travelers Names and Affiliations: Fayad (IPM IL ME, Virginia Tech).

Purpose of Trip: attend the IPM IL Vegetable Crops IPM in East Africa planning meeting.

Sites Visited: Nairobi, Embu

Description of Activities/Observations:

March 18: Fayad traveled from the U.S. to Kenya

March 19: Fayad reached Nairobi, Kenya.

March 20: Fayad, George Norton (VT), Luis Canas (OSU), Mark Erbaugh (OSU), and John Cardina (OSU) traveled from Nairobi to Embu reaching around noon. In the evening, the group met and discussed the meeting schedule. Fayad requested that country participants not only discuss this year’s workplan, but also start thinking about next year’s plan.

March 21: Jesca Mbaka gave a welcome and objectives if the meeting. Fayad welcomed participants on behalf of the IPM IL management entity, thanked the organizers, and stressed the importance of critically reviewing the progress of the project/ experiments so far. He also requested participants to think about the current workplan and what modifications are needed to address project activities in terms of IPM packages for crops rather than pests/ diseases or single pest management technologies/components. He mentioned that everyone pesticide that is used needs to be in an approved PERSUAP, reminded everyone that semi annual report of this project is due to the ME by April 14. Fayad reiterated that activities need to be aligned with the program’s overall objectives of IPM research, technology transfer, Gender equity, impact, and capacity building. He stressed the importance of timely actions regarding proposed activities, invoicing, and reporting including semiannual reports, workplans, success stories, and news/ media placements. He also encouraged participants to share information and strengthen dialogues.
between the three countries and stressed the importance of engaging the value chain projects and the local USAID missions.

Cardina gave general remarks as the project PI and he laid out the plan for this meeting and suggested few shifts in the schedule. Changes were unanimously approved. He directed participants to discuss the baseline survey data, workplans, and capacity building activities.

**Kenya Progress Review**

**Danny Coyne (nematologist IITA)**

Coyne mentioned that he and IITA were invited by Sally Miller to participate in this project (last minute extra money) presented on IITA’s work on IPM, healthy seedling production, and nematode impact on vegetable production. He emphasized that even though it has so far been a mismatch (vegetables is not IITA mandate) between the project and IITA, there is a need to find complementarity, links and synergies. Need to focus on biology, population dynamics, baseline studies, source of resistance screening, biological control, seedling systems. Need to work with AVRDC and national centers. He mentioned that Local produce: heavy pesticide on tomato (mancozeb). Consumers want pesticide contaminated tomato as they think better quality. Discussions centered on pest diagnosis, technology development and capacity building. Coyne emphasized the need to start with healthy seedling: resistance, grafting, microbial enhancement, sustainable production. On farm: farmer seedlings, farmer practice, healthy seedlings (increased quality, with other practices almost double production). Four fold reduction in pesticide use, plus increased production (IITA managed the plots). They are using *Bacillus subtilis*, *Trichoderma asperellum* (drench seedlings). They can collaborate with the project on grafting: bacterial wilt and root knot nematode. They already produced a Pest and disease identification guide and a Manual for basic techniques, practical guide that could be a great resource for students, technicians, researchers, and extension agents.

**Jesca Mbaka**

Mbaka gave an overview of KALRO and activities under the east Africa project. She mentioned that pesticides are not allowed in this project. Fayad corrected this misinformation and. Fayad said that while the IPM IL promotes biocontrol and botanicals, cultural practices and other non-pesticide technologies, environmentally safe synthetic pesticides could be used in an IPM program as long as they are registered in the respective countries and are approved in a PERSUAP.

Mbaka described how she worked with county offices and the lessons learned: politics is polarized, why one area and not the other. Inception workshop: she invited universities, extension service, agrovets, farmers, and other stakeholders. Focus crops include French beans, tomato, cabbage, kale. Major pests include Bacterial wilt, nematodes, and *Tuta absoluta* on tomato; black rot, soft rot, DBM on cabbage and kale, nematode, foliar disease (leafspots, rusts) on French beans. They are using the following:

- Tomato seedlings: solarization, polyethylene sheet for 8 weeks; establishes seedlings, hybrid variety that is expensive; nursery beds less than 20% germination Kilele seeds, Cal J with *Trichoderma*
- Manage tuta absoluta in nursery (insect proof net)
- Two strains of *Trichoderma*
- Neem, *Bacillus* spp
Discussions focused on how many farmers are included in the tomato package trials and whether commercial nurseries are available. Plant mead (Israeli company) Seedling Company is very active.

