

Proceedings of the Annual Review Meeting of Rice, Maize and Chickpea IPM for East Africa Project, Hawassa, Ethiopia 17-18 July , 2017




Rice, Maize and Chickpea IPM for East Africa Project
Annual Review and Planning Meeting
17-18 July 2017, Hawassa-Ethiopia



17-18 July 2017, Hawassa, Ethiopia

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1. Summary of the annual review meeting

The purpose of the annual review meeting was to review the status of the project in the first year, to exchange the challenges, achievements and to discuss on the way forward. The meeting was also giving an opportunity to introduce the staff working under rice, maize and chickpea IPM project and to bring synergies together, and adhere to the goals of the project.

Twenty-two (including 9 students supported by the project from Ethiopia, Kenya and Tanzania) participants drawn from the countries in which the project is operating (Ethiopia, Kenya and Tanzania) attended the event. The presentations glanced about the panoramic overview of the IPM project from the general objectives and outcomes, improved agricultural technologies, as well as controlling mechanisms and its economic benefits. Different types of diseases and pests, and emerging threats against the three crops, introduction push-pull technology, gender issues, digital solutions to enhance farmers adoption of IPM and the communication approaches were topics addressed and robust discussion held. Nebiyu Solomon, program management officer and Desalegne Tadesse, communication officer took the lead organizing the exciting event with the leadership of Dr. Tadele Tefera, icipe-Ethiopia Country Director.

Dr. Tadele Tefera opened the meeting by welcoming the participants and introducing the purpose of the gathering, followed by Dr. Sophia Kashgenge's inspiring remarks appreciating the implementation of the project. Among the three project Technical Advisory Committee members, Dr Sophia Kashenge, Centre Director, Dakawa Research Centre, Tanzania attended while other two Dr Lusike Wasliwa, Director Crop Systems, KALRO, Kenya and Dr Eshet Derso, Director, Crops Research, Ethiopia were excused absentee due to various urgent commitments. The review meeting was facilitated/chaired by different personalities.

2. Background

Researches and reports came out of several conferences are urging the significance of holistic approach for pest management to improve agricultural productivity in East Africa region. Rice, Maize and Chickpea Integrated Pest Management (IPM) for East Africa project is part of those initiatives embracing for the integrated approach to control pests and improve production and productivity. It is designed to put in place sustainable approaches to pest management in the region, mainly in the project operating countries (Ethiopia, Kenya and Tanzania). In these countries Rice, Maize and Chickpea are staple crops. However, their production and product at national levels is low due to different factors. Pests and diseases are major causes for reduction of yields.

Since 2015, icipe and its partners joined their efforts to break this trend and to tackle pest management problems together in the three countries. The project's approach is increasing crop productivity through IPM. It addresses IPM-related production, processing, storage and marketing to improve livelihoods of smallholders. The intention is to develop participatory approach for pest management alternatives for priority crops and diseases, to raise knowledge and awareness of fundamental concepts of IPM. The project has been implemented in three East African countries; namely Ethiopia, Kenya and Tanzania with financial support from USAID Feed the Future IPM Innovation Lab through Virginia Tech.

3. The workshop

Dr. Tadele, the principal investigator of the project and Head of icipe-Ethiopia facilitated the two-day sessions. Proceedings started with participants introducing themselves and the presentation of the objectives and expectations of the workshop. This was followed by the opening session, presentation and discussions.

3.1 Welcoming Remarks

The welcoming remarks given by the Dr. Tadele, the principal investigator (PI) of the project and Head of icipe-Ethiopia, Dr Fayad Amer, Associate Director, IPM Innovation Lab, USA and Dr Lusike Wasliwa, Director Crop Systems, KALRO, Kenya respectively. Warmly welcoming the participants, Dr. Tadele, explained the objectives of the review meeting and expected outcomes of the meeting.



He also provided a coherent guidance in directing sustainable IPM that contributes to improving food security and the livelihoods for smallholder farmers in the three countries. In this regard, the PI called up on the participants to exert their maximum efforts and commitments to push forward achievements gained so far and also to tackle challenges facing together.

3.2 Opening remark



Dr Sophia Kashenge, Centre Director, Dakawa Research Centre, Tanzania and Technical Advisory Committee delivered opening remarks. She said, “The meeting gives us a golden opportunity to exchange information on the main challenges the farmers facing in the region. Including the heartbreaking invasion of Fall Armyworm, the productivity of crops and livelihoods of our farmers affected by pests and diseases. So, in the two days we will have common understanding on the significance of IPM and on how we can find solutions for these emerging challenges”. Consequently, Dr. Sophia appreciated the implementation of the project and its capacity building packages.

The meeting was chaired by eight chairmen/women and entertained nineteen presentations and discussions.

4. Presentations

Several topics addressing the activities, achievements and challenges on the project presented by principal researchers, partners, technicians and students. The presentation mainly clustered into research, capacity building packages and communication & education. The research components is dedicated to developing and testing IPM technologies, delivering pragmatic pest diagnostic toolkits. The capacity building and strengthening policy is emphasis on the creation of young IPM leaders and policy makers, while the communication and education pillars are focusing on linking the science with the community and also promoting and dissemination of the impacts.

4.1 Addressing research needs through sustainable approaches to Pest Management in East Africa

Rice, maize and chickpea are staple food crops in Ethiopia, Kenya and Tanzania. However, the national yield average is low compared to other regions of the world due to biotic (such as insect pests, diseases, weeds and rodents) and abiotic factors. *IPM for Rice, Maize and Chickpea for East Africa project* aims to address research needs of IPM, barriers to the adoption of IPM and strategies to overcome them such as capacity building, knowledge sharing and outreach activities. This includes developing and implementing proven, robust and locally adapted IPM options that will help:

- to reduce crop losses due to pest
- to improve natural eco-systems and improve human and environmental health
- to enhance biodiversity, and increase the productivity of soil and crops value chains

The aforementioned pillars of the project were highlighted and proved by the presentations and discussion held during the annual review and planning meeting.

4.1.1 Rice, Maize & Chickpea IPM for East Africa Annual Review & Planning

By Dr. Tadele Tefera, icipe-Ethiopia head



Dr. Tadele presented the objective of the meeting and brief over view of challenges and achievements have been made so far. His presentation commenced by demonstrating project partners and explaining the main objectives and expected outcomes of the project.

Introduction

The project has four major objectives: 1) Developing and testing IPM technologies 2) Developing and delivering pragmatic pest diagnostic toolkits 3) IPM communication and education and 4) Capacity building and strengthen policies that influence IPM.

The following are expected outcomes.

- **Outcome 1: Developing IPM Options for Rice, Maize and Chickpea.** These includes; Developing & testing IPM technologies, Scale out proven technologies and Evaluation of IPM technologies. The scope of the options extended from prevention to suppression.
- **Outcome 2: Pest diagnostics toolkits.** Developing tools for field identification of pests Capacity building in pest and disease diagnosis. Working document series came out reporting on pest diagnostic capacity assessment in plant health laboratories in Ethiopia, Kenya and Tanzania. Digital IPM support initiated by Minnesota University is also part of this outcome.
- **Outcome 3: Communications and Capacity building.** Create awareness and disseminate information, Develop promotional materials targeted to different stakeholders, Train farmers and extensions agents and Establish network of key stakeholders.
- **Outcome 4: Strengthen policy.** (Dis) incentives to adopt IPM, Policy gaps and institutional arrangements. These includes:
 - Review on Pest Diagnostics Services Provision Capacity of Plant Health Clinics, Quarantine Posts, Research Centers, and Universities in Ethiopia, Kenya and Tanzania

- Regulations on pesticides and biological control agents being reviewed

Major Activities

Major tasks carried out on different IPM grains in the first year period enumerated below.

a) Rice IPM

- Screening about 50 rice genotypes against rice diseases in greenhouse in Mvomero district of Tanzania. Demonstration of improved rice varieties against blast and YMV 10 demos (Saro 5, Komoka and Local). 250 farmers participated and each demo has 25 members.

Outcome: *T. asperellum* and *B. subtilis* showed a very high antagonistic activity to blast

- Screening botanicals, *Beuveria*, *Metarhizium* against rice stem borers

b) Chickpea IPM

- Screening *Metarhizium* and *Beuveria* against pod borer.
- Fungal growth after killing the insect- pod borer (see the picture below)
- Selection 3 virulent strains. 3 *B. bassiana* isolates were considered more virulent than other isolates: PPRC-9604, DLCO-EA-56 & PPRC-T5
- Field evaluation on biotic stress and *Trichoderma* against wilt (Raised bed-wilt, seed dressing-wilts, resistant varieties and two times spray-pod borer) conducted. *Fusarium oxysporum* f. sp. *ciceri* is the most important biotic stress in Ethiopia. It causes severe yield loss (10–15%) in chickpea which may rise to 60–70%

c) Maize termite IPM –Ethiopia

- Integrated termite management trails at Bako using cropping system, mulching and manuring at 2 demo sites.
- Effects of intercropping (soy bean, *Desmodium*), mulches (maize stovers), manures, insecticide (Control) and sole cropping (control) evaluated.

d) Maize IPM- Ethiopia, Kenya and Tanzania

- Demonstration of push-pull technology against stem borers in Hawassa involves 115 demo farmers, 3 farmers training center and 2 schools.
- Push-pull technology demo plots against stem borers in Nakuru, Naivasha & Kericho involve 40 farmers.
- 11 farmers engaged in the demonstrating of the PPT against stem borers and striga in Motombo Village of Tanzania.

Apart from Stemborer and Striga control, another multiple benefits of the PPT explained. These include improving animal feed, soil fertility and crop yield.

Challenges

Drought in Kenya hit some of our demos, general election in Kenya and the invasion of Fall Armyworm are challenges highlighted.



FAW Invasion that poses great challenges affecting project sites. As of June 2017, it affected Maize 373371 ha in Ethiopia, 200000 ha in Kenya and 1,000,000 ha in Tanzania. Use of pesticide and hand picking are ongoing controlling attempts. In order to control the pest 105790 ha sprayed in Ethiopia, 40,000 ha in Kenya while 134768 ha by handpicking in Ethiopia, 50,000 ha in Tanzania. 108375 litre insecticide (940221 USD) used in Ethiopia, 40,000 lire (1, 600000 USD) in Kenya and 15000 litre (450000 USD) in Tanzania. In terms of household level the infestation affected 648930 households in Ethiopia, 1,000000 in Tanzania. As part of the efforts to control the spread of the pest, the project bought pheromone traps from India, installed and testing is underway. The pheromone traps caught many FAW moths and recorded promising results are coming out of this initiative.

4.1.2 Maize stem borers IPM in Kenya

Dr Paddy Likhayo, KARLO

The focus of the presentation was on the promotion of Push - Pull Technology for the control of stem borers in Bomet, Kericho and Nakuru counties in Kenya. While stating the problems, Dr. Paddy underlined stem borer is a serious challenges in the production of Maize causing 10-85% yield loss.

Activities:

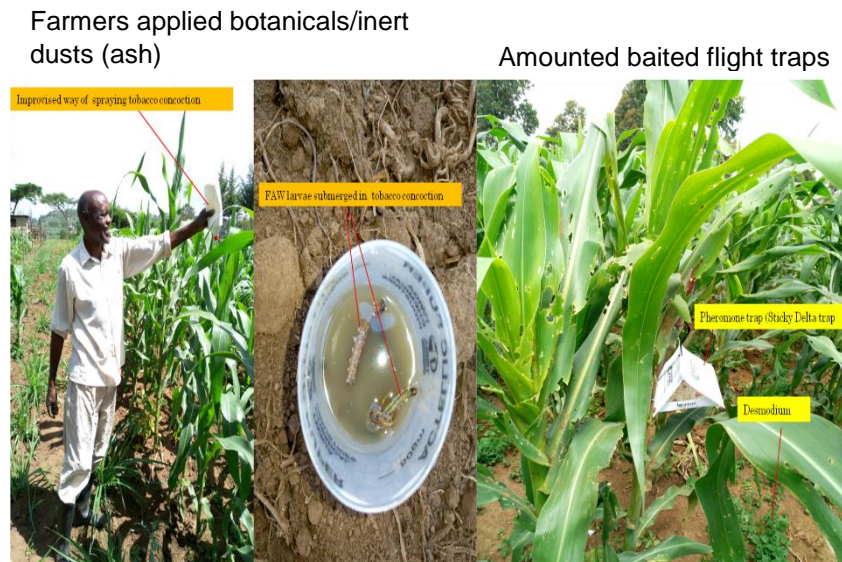
- Sensitization and selection of farmers: Done in collaboration with USAID-KEAVES and extension staffs. Members allowed to select among themselves those to participate in the demos based on land available and willingness to participate in the study. A total 40 farmers agreed to participate in the study.
- Land preparation and planting: Each farmer availed approx. 0.5 acre (half planted with push-pull, remainder served as control). Napier grass cuttings sourced from farmers & Desmodium from Kenya Seed Co.

Achievements

- Soil fertility tests of samples taken before planting, soil acidity, and phosphorous availability tested (see the table below)

Group	Soil P ^H	Total Nitrogen %	Total Org. Carbon %	Phosphorous (Mehlich) ppm	Potassium Me %	Calcium Me %	Magnesium Me %	Zinc ppm
Osach Kosachi	5.83	0.30	3.08	5.0	1.3	11.5	3.13	20.0
Kilimo Bora	6.16	0.35	3.60	20.0	2.46	20.6	4.1	18.0
Kitoben	5.66	0.30	3.13	10	0.98	12.0	2.62	13.2
Tai Klap Women	5.57	0.2	2.12	5.0	0.52	6.5	2.09	5.24
Chebewor	5.55	0.28	2.72	5.0	0.7	9.6	1.05	13.8
Borop	5.76	0.23	2.50	5.0	0.68	6.2	1.51	9.86
Kiptemit	5.25	0.34	3.45	5.0	0.62	6.0	1.66	5.32
Kifao	5.52	0.35	3.48	5.0	1.30	9.6	1.65	20.4
Eve Women	5.88	0.28	2.85	5.0	1.08	12.3	1.12	18.3
Lambei Timbililwe	5.87	0.29	3.06	15.0	1.82	11.6	1.32	22.5
Mean	5.71	0.29	3.00	8.0	1.15	10.6	2.03	14.7

- Farmer awareness creation meeting held and data collected from farmers regarding the level of infestation, yield loss, expectation for the next seasons, etc.



Lessons drawn

- Push –pull technology works well in areas that receive enough rainfall
- Frequent weeding of Desmodium during the early stage of establishment
- Integration of the technology with livestock production (motivates the farmers)

Challenges encountered

- Effect prolonged drought & FAW infestation
- How to differentiate between stem borer & FAW score damage

2017/2018 Plan of Activities

- Score for stem borer damage by end of July 2017
- Train farmers and extension staff (Kericho & Nakuru Counties) by end of August 2017
- Collect yield data for 2016/2017 season end of November 2017
- Prepare and submit annual report for 2016/2017 season by end December 2017.
- Increase demo sites by 20 (Kipkelion West & Molo Sub-Counties) in 2018 planting season

4.1.3 Maize Stemborers and Striga management in Tanzania using Push- Pull Technology

By Nsami Elibariki, Biocontrol Program-Kibaba



The significance of Maize in Tanzania, the number of households engaged in the production of Maize (4.5 million), major production constraints (pests, diseases, striga weeds and soil fertility depletion) addressed under the statement of the problem. The yield loss (30-53% on maize), use of push-pull technology being implemented 5 villages of Morogoro and Mvomero districts, the data collection (parameters, plant height/exit holes count, Fall Armyworm infestation and striga count), results achieved lessons learned and challenges were the main focus of the presentation.

Achievements made because of push-pull technology

- 25 extension staff and lead farmers were trained on Push pull technology
- Total of 101 people attended farmers field day at Kiswila village in Morogoro district
- Mean plant height increased by 3.02 % and mean exit holes were reduced by 56.81% in Push pull plots.
- Mean tunnel length increased by 100% in control plots while striga count was reduced by 40.19 % in Push pull plots.
- Mean yield per acre increased by 24.94% in push pull plots when compared to control plots.

Lessons learned

- Demand for implementation of Push pull Technology among Maize Farmers and other stakeholders was high as was shown by farmers field day
- Farmers field day helped to extend push pull technology beyond project sites
- Many farmers want to increase their income through sale of Desmodium and Brachiaria seeds
- Many farmers prefer use of Brachiaria to Napier grass as a 'Pull'.

Challenges encountered

- Invasion of new pest (Fall armyworm) in trial plots
- Inadequate desmodium and brachiaria seeds
- Termite damage at harvesting stage
- Bird scaring against brachiaria seeds
- Action taken:
- Use of recommended pesticides(Cypemethrin 100g/l)
- Desmodium seeds was ordered from Arusha but was not enough
- Early harvesting
- Use of bird scarer

Plan of activities for 2017/2018

- Extension of Push –pull technology in more villages in Morogoro and Mvomero districts
- Implementation of the technology in Kiteto district – Manyara region
- Multiplication of brachiaria and desmodium seeds (2 hactares) in Morogoro district
- Technology awareness creation through farmers field days, farmers exhibitions (nane nane)and mass media(Tv and Radio programs)

4.1.4 IPM on rice diseases and insect pests in major rice growing areas of Tanzania

By Dr. Charles Chuwa, Senior Agricultural Research Officer, Dakawa ARI,

Introduction section highlighted the significance of rice both for food and cash in Tanzania, processing. Causes for the low production of the crop; these includes rice blast, yellow mottle and bacterial late blight diseases. RYMV causes Yield losses 92 - 100%, Rice blast reduce yield by 11 – 37% and BLB reduces by 70–80%. All the factors cause severe crop yield losses range from 7 – 100 %.