She briefly mentioned the diagnostic training for extension staff and farmers and seedling health workshop. She also talked about KALRO management of *Tuta absoluta* using entomopathogenic nematodes.

Long-term training: one potential student with Luis Canas and another to work on nematodes (Chuka University)

Fayad asked her about linkages with the value Chain project and to that, she responded that she already met with KAVES staff at their office and discussed grafting in western Kenya (Monsanto variety).

**Patrick Mathenge- Real IPM**

Mathenge described that the main role of real IPM is to provide infrastructure. He talked about smartphone and digital communication and more specifically the WhatsApp application. He and Luis said that the WhatsApp group has 64 members and is not very active. There need to be more members from extension agents and NGOs. Most posts are added when there is a meeting but otherwise participation has been shy. Adoption of this technology is not very high in rural areas. Participants also discussed what happens to this group after project ends.

He described the online diagnosis portal with sections including “view our collection, get free diagnosis” and others. Fayad question the need for this project to invest resources in building such a diagnostic portal when others are already present in the market and some data bases are free or have a minimal fee. Can the project personnel produce a comprehensive product within the timeline and resources of this project? Patrick and Luis presented no clear response or justification except that as a commercial company, it is in Real IPM’s interest develop a system and sell it.

A separate discussion centered on using *Trichoderma* and other bioproducts from Real IPM and other sources. There is a disconnect between Real IPM and KALRO regarding this issue. Mbaka wants to include two sources of *Trichoderma* but Real IPM doesn’t think it is in their interest to compare their *Trichoderma* with other providers. More discussion focused on how KALRO would like real IPM to be involved and whether they are only interested in buying the product. Questions to Patrick included how REAL IPM see this commercial company as a partner in this project and what the holdup is. Why they do not want other products to be included in the field trials? If evaluating real IPM products, Real IPM need to engage in trial design. Jesca said they will be validating and not evaluating *Trichoderma* and other biopesticides, so there is no need to have the manufacturer’s approval for field trials as long as they follow the label. Everyone agreed that Kenyan partners must discuss this issue and others related to cooperation during the afternoon.

**Tanzania Progress Review**

**Amon Maerere (SUA)**

Amon explained that they received project funds in July 2016. First year activities did not happen; they are conducting them this second year. Activities include conducting a baseline survey, capacity building, and testing IPM technologies. He mentioned that a country inception meeting took place in
April 2016. Identify and agree with stakeholders on priority vegetables, IPM technologies test or research, training and demonstration needs. Crops are: tomato, onion, cabbage, cucurbit, common bean. Tomato is the predominant crop followed by onion, cabbage, cucurbits, and beans. Team decided to drop bean as a crop.

- Tomato grafting, slur biogas for root diseases, soil borne pests
- Evaluate Hybrid varieties for pest resistance
- Evaluate parasitoids for bean stem maggot
- *Metarhizium* and *Beauveria* against white grub
- Overhead irrigation for mating interruption for DBM
- *Tuta absoluta* management

Information that is more specific is needed on all objectives mentioned above.

Three districts in Morogoro and two in Iringa; three villages in each district so total of 15, reaching 53000 people.

Fayad asked what they have learned from previous phase of the project, specifically from previous baseline and adoption studies to which Maerere gave no clear response.

Maerere briefly talked about the first draft of this baseline survey report.

- 73% farmers interviewed were males, 40 years average age
- Mean acreage was 3.4 acres
- Onion and tomato acreage was lower mean cultivated lands
- Important source of information: farmer-to-farmer information, agriculture extension, agro dealers, buyers
- Knowledge of IPM tomato and onion growers not the others

Short-term training: a 3-day workshop on seedling health management 63 (14F 49M)

Next steps: Identify early adopters, set up demonstration using healthy seedlings, conduct survey on usage and costs of seeds versus seedling, extension material on healthy seedlings

He mentioned that field-testing would include the following: grafting, slurry biogas, variety selection, overhead irrigation, and botanicals.

Fayad requested a clear write up on the experiments including treatments and experimental design.

**Peter Sseruwagi (MARI)**

Peter mentioned that their main activities fill focus on vegetable virus diseases and vectors.

They will be involved in conducting workshops on plant virus diagnostics at MARI and training farmers and extension agents in vegetable plant and virus symptoms Identification and IPM.

They already conducted a field survey:

- 40 vegetable fields where farmers were present
- Tomato, okra, Chinese cabbage, cabbage, okra
- Looked at 15 plants for incidence in single crop fields (x pattern for selection)
- Scored symptoms, incidence, severity 1-5 scale
• Insect assessment: type number damage 1-5

He reported the following

• Lowest virus-like symptoms on onions, Chinese cabbage, cabbage, African eggplant, kale, okra, green pepper, and tomato
• 125 virus-symptomatic samples, DNA extracted and RCA performed
• 70% farmers were men (they were on site); 75% 0.5-3 acres, 25% more than 3 less than 10 acres
• 62% monocrops, seeds 66 from shops
• Aphids ranked high
• Awareness of virus disease symptoms: 75% yes, importance of virus diseases 87% yes, effect: poor yield, leaf folding, death of plants
• Farmers were not familiar with vector-virus concept
• Mite was a problem in screen house nurseries

They conducted a workshop: 12 F 23 M; participants included extension officers, seed certification personnel, and others

Ethiopia Progress Report

Ferdu Azerefegne (Hawassa University)

Ferdu informed everyone that their activities are just starting; they had several administrative hurdles regarding transfer of funds but now these issues have been resolved. They are focusing activities on vegetables and pests in the rift valley. Crops include onion, tomato, cabbage, and chili/pepper. All year round production with irrigation except for chili. He mentioned the following regarding smallholder vegetable production:

• Use little inputs; open fields, furrow irrigation, manual knapsack sprayers
• Low level of knowledge and use of pest management
• Do not observe safe use of pesticides, no regulation in using pesticides (spay Coragen 3 days before they harvest, they say fruits look good if they have pesticide residues)
• Many reject pesticide safety gear; they say it becomes too hot. They are usually hired, contract based so farmers do not care about safety.
• Few pesticides with high rates and frequencies, mix pesticides, pesticide treadmill
• Most farmers follow crop calendar

He also reported the following:

• Tomato: ABW, PTM, Tuta absoluta, WF, thrips, spider mites, late blight, early blight, TYLCV, leaf spots fungal bacterial, nematodes, orobanche, powdery mildew. Viruses on tomato becoming a serious problem in addition to powdery mildew
• Most important cabbage pests: aphids, DMB, thrips, black head, root rots
• Onion: thrips, Downy Mildew, purple blotch bulb rot
• Pepper: aphids, thrips, whiteflies, ABW, powdery mildew, Ethiopian pepper mottle virus (EPMV and other viruses, wilts, nematodes, bacterial spot
• Two methods of seedling raising: own nursery, commercial farms.
Regarding graduate student involvement in the project, Ferdu said that on student, Kumsa, will work on EPMV: focus is to delay infection using netting.

Research activities will also focus on types and importance of weeds associated with onion. Efficacy of herbicides in combination with hand weeding will be conducted in Zi?way (farm has been selected, planting second week of April). Commonly used herbicides include: Profenofos, Dimethoate, and Lambda cyhalothrin; sprays 6-10 times per season (55%)

Collaborators will include Ziway health clinic and Ambo plant protection research center.

They will be testing three sources of *Trichoderma* (including Ambo and Real IPM ) in addition to *Bacillus subtilis* with the aim of helping to give policy advice.

Registration of biopesticides is a big concern in Ethiopia. Plant protection directorate, ministry of agriculture: no regulation with registration of biocontrol agents. Will allow them to bring biocontrol agents for experiment.

Capacity building: a graduate student, Habton, will join OSU.