The objective of this project is to help rice farmers to reduce yield losses imposed by major diseases by screening and disseminating tolerant/resistant rice varieties.

Activities implemented and achievements

Screening and disseminating tolerant rice varieties to rice yellow mottle virus (RYMV), rice blast and bacterial late blight (BLB) diseases in Mvomero district, Morogoro region, Tanzania are among major activities have done. Other activities, include; rehabilitation of screen-house, establishment of demonstration plots in the farmers' fields, training farmers and extension agents, and conducting farmer field days.

A total of 242 (114 F and 128 M) were trained, 42 % women and 58 % men. And, 254 (132 M and 122 F) stakeholders participated in farmers' field days.

Establishment of the screen house experiment and demonstration plots

- Total of 50 rice genotypes including both resistance and susceptible were planted in the screen-house to screen for the promising ones against rice yellow mottle virus, rice blast and bacterial late blight diseases
- The seedlings were inoculated with bacterial late, blast and RYMV pathogens at the age of 21 days after seed germination.
- The experiment was repeated by planting 22 rice varieties. Of which 9 were from Uganda (tolerant to RYMV) and the rest from Tanzania.
- A total of 10 demonstration plots were established at ten villages Dakawa, Msufini, Bungoma, Mkindo, Kigugu, Mbogo, Digoma, Lukenge, Dihinda and Kanga. About 250 farmers (beneficiaries) were reached.
- Komboka and TXD 306 (SARO 5) rice varieties were raised in the nurse bed and transplanted at the age of 21 days after germination.

In order to observe the severity diseases assessment was conducted on the farm trials using the formula described by Hajano et al. (2011). The severity of rice diseases was determined using the disease scoring scale of 1-6 as described by Prasad et al. (2009). Then the disease severity scores were converted into percentages using the formula described by Ghazanfar et al. (2009).

Results of disease assessment shows that the lowest disease incidence and severity recorded on SARO 5 and Komboka rice varieties compared to local variety. As indicated in the result, TXD 306

(SARO 5) and Komboka are tolerant to rice blast, rice yellow mottle virus and bacterial late blight diseases. Local varieties were susceptible.

Lessons drawn

- The mode of involving farmer groups are necessary for wider dissemination of the technologies
- Training of VAEOs, lead farmers and farmers ensures the sustainability of the technology
- Involving Local government and other stakeholders in technology dissemination strengthened research – extension linkages

Challenges

- Rainfall: Delayed onset of rainfall, destroyed road networks (Digoma villages) and floods (some demos were washed out (Mbogo, Lukenge, Digoma))
- Outbreak of stem borers in Mbogo and Mkindo demonstration plots
- The budget is very small to meet the targets.

Planned activities 2017/2018

- Reconfirmation of previous sites for establishment of demonstration plots
- Distribution of rice seed
- Establishment of demonstration plots
- Training of VAEOs, lead farmers and farmers
- Conducting farmers field day
- Report writing and production of publication (TV, radio, leaflets, posters)
- Conducting feedback meeting
-

4.1.5 Impact of women empowerment and PPT technology adoption on nutrition and farm labor

By Geoffrey Muricho, Economist icipe

Introduction

Sub-Saharan Africa suffers most severe poverty and malnutrition compared to other regions of the world (Bain et al., 2013; Von Grebmer et al., 2016; FAO 2015; WHO 2015). Improved agricultural technology promoted as key in addressing poverty and food security in this region (Verkaat et al., 2017). Recently, women empowerment has gained prominence too (Doss et al. 2006; Alkire et al., 2013; etc.)



Effects of improved agricultural technologies and women empowerment on nutrition have been explored in past empirical literature though in isolation (Larochelle & Alwang 2014; Malapit & Qisumbing 2015). More importantly, studies on the effect of interaction between improved technologies and women empowerment on nutrition are almost non-existent. Also, there are limited studies on the effect of improved technologies on household labour supply.

The study bridges the literature gaps by analyzing: Effect of PPT and women empowerment on women nutrition, effect of interacting PPT adoption and women empowerment on women nutrition, and effect of PPT adoption on own farm family labour supply by gender.

Methodology and methods

The study uses household level gender disaggregated data collected by icipe in 9 counties of western Kenya in 2016. Women empowerment is provided by women empowerment in agriculture index (WEAI) and women nutrition is estimated by women dietary diversity score (WDDS) based on recall of 9 food groups consumed in the last 7 days (Kennedy et al., 2011). Labour is measured in person days (8 hrs of work).

Due to endogeneity of Push-Pull Technology (PPT) adoption and women empowerment, the study adopts endogenous switching regression (ESR) framework. ESR controls for both observed and unobserved heterogeneity to disentangle the effect of the treatments (PPT & WEAI) on outcome variables (women nutrition and labour supply).

The descriptive analysis compared the PPT adoption impacts between adopters and non-adopters in terms of labour and time. The result revealed that there is heterogeneous effects on female and male labour. However, reduces plowing/planting, weeding labour whereas increases harvesting/threshing labour which would increase yield.

Conclusion

PPT adoption and women empowerment have positive effect on women nutrition. It has mixed effects on agricultural labour supply by increasing female labour supply and reducing their weeding labour. Thus, policies that encourage PPT adoption and women empowerment are likely to increase women nutrition and reduce their workload.

4.1.6 Digital Solutions to enhance farmer adoption of IPM

By Prof William Hutchinson, University of Minnesota



Aim: via extension & farm advisors, enhance IPM Learning & Adoption for maize, chickpea & rice insect pests. Designed to achieve the following two primary goals.

- Smart phone App: to provide Android based insect and pest identification (e.g., Samsung), colour photos. Identification will be sorted by crop growth stage ((seedling vs. ear), & insect pest groups (caterpillar vs. weevil). All 3 crops in one App (maize, rice, chickpea). However, recent invasive pest, Fall Armyworm, selected beneficial insects, key plant pathogens will be added.
- Smart phone/PC: to provide IPM Animations focusing on Maize, Push-Pull for Stem Borer IPM.

Primary languages: English, Amharic and Swahili

Primary audience: Ext./Farm Advisors and Farmers

Surveys conducted in 2016 and 2017 on Extension and Farm Advisor to identify target audience and their interest. The results confirm that in Ethiopia 49% of Ext Advisors currently have smart phones and in Tanzania 45 and 55% currently have smart phone. Remainder planned to obtain a SP within 1 year. For example: Extension Advisor survey, IPM mtg conducted in Hawassa, Sept. 2016 (several districts). Written survey, conducted in Amharic

- Key Results: IPM workshops (n=24):
 - IPM-App Priorities: requested the following priorities
 - Stem borers (92%)
 - Pathogen/disease concerns (75%)

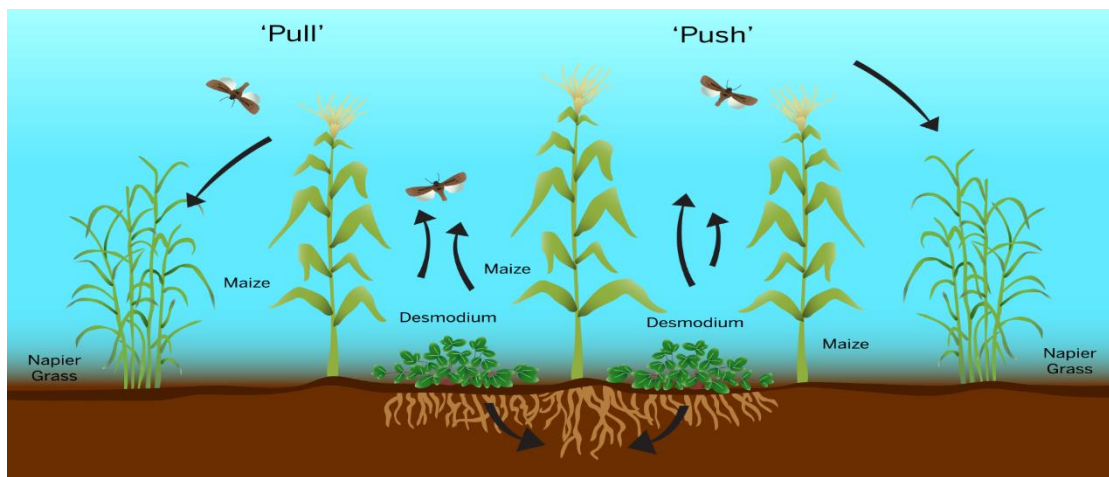
- Weeds (42%)
- Maize Leaf Necrosis (12.5%)
- Confirmation: Enthusiasm for the App & knowledge that once images are downloaded to phone, they can be viewed in the field -- do not need Internet/Wifi connection.