**Report on Training/ Seedling workshops: what went well, what did not? Peter and Amon**

Based on participant feedback:

- Facility and material are good
- Generated enthusiasm for the idea that horticultural practices are part of IPM
- Need to conduct training on other production phases and practices that contribute to IPM
- Many participants weeds are not considered as pests
- How biocontrol product are applied?
- A visit to a seedling production facility would have been important
- More information on sterile techniques would be useful
- Some expressed lack of enthusiasm for the lecture based power points as a medium for most of the morning session

John Cardina asked all participants to suggest topics for future trainings/ workshops

- Weed management
- Biocontrol product education
- Post-harvest management
- Disease, nematode, insect pest identification
- Pesticide safety
- Pest management decision making
- High and low tunnel production
- Early warning system: prediction and anticipation of pest problem (training)
- Regional training, *Tuta absoluta* management

Fayad explained that specialized pesticide safety training were conducted several times in the past phases of this program. Any field demonstration where pesticides are used will have to follow proper protocols and therefore no need for a specialized training, as they are part of any field demonstration.

**Luis Canas- Whatsapp**
Luis gave an overview about the WhatsApp group for this project. Messages increased only when a meeting or a workshop was happening.

- 64% are female (this comes from the workshop)
- Messages by keyword 8% Tuta, 22% seeds, 22% symptoms
- Number is important, who is willing to participate and contribute; multiplier effect.
- Connect to a database: basic excel, can be searchable
- Free access, regional connection
- This platform could be used to share recommendations, publications, guides for identification, updates, etc.
- Importance in capacity building

Fayad asked Luis how exactly is this related to capacity building? And how can he measure this? What if same question is asked repeatedly? Will this result in project partners just sending pictures with requests for identification/diagnosis instead of doing diagnosis themselves? Fayad also asked who will be doing the editing, filtering, and curation? These are all questions that need to be addressed.

George Norton suggested we share to other sites and share information. Mark Erbaugh said this should be country driven and mediated by country coordinators. Fayad mentioned he could share IPM packages on the WhatsApp group.

**Baseline Surveys: George Norton (VT)**

Georges described the objectives of the baseline survey and said that he is collaborating with the Rice, Maize, and Chickpea IPM project in East Africa (PI is Tadele Tefera of icipe). He reported a miscommunication between Menale of icipe (Nairobi) and Maerere (SUA) regarding the Tanzania baseline survey. Menale was going to conduct the baseline survey for the grains project in Tanzania and collaborate with Maerere on the vegetable survey. However, Maerere had already administered the survey without sharing the questionnaire with George and Menale. George and Menale need to review the questionnaire and data to decide on a course of action.

**Highlights of the survey in Kenya:**

- Sample size 403 farmers
- Random selection
- Relevant information includes distance to input supplier, extension office
- Almost 50/50 M to F
- These surveys confirm what farmers think pests are but are not a substitute to doing the identification/diagnosis
- What current pest management practices are used
- Analysis why some farmers adopt and some not, gender, etc.
- Useful information on demographics, gender, market groups, or organizations, agriculture knowledge

Maerere did not have the data analyzed yet but shared that about 75% respondents were males. A discussion followed on why that is the case and how to increase participation of women farmers. Laura (IITA) asked if enumerators were men and to that, Maerere said yes. She suggested they have
women interviewers in the future and Norton confirmed that this is essential. He said half of enumerators were men and half were women in the survey his team conducted.

The survey in Ethiopia will be scaled down: cut back number of vegetables to include grains. Ferdu said that farmers don’t always disclose how much they are selling so this might be problematic assessing the economic status.

Planning meeting participants representing Ethiopia, Kenya, Tanzania, and the U.S.

March 22

Feed the Future Indicators - Fayad (VT)

Fayad presented on the Feed the Future Indicators and handed a copy of these to all participants. He described each of the eight indicators that the IPM IL reports on to USAID and submits to the FTFMS system. He stressed the importance of collecting and reporting data by the segregated categories.

Future Workshops: Tuta absoluta? Diagnostics? IPM Packages?

A discussion on tomato IPM/ Tuta absoluta workshop followed.