Opportunities to couple the IPM App with existing resources

- **Maize Doctor, Rice Doctor?**
 - Maize & Rice Doctor (CIMMYT)? Is possible to incorporate some of the diagnosis ideas of CIMMYT; e.g., pest groups by crop stage (seedling, whorl, ear)
 - Extension advisors (Hawassa survey), also suggested to include IPM Solutions. Example, sources of improved maize varieties/hybrids, biological control, crop income calculators (yield estimate, etc.). In addition, user's can submit photographs of pests for Identification.
 - Promoting and expanding grower network opportunities by coupling real-time messaging, pest alerts, via "WhatsApp"

Primary initial goal is building Quality Pest image library & diagnosis framework

- **Push-Pull Maize Stem Borer Animation to Enhance Farmer Adoption (sample artwork): 2017**
Via Univ. of Minnesota, sub-contracted to Intern to monitor the progresses in developing animation on PPT (see example and more animations by SAWBO in West Africa: <http://sawbo-animations.org/>). The purpose of animation is to Enhance Farmer Adoption of IPM.



Plan 2017/2018

- Collection of high-quality images continues for App
- Final script for Push-Pull animation will be finalized in Sept. 2017; draft will be available in Dec. 2017

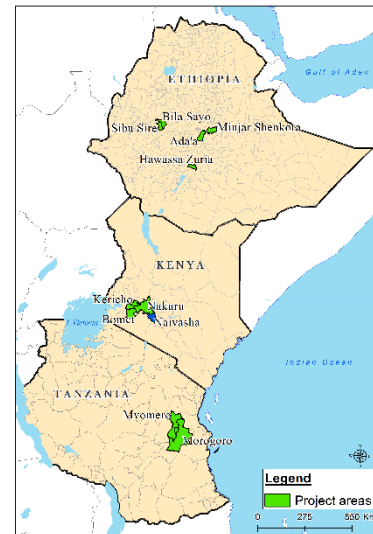
4.1.7 Base line study reports (chickpea, maize and rice) and reports on indicators and gender mainstreaming

By Dr Menale Kassie, Head of Social Science and Impact Assessment Unit, icipe

A) Socioeconomic component: Key achievements

Dr. Menale presented both the base line study, indicators and gender mainstreaming reports in the countries where the project is operating. Details baseline surveys demonstrated major pests, such as stemborer, cutworms, termites, aphids, striga, nematods, whiteflies and striga weed in the three countries and three crops. While posing question whether the FAW could be a major pest in the coming years.

Similarly, major diseases, such as Maize lethal necrosis (MNL), Maize streak virus, Ear rot, Rust, Leaf blight, Stem and root rot and Head smut affecting Maize in Ethiopia and Kenya. Other disease like, Fusarium wilt, Root rot, Anthracnose and Blight affecting Chickpea in Ethiopia addressed in the survey.



Major Achievements

- Baseline surveys data collection completed in three countries
 - **Ethiopia:** Maize and chickpea baseline surveys completed. Maize survey covers 300 maize growing households in three districts and 12 villages. The chickpea survey covers 200 chickpea growing farmers from 2 districts and 9 villages.
 - **Kenya:** Maize production and IPM related data from 200 households in Bomet and Nakuru counties collected.
 - **Tanzania:** rice and maize baseline survey completed in two districts and data on 400 hlds collected

Three baseline survey reports completed: (two in Ethiopia: maize and chickpea; one in Kenya). Reports contain detail data such as data on pests and their management, IPM and farmers' willingness to pay and potential adoption of IPM technologies. Data compiled on project indicators and consultants identified to undertake desk review on pesticides and IPM policy regulation (see the sample below the survey used).

Country	Sample			
	Households	district	Villages	Current demo villages
Ethiopia	500	5	14	11
Kenya	206	2	8	17
Tanzania	400	2	15	17

Survey results

Demographic characteristics (hhld %)

	Ethiopia		Kenya
Human capital	Maize areas (N=300)	Chickpea (N=200)	Maize (N=206)
Sex (1=male)	95	96	93
Head age	40	46	47
Head education (years)	7	6	9
Household size	6	5	6

- Aging farmers: advantage and disadvantage
- More educated farmers in Kenya may be good for technology uptake

Information and physical asset ownership (%)

Asset	Ethiopia		
	Maize areas (N=300)	Chickpea areas (N=200)	Kenya (N=206)
Information asset			
Mobile phone	68	85	98
Radio	38	11	NA
Tape/radio cassette	18	26	NA
TV	3	18	NA
Physical asset			
Farm land (ha)	1.54	1.22	1.17
Maize area (ha)	0.63	NA	0.53
Chickpea area (ha)	NA	0.43	NA
Tropical livestock unit (TLU)	4.35	5.47	3.07

- High information asset ownership that can help to deliver project information and reach our target
- Livestock should be seen an advantage to promote our technologies: relax liquidity constraint, buffer against risk, fodder shortage

Information and physical asset ownership (%)

Source	Ethiopia		Kenya
	Maize areas (N=300)	Chickpea areas (N=200)	Maize (N=206)
Agricultural extension	94	82	63
Relatives	70	53	49
Neighbor framers	83	69	63
Field day	47	35	34
Farmers field school	43	30	NA
Input dealers	45	19	41
Radio	34	10	82
Television	15	6	52
Newspaper	4	3	39
Framers group	4	37	?
Mobile phones	NA	NA	19

- Identifying and choosing right information pathway is crucial to meet project targets and deliver solid and quality information

Gender outcomes

- Gender, control over crop choice and resource in Ethiopia
 - About 60% of maize growing decisions are joint, and but men alone make the decision for 40%
 - 90%, 87% and 92% maize sell, control over maize income and spending maize income decisions are joint
- Gender and pesticides use decision making in Ethiopia and Kenya

The study conducted in the two countries confirm that women seem to have less role in decision making related to pesticides. Majority of households made *joint decision* over use of maize income.

B) Project indicators and Monitoring & Evaluation

The topic evaluates how IPM grain project reaches to the farmers and dissemination of improved varieties based on gender segregated data (as June 2017).

Indicators	Maize IPM			Rice IPM			Chickpea			Overall		
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total
Number of rural households received information about maize IPM (reached farmers)	14,468	4,445	18,883	2,770	1,080	1,690	8	2	10	17,246	5,527	22,773
Number of farmers using IPM in maize/Rice/Chickpea (130	46	176	277	108	168	8	2	10	415	156	571
Number of <i>hectares</i> under IPM maize/Rice/Chickpea	12.5	9.06	21.56	27	10	37	0.37	0.042	0.42	39.878	19.102	58.98
Number of rural households benefit directly from IPM maize/Rice/Chickpea	780	276	1,056	1,662	648	2310	48	12	60	2,490	936	3,426
Number of women's groups using IPM		31	31								31	31
Number of maize/rice/chickpea IPM technologies/practices under field testing			2			1			2			5
Number of maize/chickpea/rice IPM technologies/practices available for transfer			2						2			4
Number of individuals receiving long-term training (PhD/MSc)	2	2	4	3	0	3	2	0	2	7	2	9
Number of individuals received short-term training	269	50	319	16	15	31	42	15	57	327	80	407

Gender and participation in IPM demonstration



- 156 women and 415 men are directly involved in demonstrating IPM technologies in the 3 project countries
- Women are demonstrating IPM technologies on 19 hectares of land and men on 40 hectares.
- 31 women groups are involved in demonstrating IPM technologies
- 2 females and 7 males students are benefiting from the project

4.2 Capacity building: creating the next generation IPM leaders

The capacity building package of the project goes far beyond the target. These includes: Short- term trainings, Long- term trainings, **field days and dissemination of promotional materials**. Short term trainings provided on the three crops. On Maize 72 trained in Ethiopia, 31 in Kenya and 30 in Tanzania. On Rice 31 trained in Tanzania and on chickpea 27 trained in Ethiopia. Field days attendees (147 in Ethiopia, 132 in Kenya, 60 in Tanzania for Maize respectively and 91 for Rice in Tanzania).

Under the long term training package the project is supporting nine students (4 PhD and 5 MSc) from the three countries universities. Four are from Ethiopia, 3 from Kenya and 3 from Tanzania. Of which 2 are Female. The presentations by students addressed major issues in IPM, including the new pest (Fall Armyworm) shaking the East Africa region as well as the whole continent.

4.2.1 Distribution and Biology of the Fall Armyworm in Kenya

By Josephine Nawire Simiyu, MSc student, University of Eldoret, Kenya



The presentation addressed basic issues from the introduction to problems, objectives of the study as well as methodology and results on the Fall Armyworm invasion. Josephine also demonstrated the level of spread, damages the pest is causing, specific features and morphology. In the methodology section; crop damage assessment (stratified random sampling technique, survey in selected countries, leaf damage), questionnaires used (random sampling technique, affected farmers at village levels and level of FAW damage quantified) and monitoring mechanisms, such as moth traps baited with four commercial pheromone lures, lures placed in 4 sites using Latin square technique and data collected every 14 days.

Similarly the Life Style on different crops, mainly Maize, Sorghum, Rice, Common bean and Tomato. The strain analysis also part of methodology demonstrated Larvae collection from Maize fields, moth traps installation, sample preservation and DNA analysis to confirm the species of the FAW. Finally the damage and coping strategy presented.

The following are coping strategy used by farmers.

- The whole of farmers maize crop infested by FAW
- Farmer decided to feed his livestock with FAW infested maize crop after losing hope of any harvest
- Farmers use different indigenous technologies like ash to control the pest
- Most farmers are not using the recommended dose of pesticides leading to an overdose of chemicals thus scorching the leaves

4.2.2 Evaluation of microbial-fungicides for the control of rice blast disease in Tanzania

By Ibrahim Hashim (PhD student) Sokoine University of Agriculture (SUA)

Introduction

Rice blast disease (RBD) is among the most economically important disease that reduces rice yield in Tanzania. It is caused by *Pyricularia oryzae*. The damage is in all growth stages of rice plants (Pooja and Katoch, 2014). 60% of the yield losses in Kenya and 38% in Tanzania have been reported (Kihoro *et al.*, 2013 and Chuwa *et al.*, 2015).

Resistant rice varieties, fungicides and cultural practices are controlling mechanisms. The most effective RBD control is the use of resistant cultivars. However, the resistance tends to be broken down as *P. oryzae* develops new races over short time.

Persistence use of fungicides result in developing pathogen resistance and negative effect to the environment and human healthy. RBD resistant cultivars should be used in combination with other control strategies that are effective and environmentally friendly. Foliar spray and seed treatment with bio fungicides is a safe and effective method. *Trichoderma harzianum*, *T. viride* and *Bacillus subtilis* have been reported to reduce RBD incidence by 70% in India (Singh *et al.*, 2012; Jayaraj *et al.*, 2004). In Tanzania, *T. asperellum* and *B. subtilis* are used for foliar diseases of ornamental plants and vegetables (Real IPM Tz, personal communication). However, no report on the use of *T. asperellum* and *B. subtilis* for controlling RBD in Tanzania.

This study aimed at an in vitro evaluation of *T. asperellum* and *B. subtilis* for the inhibition of growth of *P. oryzae*. The laboratory of SUA, commercial *T. asperellum* and *B. subtilis* from RealM, Nairobi, and also other materials and methods used for the experiment. The experiment also compares the interaction between inhibition method and temperature. The following are major results of the experiment on the effect of growth inhibition, concentrations and temperature on radial diameter growth of *P. oryzae*

- Significant differences were observed between inhibition methods and temperature
- Interaction between inhibition method and temperature was also significant
- No Significant different observed between *Trichoderma* and *Bacillus*

Conclusion

T. asperellum and *B. subtilis* were found elite in inhibition of radial growth of *P. oryzae* in dual inoculation. These two bio-control showed a very high antagonistic activity as compared to synthetic fungicide. The inhibition of radial growth of *P. oryzae* can be influenced by temperature and inhibition method.

Planned and ongoing Activities for 2017/2018

S/N	Activity	Time
1.	In vivo assessment of <i>Trichoderma asperellum</i> and <i>Bacillus subtilis</i> against <i>Pyricularia oryzae</i> on inoculated rice plants	Ongoing
2.	Evaluation of the efficacy of selected seed treatment methods on rice blast disease	Oct - Nov 2017
3.	Determination of the effect of rice blast disease on yield of upland rice genotypes grown in Tanzania	Jan - Jul 2018
4.	Field survey to determine the incidence and severity of rice blast disease in upland rice ecosystem	March -May 2018

4.2.3 Efficacy of different mycopesticides and botanical extracts in control of Rice stem borers in Irrigated low land rice ecosystem in Tanzania

By Bonaventure January (PhD student), Sokoine University of Agriculture

Introduction



Rice (*Oryza sativa* L.) is the staple food for more than half of the world's population. Abiotic and biotic stresses are known to affect rice production in Tanzania. Of various biotic stresses, rice stem borers have been reported as most destructive pest among insects affecting rice.

No recommended methods for management of rice stem borers in Tanzania. Use of bio-control agents such as mycopesticides and botanicals are potential remedies to stem borers problems and could make better alternative to pesticide based management. The current study therefore aimed at assessing the effectiveness of selected mycoinsecticides (*Metarhizium anisopliae* & *Beauveria bassiana*) and botanicals (*Derris elliptica* & *Neuratanenia mitis*) in controlling rice stem borers.

Materials and Methods

The study conducted at Sokoine University in screen under artificial infestation using SARO5 rice variety as experimental unit in 2017 and six treatments. Preparation of botanicals, infestation of plants with stem borers, data collection were highlighted in detail as part of the study methodology. The experiment result revealed that Higher grain yield of 6.387t/ha, 5.725t/ha, 5.725t/ha and 4.85t/ha respectively for MA, BB, NM and DE treated plots which was as close as 7.45t/ha for Cypermethrin treated plots was recorded when compared to the untreated control (2.837t/ha). Moreover, significant differences in yield loss recorded due to *C. partellus* in all the plots comparing to untreated control ($P<0.01$). Plots treated with *M. anisopliae* recorded the lowest yield loss (10.69%). This was followed by *B. bassiana* (19.7%), *N. mitis* (27.58) and *D. elliptica* (32.23).

Conclusion

- The results from this study indicated that Mycopesticides (*M. anisopliae* and *B. bassiana*) and Botanical extracts (*D. elliptica* and *N.mitis*) were effective in reducing the damages caused by rice stem borers at very low concentration rate
- The treated plots with 2 mycopesticides and 2 botanical extracts had the lowest percentage of dead hearts, white heads incidence with high number of productive panicles and grain yield as compared to untreated control
- Therefore it can be used in rice stem borers IPM programme as alternative to synthetic insecticides

2017/2018 plan of activities

- Screen house trial (2nd season trial) : Efficacy of *mycopesticides and Botanical extracts* against rice stem borers by Sept. 2017
- Field diagnostic survey (Dry season): To assess the incidences, species abundance and damages associated with rice stem borers in farmers' fields by Oct. 2017
- Field trial: Effects of spacing and nitrogen fertilizer on incidences and damage of stem borers by Aug. 2017
- Field trial: Efficacy of *mycopesticides and Botanical extracts* against rice stem borers by Aug. 2017

4.2.4 Endophytes associated with rice in Tanzania and their interaction with rice pests

By Nana Amiri, MSc Student, University of Dar Es Salaam

Introduction

Rice (*Oryza sativa* L.), which has two cultivated subspecies, *indica* and *japonica*, is one of the leading food crops in the world and staple for more than half the world's population. Tanzania is the second largest rice producer and consumer after Madagascar (FAO, 2001), whereas rice is among the major sources of employment, income and food security. Endophyte is a fungi or bacteria that inhabit the interior of plants especially leaves, roots, branches and stem, showing no apparent harm to the host.



Stemborer is any insect larva or arthropod that bores into plant stem.

It can destroy rice plant at any stage from seedling (Deadhearts) to maturity (Whiteheads). Six species of stem borer attack rice. These are the yellow stem borer (*Scirpophaga incertulus*), white stem borer (*Scirpophaga innotata*), striped stem borer (*Chilo suppressalis*), gold-fringed stem borer (*Chilo auricilius dudgeon*), dark-headed striped stem borer (*Chilo polychrysa*), and the pink stem borer (*Sesamia inferens*).

Statement of the problem

In Tanzania, rice is the third most important food crop after maize and cassava. The Tanzanian rice production currently stands at only 1.8 tons per hectare (t/ha) compared with 2.5 t/ha for Africa as a whole and 4.4 t/ha in Asia. Nevertheless, this crop is affected by diseases - Blast -*Pyricularia oryzae* (40-75%), Brown leaf spot -*Cochliobolus miyabeanus* (12-43%), Bacterial leaf blight -*Xanthomonas oryzae pv oryza* (20-60%) and RYMV viral disease transmitted from infected to healthy plant by insect vectors (10-100%).

Stemborer is another serious problem which cause loss in rice production in TZ-about 37%. For quite some time now, it has been demonstrated that fungal endophytes do decrease impacts of insect herbivore on the grasses.

Objective of the study is to assess resistance of rice that has endophytic fungi to herbivory by stemborers. The study also intends to increase agricultural use of endophytes to produce crops that grow faster and are resistant than crops lacking endophyte. It also will enhance the use of fungal endophytes to decrease impacts of insect herbivore on the grasses, hence decrease the use of chemical pesticides.

Sample collection to cleaning under tap water, incubation and identification of species are part of the methodology the study uses.