Fayad mentioned that the program has already conducted several workshops in East Africa and Erbaugh asked about the purpose of conducting another Tuta absoluta workshop. Danny said that Coragen is the only effective way to control this pest. Coragen is already used in Kenya. Jesca mentioned that not all extension agents know how to identify this insect/pest. Ferdu mentioned that farmers already know about Tuta and said Coragen is registered in Ethiopia. He added that chemical sprays killed Tuta and its predators and suggested rotations using Beauvaria, and Metharizium are not very efficient in the field. Biocontrol is more effective on greenhouse, but not in the field.

A discussion that followed shifted the focus on the need to address IPM package and IPM practices.

Laura suggested prioritizing crops and pests. Participants Agreement that training on tomato IPM is the most needed.
Jesca mentioned they have no experts on virus diagnostics in Kenya and that the project had reported viruses from Tanzania and Ethiopia. Fayad reported that the IPVDN team of the IPM CRSP/IPM IL did indeed report viruses from Tanzania and Kenya and listed these for them and directed participants to the respective annual reports in which they have been reported.

Danny informed participants that IITA is working on pyramiding genes for resistance to *Tomato leaf curl virus*, bacterial wilt, and nematodes; he suggested we could use these pyramided lines in the IPM field experiments.

Laura said she could help with *Rasltiona* characterization as they are already working on this. Peter mentioned he has colleagues in Kenya who are working on whiteflies and on the cassava project. He said they could help with characterization of whiteflies and viruses.

Participants discussed the issue of pesticide regulations/policy related concerns. Jesca mentioned that there are no regulation on agrovet business licensing. Ferdu reported that he is engaged with MoA and the plant health clinics regarding these issues. He can invite them to IPM sites, correlate with what the project is doing. Amon mentioned the need for policy briefs. Delphina said that the plant protection act in Tanzania is under revision; IPM has been accepted. Farmers are ahead of researchers she said: farmers found a way to manage using pheromone traps, soapy water, devising methods to manage.

Following a discussion on priorities and resources, participants came to a consensus that a training on IPM packages for tomato, including managing *Tuta absoluta*, is a priority.

**Linking with farmer groups: Mark Erbaugh (OSU) and others**

Mark presented on “Linking with farmer groups, on farm trials, on farm training, and technology transfer”. He recommended participants revise workplans to build in farmer relevant activities. He urged them to focus for select crops, 2-3 crops maximum, in accordance with budget, resources, and time. Need to work in FtF priority areas and develop strategies (R&D), tech transfer. He worries about merging research activities with technology transfer. He suggested identifying/working with hubs: KALRO, SUA, Hawwasa, IITA, Real IPM. He also talked about the importance of collaborations with development partners, farmer association, value chain (KAVES in Kenya in Tanzania, TAHA, M&M, extension agents.

Mark invited George to share his experience from the Asia project regarding field trials. George said components could be done in one plot

- trts 3x3;
- IPM package replication becomes a farm
- At least 6 farms. Demonstration is different.
- On farm experiment: collect research data
- Demonstrations: no need to collect the extensive data but the main purpose is to disseminate information
- IPM package compared to farmer practice.

Cardina summarized the discussion by saying that there is a clear distinction between field demonstrations and field experiments. Research protocol and experimental designs must be included with the workplans.
Mark described the tomato IPM in the previous phase. Mulching and staking in Tanzania in addition to using MT56 resistant to bacterial wilt. MT56 in Kenya: not desirable in Kenya so they used it as a rootstock. Indigenous solanaceous had problems with grafting compatibility. Some from AVRDC. Kenya: high tunnels. Nets for whiteflies.

Jesca reported a seedling quality: problem with cocopeat as it becomes loose when watered, will splash. I advised them not to dismiss technology. Danny said they have no problem with cocopeat. There are issues with sustainability of these technologies as farmers go back to using seed beds, or sterilized soil rather than cocopeat and netting. Participants agreed that the project needs to connect with nursery suppliers. There needs to be a sustainable demand for business to be sustained. To that, Mark asked about certification for nursery suppliers, how it could be done.

**Breakout groups**

Participants grouped by country met in the afternoon to review and revise their workplans based on earlier discussions; items for consideration included:

- seek expertise if needed
- define experimental design
- Consider on farm demonstrations
- Identity that experiments for individual components (ex individual biopesticides)
- Set up experiments to evaluate packages (ex. IPM package for tomato).