4.2.5 Seasonality, biology and management of chickpea pod borer

By Tarekegn Fite, PhD student, Ambo University

Introduction



Yield level of chickpea is constrained due to insects & fungi. Chickpea pod borer is key pest heavily damaging the production. Pod damages 26.5% in Ethiopia and causes 400kg/ha grain loss. The favourable condition for pod damage is 90-95%.

Statement of problems: initiatives are highly relied on pesticides, while indigenous knowledge & perceptions not yet identified & incorporated. Biology, population genetic structures, monitoring and evaluation of bio pesticides are not exhaustively investigated.

Objectives the study: to develop eco-friendly and economically viable IPM of Chickpea Pod Borer, *Helicoverpa armigera* in Ethiopia.

Examining the biology of Chickpea pod borer on Selected Host Plants under Laboratory conditions, examination of general procedures (data collection, Quarantine procedure and stock colony) and stock rearing of the insects are activities carried out. The result of comparative analysis on nutritional indices, development stages (fourth and fifth instars), and biological parameters of pod borer on Chickpea, Fababean and Tomato demonstrated using graphs and tables.

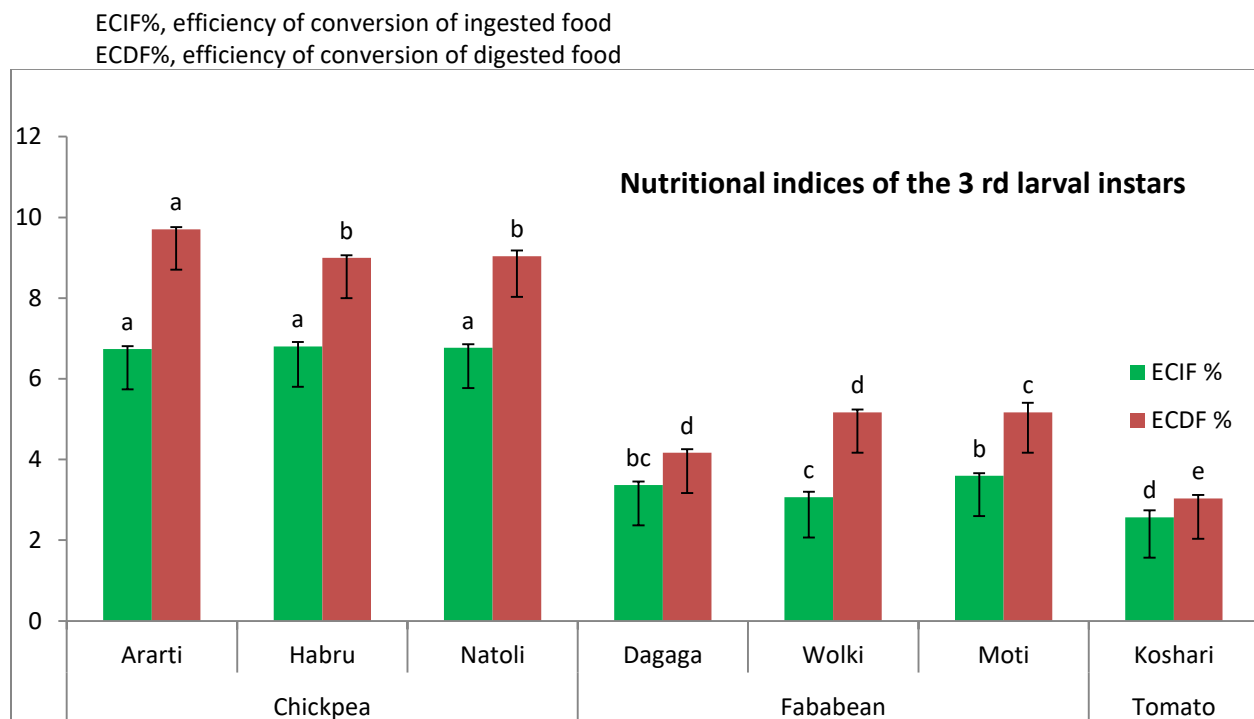


FIGURE 1. Nutritional indices of third instar larvae of *H. armigera* on different chickpea/Fababean Varieties & tomato

Materials and methods

Experimental site, conducting EPF at AU, insect rearing, use of quarantine protocols (for plastic green house and lab separation Virulence testing against *H. armigera* larvae instars of inactivated and DSS larvae), etc. were methods used and results came out of the experiment accordingly.

Lessons:

- Field damage & the economic importance of *H. armigera* in Ethiopian context
- Dependence of farmers on insecticides to manage *H. armigera* in Ethiopia (due to absence of other alternatives), chemicals are misused, no dose, no safety protocols; un protective, ...
- Potential of EPF in the management of *H. armigera* under laboratory condition
- Determining the food utility of *H. armigera* (consume, ingest, digest, convert to tissue and growth); host preference.
- Constructing the life table of *H. armigera* from laboratory reared

Challenges

- Lack of isolated and protected, self-regulating laboratory
- Delay in supplying of artificial ingredients (absent from local suppliers)
- Policy issues (importing of biological control agents); the Ethiopian government don't allow) to use them under field condition

Plan for 2017/2018

No	Chapters/Activities	Year/months, 2017/2018
1.	Evaluation of Bio-rational based IPM for the Management of pod borer, <i>Helicoverpa armigera</i> (Hubner) (Lepidoptera: Noctuidae) in Chickpea under Field condition	July-Oct (2017)
2.	Farmers Perceptions, Knowledge and Management Practices on Major Chickpea Insect Pests in Some Selected Districts of Ethiopia	Nov-Feb (2017/18)
3.	Population Genetic Structure of Pod Borer, <i>Helicoverpa armigera</i> (Hubner) (Lepidoptera: Noctuidae) Infesting Various Host Plants Grown in Ethiopia	September-Oct (2017)
4.	Population dynamics of pod borer, <i>Helicoverpa armigera</i> (Hubner) (Lepidoptera: Noctuidae) in Chickpea growing areas of Central Ethiopia	July-Oct (2017) July-Oct (2018)

4.2.6 By In vitro evaluation of bio-agents against chickpea Fusarium wilt disease

By Gezahegn Getaneh, PhD student, Jimma University

Introduction



Pulse crops share 13.24% of the grain crop area and 10.38 of the grain production (2015/16). *Fusarium oxysporum* f. sp. *ciceri* is the most important biotic stress for pulse crops in Ethiopia. It causes severe yield loss (10–15%) in chickpea which may rise to 60–70% (Jalali & Chand, 1992). Under favorable environmental conditions, the disease can completely destroy the crop (Halila & Strange, 1996). The genus *Trichoderma* includes the most widely used bio-control agent of soil-borne, seed-borne and other plant diseases (Chet *et al.*, 1979; Chet and Baker, 1981).

Objective of the study: To evaluate the antagonistic property of *Trichoderma isolates* against *Fusarium oxysporum* f.sp. *ciceri* at different temperature ranges.

Materials and Methods:

- Antagonistic potential of the *Trichoderma* isolates were tested by dual culture technique on PDA.
- Pure culture of the wilt fungus isolates were used
- At opposite ends at equal distance from centre were incubated at $25 \pm 1^\circ\text{C}$
- Percent growth inhibition was recorded on 3rd to 8th day
- The radial growth of the test pathogen were measured and analysed at different temperature ranges viz., 5°C , 15°C , room temperature (23°C), 30°C and 40°C were tested.

See table below for the result of radial growth after incubation

	Bio-control Agent	Average Radial Growth of the pathogen (mm) at different Temp on 8 th day			Inhibition (%) At Different Temp		
		15°C	23°C	30°C	15°C	23°C	30°C
1	<i>T.atroviride</i>	1.50	2.13	1.27	68.28	54.29	70.8
2	<i>T.longibrachatum</i>	1.43	1.87	1.00	69.66	60.00	76.9
3	<i>T.harzianum</i>	1.60	2.07	1.47	66.90	55.71	66.2
4	<i>T.viride</i>	1.60	1.87	1.13	65.52	60.00	73.8
5	<i>T.hamatum</i>	1.61	1.93	1.67	66.90	58.57	61.5
6	<i>T.asperilum</i>	1.61	1.83	1.40	66.90	60.71	67.7
7	Control	4.85	4.67	4.33	0	0.00	0.0

Conclusion

- Most of the *Trichoderma* isolates were found significantly different in their radial growth and to inhibit the wilt pathogen at in-vitro test on different temperature ranges.
- The temperature ranges may help to correlate with soil temperature of the growing areas
- The hottest temperature (40°C) and the lower (cooler) 5°C were not suitable for Ethiopian collection isolates to grow.
- Relatively *T. viride* has got better performance in its growth ratio and efficacy.
- Two of the bio-agent isolates will be further tested at in-vivo on micro plot with standard design and carriers to enhance their efficacy.

4.2.7 Evaluation of Different Management Options against Fall Armyworm in Ethiopia

By Birhanu Sisay, MSc Student, Haramaya University

Introduction



More than 40 species of insects have been recorded on maize in the field. *S. frugiperda*, is one of the major insect pests causing substantial yield losses of maize. FAW is a key pest of maize and many other crops throughout in the United States. It was first detected in Africa (Nigeria) in 2016 and spread to more than 20 African countries within a year.

Statements of the problem

- The pest damaged more than 217,218 ha of maize crop in Ethiopia.
- To control *S. frugiperda*, MoA distributed more than 100,000 liters of insecticide.
- Even though, the efficacy of the insecticide is under questions.
- There is no FAW control method at the moments.

Objectives of the study

- To Screen the efficacy of insecticides, bio-pesticides, botanicals and pheromone traps against fall armyworm.
- To determine the parasitoids associated with fall armyworm

About 12 synthetic insecticide against FAW screened to design treatment strategy. Data collected on the number of egg, number of live larvae, and number of pupa, damage rating and yield data.

Potential insecticides, bio-pesticides, botanicals pheromone lure and parasitoids will be identified and used as the control of FAW are expected outcomes of the study.

4.2.8 Endophytes associated with Maize and Pathogenicity of selected Entomopathogenic Fungi against the spotted Stemborer *Chilo partellus*

By Denberu Kebede, MSc student, Addis Ababa University.

Introduction



Despite the increased need of maize, its production gets biotic constrains such as the parasitic weed; genus *Striga* and Lepidoptera stemborers (*Chilo partellus*, *Busseola fusca*, *Sesamia calamistis*, *Eldana saccharina*). The crop yield loss due to stem borers vary from 0-100% (Sylvain *et al*, 2015). The loss in maize ranging 10-88% depending on crop cultivar stage and severity of attack (Midega, 2013).

Lepidopterous stem borers *B.fusca* and *C.partellus* damaging insect pests of maize and sorghum. **Chilo partellus** is competitive colonizer in many areas of eastern and southern Africa which can displace native species. It will partially displace *B.fusca* and become predominant borer in the continent (Sylvain *et al*, 2015). Cultural, chemical and biological control methods are available control mechanisms.

Endophytes -Almost all plants are known to harbor endophytes. Reservoirs of novel bioactive secondary metabolites serves as potential candidates for anti-microbial, anti-insect and anti-cancers (Gouda *et al*, 2016). Distribution and population structure of endophytes is considerably affected by genetic background, environmental conditions and age of the host plant (Jia *et al*, 2016; Silva *et al*. 2014). Hence, knowledge of endophytic microbial diversity will facilitate the search for bacteria and fungus capable of exerting antagonism towards insect and pathogen attack.

Objective(s) of the study

- to explore noble maize endophytic fungus and bacteria
- to evaluate endophytic fungi and bacteria towards the control of *Chilo partellus*
- to evaluate the endophytic potential of selected EPF and newly obtained maize endophytes

Materials and Methods

Isolation of maize endophytes, Isolation of EPF and Bt from soil, insect collection, rearing, insect feeding and mortality study, in-vivo evaluation of the newly identified maize endophytes and local EPF for their endophytic potential and molecular identification.

Achievements made

- Seven maize varieties were obtained from two institutes (from EIBD and APPRC) and planted at different sites; namely: MARC, BARC and APPRC (Chelia Experimental site)
- Soil samples were collected around West Wolega and Assosa. The samples were analyzed to isolate EPF using galleria bite Method and 12 EPF isolates were obtained. Of which 8 expected to be *Beauveria*, 4 expected to be *Metarhizium*
- Rearing of *Chilo partellus* were done using its natural host, Maize

Plan for 2017/2018

Main activities	Sub activities	Expected output	Month of implementation
In-vitro evaluation of EPB and EPF on <i>Chilo partellus</i> feeding and mortality	<ul style="list-style-type: none">• Isolation of Bt from soil• Culture re initiation and purification• Feeding and mortality evaluation	<ul style="list-style-type: none">• Pure cultures of Bt and EPF• Specific microbial isolates with feeding and mortality effects	07-11/2017
Maize endophyte isolation	<ul style="list-style-type: none">• Sample collection from the study sites• Isolation of endoph	Pure endophytic microbial cultures	07-11/2017
In-vitro evaluation of maize endophytes on <i>Chilo partellus</i> feeding and mortality	<ul style="list-style-type: none">• Microbial broth suspension preparation• Feeding & mortality evaluation	Specific endophytic microbial isolates with feeding and mortality effects	07-11/2017

4.2.9 Economics of Rice, Maize and Chickpea IPM in Kenya, Ethiopia and Tanzania

By Josphat Korir, PhD student, University of Nairobi

Introduction

Maize, rice & chickpea staple & cash crop for majority of Sub-Saharan Africa inhabitants. Maize contributes 15% of Kenya's agricultural GDP (Kang'ethe, 2011). Maize Production constrained by stem borer, up to 20-40% of pre-harvest losses. Stem borer causes maize yield losses in Kenya worth about Ksh. 7.2billion annually (Odeno et al., 2003).

Chickpea pod borer losses can be as high as 75%-90% of seed yield (Rashid et al., 2003). It causes severe losses up to 100% in spite of several rounds of insecticidal applications (Sarwar et al., 2010).

Rice stem borer causes yield losses of up to 60% in Africa and Asia.

Statement of the problem

- Much of the agriculture research focus on agronomic practices for high yields, assumption that pest problems can be easily eliminated with pesticides (Debass 2000; Tefera et al 2013).
- Research and experience show that intensive, widespread use of pesticides worsen pest problems, pesticide resistance (Debass 2000).
- IPM, alternative strategy reducing pesticide load in the environment & increasing pest control effectiveness (Hristovska 2009).
- Chickpea and rice stem borer IPM under development by icipe and partner research institutions in East Africa and also efforts to scale up push-pull technology are ongoing. However, adoption potential in East Africa is largely unknown.
- This study seeks to fill this gap in knowledge by assessing WTP of farmers for grain IPM & Ex-ante assessment of its economic impact in East Africa.

Objectives of the study

To assess of adoption and economic impacts and adoption of PPT practices in Kenya, Ethiopia and Tanzania.

Methodology and methods

On the basis of random utility theory, several methodologies that fits to the objectives used. These include: double bound contingent valuation method, cost benefit analysis and economic surplus analysis and damage abatement function.

Key results:

a) WTP for maize and chickpea IPM in Ethiopia

Almost all (>95%) sampled chickpea and maize farmers were WTP for IPM. Incremental acreage on which farmers were willing to produce crops under IPM. Cumulatively, farmers were willing to allocate slightly more acreage to chickpea than maize.

b) Major maize pests in Ethiopia

- Stem borer was major pest for >80% of farmers.
- Approx 63% reported termite as the serious problem.
- Only 20% & 23% reported striga weed and aphids respectively as major pests.

c) Major Chickpea pests in Ethiopia

- Pod borer was major pest in about 60% of farms.
- Approx. 17% & 19% reported cutworms and nematodes respectively as major pests.
- Aphids & whiteflies was not a serious problem (<2% infestation reported).

d) Major Maize pests in Kenya

- Stem borer was major pest in about 81% of farms.
- Approx. 38% reported cutworms and Aphids infestation on their maize.
- Termites were reported in approx. 27% of farms & only 3% reported striga weed infestation.

The study conducted comparative analysis on major gender issues, decision making for Maize production (in Ethiopia), pest management and income and push-pull technology adoption practices in Kenya.

Gender issues

- Fewer women than men make decision on pesticide expenditure, actual purchase and apply pest control methods
- Decision with regards to utilization of maize sale proceeds in both countries made jointly in majority of the households.

- Majority of decisions are made jointly.

Conclusion

- Ownership of livestock, dual benefit derived from pest control and animal fodder
- Gender, male headed HHs more likely to adopt than female headed. Probably resource ownership and control, perennial Desmodium crop have bearing on resource control
- Group membership enhance knowledge sharing and consequent adoption, thus positive influence for members
- Education and yield have influence on bio-pesticide adoption

Ongoing and planned activities

- Developing of WTP manuscripts for rice, maize and chickpea IPM in Tanzania, Kenya and Ethiopia. Expected to be complete by September, 2017
- Development of manuscripts on ex-ante economic impacts of grain IPM technologies in East Africa. Expected to be completed by December, 2017
- Collect data and develop manuscript on productivity of various grain IPM technologies, expected to be completed by July, 2018.

4.3 IPM Communication Approaches

This section deals with the communication approaches and activities of the project. Presentation entitled “Rice, Maize and Chickpea IPM project Approach for Communications” by *Desalegne Tadesse, Communication Expert, icipe-Ethiopia*

The purpose of communicating the project, the IPM communication vision, how and what to communicate are the essence of discussion under this topic. The main objective is to help the IPM project on Rice, Maize and Chickpea to achieve its research and development outcomes.