**Kenya- Jesca Mbaka**

Jesca reported that issues regarding *Trichoderma* and other biopesticides were resolved with Real IPM, and that they will be doing evaluation of IPM on station and on farm trials.

- They will use three sources of *Trichoderma*, one from real IPM and two from two other sources.
- They plan to do validation of technologies for management of black rot and soft rot of cabbage.
- Use of plant resistance and grafting in the management of nematodes and bacterial wilt.
- Cost/benefit analysis of IPM options used in control of various pests and diseases in selected vegetables.
- Evaluation of IPM for red spider mites, thrips and WF in French beans
- Stakeholder workshops: show them data, solicit comments on how to move forward by September 30.
- Information packaging: brochures, fact sheets, posters.
- Presentations in different fora: scientific conferences, workshops

Fayad questioned her on the IPM package trials but she still did not know we were looking for IPM package for a crop rather than a pest or single components. Mark, Amer George, Luis further explained the concept and the objective. Fayad explained the need to include controls and look for disease/pest pressure. Luis said that disease pressure would work no station but not in farm trials as farmers will not work with you. Need to evaluate biopesticides as they have not been evaluated before. Fayad and Norton agreed that field demonstrations and field days are better than FFS in this project.
Tomato IPM workshop: September 2017, 3 days in Kenya. Participants to include growers, extension, researchers, private sector, nursery operators.

**Ethiopia- Ferdu**

Ferdu described the planned baseline survey activities:

- Survey nurseries of vegetables in the rift valley to assess practices
- Farmers raising seedlings for own use and commercial nurseries
- Seed sources

Details of the planned Training activities include:

- Training healthy seedling production 40 farmers
- Seed treatment, soil solarization, rotation, screening covering, pest protection, good nursery practices
- Identification of healthy seedling producers, visit nurseries, try trays

Graduate students training:

- Evaluate pepper and tomato seedling treated with *Trichoderma*. Three sources of *Trichoderma* are Real IPM, Koppert, Ambo Plant Protection. Lab and greenhouse experiments
- Pepper viruses. Start with *Trichoderma*, seedling health, netting for aphid vector of EPMV, roguing, border plants, monitor ABW, powdery mildew, and bacterial spots. Experiments will be conducted in Hawassa, Ziway, Butariji, and Alaba
- 4 farms 200 m² compared with farmer practice, minimum of four farms in each locations. Fayad suggested they include on station trials in Hawassa in order to have untreated control to have the disease pressure; Ferdu agreed.

Other trials will look at Onion IPM with a focus on weeds:

- hand weeding, herbicides in Hawassa and Ziway 8 farms
- 200 m² plots
- Collect data on growth, yield, economic analysis, farmer evaluation
- Compare with farmer practice

Another study will look at onion thrips:

- ongoing research. Rotation of insecticides and adjuvants. Select best combination
- Conduct field trials, monitoring of trips, compare with farmer practice
- 6 farms, dry and wet period.
- Data on pesticide use will be collected
- Ferdu said that only approved pesticides (in a PERSUAP) would be used when necessary.

Ferdu reported the following on tomato production with smallholder farmers in Ethiopia:

- Major problems are *Tuta absoluta* and powdery mildew.
- Fungicides are effective on powdery mildew for flower and pepper but not on tomato.
- Coragen is effective and used in Ethiopia
- Farmers use emamectin benzoate and indoxacarb.
Experiments on Tomato:

- Evaluate rotation of insecticides, healthy seedlings
- 2 districts, 6 farms
- Healthy seedlings, *Trichoderma*, roguing symptomatic plants, monitoring and early detection of pests, vectors, pests and diseases, remove solanaceous weeds in the field and around.
- Compare with farmer practice

He stressed the need for producing and disseminating information (ex brochures) on pest diagnosis and management. He talked about the need to establish links to plant health clinics and to the project WhatsApp group (could even support a WhatsApp IPM groups in Ethiopia). Use university website to add information.

Challenges are:

- Many pests and diseases on each crop
- Few tested management options
- Vegetable growing farmers demand compensation
- Need to compensate farmers for losses and land, especially for control treatments.
- Availability of nursery media, nets and protected covering, approved pesticides, lab inputs for virus detection.
- Lack of professionals: ex virologists

**Tanzania- Delphina**

Delphina mentioned that objective 1 (baseline survey) was already completed and data is being analyzed. She described objective 2: conduct short-term training and capacity building activities on healthy vegetable seedlings and crop production IPM practices. These will take place May-July 2017 on tomato, cabbage, onion, and cucurbits.

Focus of field trials will be on *Tuta absoluta*, viruses, WF, aphids, thrips, blights, wilts, nematodes, bacterial, fungal wilts, mildews, and mealybugs.

- 3 groups of farmers from each of the 5 districts.
- Practices: healthy seedlings, GAP and
- Identification of pests, and well as natural enemies.
- Training at seedling, during transplanting, during production
- Farmers, extension, input suppliers

Delphina described the third objective 3: grafting experiments in addition to biogas slurry, variety selection, botanicals and biopesticides for *Tuta absoluta*.

Danny inquired on what rootstocks cultivars they plan to use for nematode resistance. He said they screened all varieties available for nematode resistance at IITA and none is present. Project needs to identify which rootstocks will use against pest and diseases.

Delphina also mentioned that they would be developing immunostrips for virus identification. Fayad questioned if she meant develop or use but she insisted that they will be developing immunostrips. Fayad doubted that they have the expertise and resources to do this activity and Sseruwagi eventually clarified that they will be using and not developing these immunostrips.
Activities in Tanzania will also include a training on use of IPM packages; this will take place in March 2018.

Mark inquired about who will the nursery be establishes with? Could that be with TAHA? Fayad asked for a clear experimental design will all relevant information on treatments, locations, and data collection.

Danny Coyne- IITA

Danny said they could provide the following:

- Technical advisory oversight in nematology
- Long and short term training
- Integration and link with IITA (German project that no longer exists)
- Evaluation of IPM packages to determine project impacts

He also described their expertise in nematology techniques

- Pest and disease management
- They already produced a practical plant nematology manual

Danny also described planned activities for objective 3:

- Beneficial microbial antagonist.
- Ethiopia Addis Ababa Univ.
- Identify suitable microorganisms, exploit an identify new organisms a, compatibility with varieties, crop
- Assess enhanced or penalty to seedlings
- Determine pathogenicity to nematodes
- Could use abamectin and Real IPM Trichoderma together
- Consider pyramided bacterial wilt and nematode resistance

He mentioned that the effect of *B. bassiana* in planta is internal protection and induced resistance. He said it goes endo in banana, and kill weevil. Does this work in tomato and cabbage? Can this be considered? He stated this for the team to think about.

He concluded by saying that printed guides are very efficient. Much better effective than electric gadgets in the field.

March 23: Field Trip

At the first site (Nthambo Horticultural Growers S.H.G), we met representatives of a farmer group; 17 farmers were present (10F; 7M). Helen Butayi (sub county Ag officer) accompanied us. Farmers grow kale, cabbage, French beans, tomato, and cowpea. Major challenges they face are lack of knowledge on appropriate pesticide use. Eston, the youngest farmer in the group, described his involvement with the group and project. He has a BS degree in math and physics but he decided to work in agriculture in his family’s land. He has been very successful in his business and hope to create employment for others. He participated in the “Seedling Health” workshop conducted by the
Jesca introduced him to a commercial nursery (Israeli company operating in Kenya). This nursery is 30 Km from his field and most operations are automated: he brings seeds to them and they establish his seedlings.

This site is the location for the Brassica and Kale experiments (Dissemination of IPM technologies for DMB and aphids). We visited the kale experiment. Treatments included the following: *Beauveria bassiana*, neem, *Verticillium*. Application of biopesticides is at one-month intervals. Major damage is due to cabbage moth, thrips, and white flies. Damage happened mostly in the past two weeks and the crop is almost completely lost. Suggestions to farmers and researchers included the need for more frequent applications of biopesticides as the one moth interval is not enough. *Trichoderma* application was also suggested for seedlings and during or after transplanting. Treatments/rows need to be labeled with the actual components rather than numbers or letters, as farmers do not know what treatments are giving better results the field.

Eston, the youngest farmer in the group describing his use of nursery seedlings.
Severe damage on Kale. Kale was however at the end of its growing season.

At the second site, Mbogoni Horticultural Growers, we observed the tomato and French bean trials. There, we met farmers Chaos Multeyi and Peter Mina plus five other male and eight female farmers who are part of this farmer group. Farmers grow kale, tomato, beans, melons, banana. A major challenge they face is the pesticide residue that affects their ability to export their French beans. Farmers spray twice a week and many report illness due to pesticide exposure. Farmers now contract pesticide applicators. The youngest farmer who hold a BS degree in statistics said he did not find a job after graduation and that why he is in agriculture now. He requested the project help him in finding a job. He was not interested in continuing with agriculture and farming. Farmers requested training in pest and disease identification and diagnosis. Bacterial wilt and nematodes are major problems in this field. The group recommended farmers stake their plants and apply Trichoderma (in seedling nursery and in the field during or after transplanting). Treatments/rows need to be labeled with the actual components rather than numbers or letters, as farmers do not know what treatments are giving better results the field.
A major concern was that plants had not been staked yet. Row labels need to be more descriptive so farmers know what treatments are in what rows.

At the tomato trial. We saw signs of early *Tuta absoluta* infestation/damage. No *Tuta* was present in the field this time during the season. Farmer said they used neem sprays earlier in the season. It appears that they had a seed purity issue and different plants had different fruits suggesting no uniformity in the commercial seed they are using. The scientists need to repeat this experiment for two additional seasons as the mixed variety compromised this trials.

At the third site, Mbwiru-Mwanjati Horticultural Growers, we observed the tomato and French bean trials. There we met 26 farmers (16M; 10F). The group secretary (a female farmer) said this group has 257 of which 90 are females and 80 are youth members and was formed in 2007. They mainly grow tomato, kale, and French bean. Challenges they face include proper identification of pests and diseases, access to farm inputs, transportation infrastructure, and access to markets.
The farmer group secretary describing their activities and challenges they face in managing pests and diseases.

Farmers share tomato nursery and they have to buy seeds in bulk and the cost is very high (975 cents per seed). They are planting Kilele seed in protected nursery. Beds are solarized for 1.5 months and seedlings covered with insect proof nets. Major problems on tomato include nematodes and mites.
The French bean trial included the following treatments:

*Trichoderma asperulum*, Azadirachtin,(0.03%), and *Paecilomyces lilacinus*. Suggestions included doing combinations of different components are this trial is only looking at single components. Treatments/rows need to be labeled with the actual components rather than numbers or letters, as farmers do not know what treatments are giving better results the field. Fayad reminded the KALRO team that all pesticides used must be registered and approved in a PERSUAP.

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

- The scientists are not addressing IPM as a package, rather as individual components. This is especially true for the KALRO team in Kenya. This is a major concern and country coordinators and PI need to rectify.
- IPM field demonstrations should include IPM package sites versus farmer practice sites.
- The Tanzania team need to build on previous knowledge from the last phase of the project in designing their field trials.
- Country coordinators need to submit to the project PI and the IPM IL ME a clear and detailed plan of all trials included treatments, experimental design and planned activities for technology dissemination.
• All pesticides used must be registered in the respective countries and be in an approved PERSUAP.
• Norton, Cardina, Maerere, and Menale to review the baseline survey in Tanzania and decide on whether it was properly done, in this case the will be no need to repeat this survey.
• Country coordinators need to continue seeking linkages with the value chain projects.
• More focus should be given to gender integration. This was apparent in the lack of efforts in the Tanzania baseline survey where most farmers targeted by the survey were men. Including female enumerators could be one way. Need to engage the gender experts in each project (gender experts like Beth (KALRO) and Cathy (OSU), and Daniel Sumner (Assistant Director, Women and Gender in International Development at VT).
• The justification for this project to invest resources in building such a diagnostic portal when others are already present in the market and some data bases are free or have a minimal fee.
• Ethiopia team need support from the PI as they just started their activities (due to delays in transferring funds).
• All project partners need to send their invoices in a timely manner.

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