IPM communication vision is to make a strategic and significant contribution to delivering and communicating research outcomes. This can be achieved through strategic planning that is focused on IPM project outcomes and impact pathways. Strategic and complementary communication helps highlight success stories that helps to bring behavioral changes in next-users while expanding the program’s reach.

The following are major communication activities have been taking place

1. **Facilitate and manage communication activities.** These includes, internal team communications, interactive knowledge-sharing platforms and communities of practice, databases and knowledge, repositories, website content management, branding and acknowledgement, event management and facilitation.
2. **Document, synthesis and analysis.** Interviewing, research, writing, translating and editing: blogs, flyers, working papers, policy briefs, research reports, workshop reports, press releases, promotional items. Multimedia production (photos, videos, presentations and infographics) and monitoring and evaluation
3. **Engagement with next users.** Media outreach: identify opportunities and stories, engage with journalists, develop press releases, and arrange interviews. Social media outreach online (twitter, Facebook, LinkedIn).



ICIPE outreach channels: the website, newsletters, annual reports, exhibition booths and Slide share. In addition, project and partner outreach channels (mini-websites, emailing lists, and blogs) and workshops and seminars are part of engagements.

Plan for 2017/2018

- Producing outcome stories, repackaging, translating, and communicating the outcomes
- Communicating about the science and strengthening engagements with stakeholders and partners and messaging.

5. Field day at the IPM sites in Hawassa District, Ethiopia



On 18 July 2017 field day took place at the IPM sites at *Dore Bafano and Jara Gelelcha villages in Hawassa* to observe the Push-Pull Technology for Stem Borers control. *The visitors learned about the environment friendly biological stemborer control practices through presentations and interaction with the research team and farmers at the sites as well as field visits during which the PPT practice was explained and discussed with the participants.*

“We had a serious problem of stemborer before the introduction of this technology, but now thanks to icipe we got relief. In addition to protecting our crop from pest, the technology is very helpful to livestock feed. Both the Desmodium and Brachiaria are palatable for cattle and thus, now we engaged more in fattening dairy cows. All these improve our sources of income and livelihoods”, said farmer Ogayu in Dore Bafano.



Dr. Tadele explained about the main objectives of the project and activities have been done during the visit at the farm. Farmers also shared the benefits they are getting from the project which help participants to aware of multi-benefits of the technology, such as stemborer control,



improving crop productivity and soil fertility, improving livestock feeds and its wider impacts on ensuring food security and livelihoods. Currently, 120 farmers involve in the project in Hawassa district to catalyze the testing of environment friendly and drought resilient technology to control Maize against stemborer and striga. The farmers allocated approximately 0.25 ha for the experiment. They planted Desmodium (push) between the farrows in the Mazie and Brachiaria (pull) at the border to protect the Maize from stemborers.

The district is high potential area for Maize production. Maize contributes 94.4% food and 80.3% income for farmers in the district. Despite its importance, Maize, constrained by stemborer pest causes yield loss of about 20-50%. As response to these challenges, ICIPE and partners have been testing an environmental friendly stemborer control strategy 'Push-Pull Technology (PPT)'.

6. General discussions

General discussion was the final session of the review meeting. It was facilitated by Dr. Menale Kassie. **Technical and Logistic** issues were points emphasized during the session.

6.1. Technical issues



Under this section IPM technology scaling approach, defining the size of demonstration site/plot and establishment of IPM village were major issues discussed.

Scaling up approaches: what kind of approach should we follow?

- **Use of cluster farming approach and establishment of IPM village**

Concentrating on specific village will be helpful for follow and visibility. The current experience of PPT is testing in different plots depending on the volunteerism of the farmers. Dr. Menale appreciated the project keeping the willingness of farmers, however; he suggested to motivate or encourage to join those

farmers in adjacent plots to the PPT. Once we exhaust one village and then will move on to the next/adjacent village.

How? Select champion or innovative farmers in the village give them incentives (not money) and use them for teaching other farmers or to create followers. Because teaching through fellow will be one of the best approach for out scaling.

This will help to make the management very easy as well as to lift up the visibility of the project. Let's concentrate on the neighboring farmers. He said, "You can imagine how it draw the attention of people and inspire others to see series of plots continuously covered by the PPT in one village".

So, as an option he strongly suggested to change this scattered approach and to focus on cluster farming approach in which putting technology in similar area. Of course, doing this we have to adjust/reconcile our intervention with the farmers local practices, like Maize-Desmodium and Beans, etc. The farmers should feel as it is their culture.

- **Plot size**

In order to manage easily we need to have economic sizable area. It would be important to encourage farmers to use more land for PPT. however, the minimum plot size for the PPT should not be less than 0.25 ha. This will make follow up and management easy and increase visibility.

- **Engage farmers and extension workers**

In the framework of scaling up approach we have invite farmers and extension workers for meetings. Even invite farmers which are not part of the project beneficiaries for field days. This could help to collect information and their experience.

- **Consider intercropping or mixed cropping**

Another point in terms of scaling up raised was consideration of intercropping or mixed cropping need. For instance in Kenya intercropping is normal and widely practiced. If it works in the other two countries would be also helpful to consider.

- **Identify the major threat/pest**

Look for areas specific in which stemborer is a serious problem. Evidences confirm that in Kenya and Tanzania striga become a serious problem. In such cases, intercropping will compromise for PPT. hence, let's identify the major threat- whether striga or stemborer and should act accordingly.

6.2 Logistic issues

Dr. Tadele presented outstanding issues related to logistics. These includes; seed supply, budget, trip reports and expected publications.

Seed supply: the source of Desmodium supply for Ethiopia and Tanzania is Kenya where as there is no supply source for Brachiaria. This is therefore, the Brachiaria seed has been imported from Thailand which causes difficulty to deliver on time. In this regard, Dr. Tadele urged the participants, mainly those in charge to plan ahead. Requests should be pulled as early as possible from all countries to proceed the purchasing. It will help us to know all the demand and to act.

There are potential partners who can produce the seed, so have to promote them to produce the Brachiaria seed. For example, we were informed that Wollega University produced 300kb. So, let's look for alternative rather than depending on imports.

Budget: Dr. Tadele presented on budget breakdown allocated dividing in to three disbursements for the national programs. It refers to the first year budget but still on the use for the second year. In order to

release some available budget from the first year, icipe is waiting the financial report. To this end, he urged those didn't submit financial report to do so. He also underlined that there is an opportunity to consider and release additional fund from the first year for those coming up with activities. The release of budget will be determined by the speed of partners financial report to icipe. He underlined that this opportunity will apply also for students.

Reporting: mainly be focused on the trip report. Participants told to use the standard template for the travel report and to submit on time. This is a requirement for USAID funded projects. We have to plan a month ahead and should submit within 15 days after the trip. If two/more people travel together for similar mission, joint trip reporting also possible.

Publications: Finally Dr. Tadele called the participants to think about the publications. Since appropriate data is available, it is better to think of publications. It could be working paper, poster, etc.

6.3 Discussion outcomes

Under the framework of technology scaling up approach, the meeting agreed to:

- a) To establish IPM village
- b) To identify major threat/pest in the three countries and adjust the practice of PPT
- c) Defined IPM minimum demo plot size defined, i.e. 0.25 ha

Under logistics

- a) To plan ahead to boost the purchasing of seeds and also to look for alternative supply chains
- b) To manage the budget properly and submit financial reports on time
- c) To use the standard travel report template and submit on time
- d) To generate publications

7. Conclusion

It is plausible to argue that the meeting was an important step to review the progresses made in the first year, to capture common understanding about the project and also to plan for the coming years. The participants exchanged insights through the discussions and agreed to move forward bringing synergies together. In his closing remarks, Dr. Tadele, thanked the partners, mainly IPM Innovation Lab, KARLO, Hawassa University, and EIAR for their valuable supports. In addition, he acknowledged organizing team who made the meeting more fruitful and all participants for their valuable contributions. Dr. Tadele winded up, by appreciating the students contribution to the science and impacts on the livelihoods.

With the same talking, Dr. Sophia shared her impressions, "it was really a knowledge sharing platform. The two days thoughts and field observation conform how the project is translated into reality on the ground transforming the livelihoods of smallholder farmers via integrated pest management." Apart from several positive progresses, she applauded once again her inspiration with the capacity building supports the project providing. She also affirmed that her office is very keen and continue providing the necessary supports for the realization of sustainable IPM in the region. Finally, Dr Amer Fayad, acknowledged that the workshop was successful and lots information were shared among partners, adding that the project is impacting the beneficiaries at large.

8. Annexes: List of participants and meeting agenda

1. List of participants

No	Name	Organization	Contact
1.	Dr. Tadele Tefera	Icipe-Ethiopia Head	ttefera@icipe.org
2.	Dr Fayad Amer	Associate Director, IPM Innovation Lab, USA	afayad@vt.edu
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8.	Bonaventure January	PhD student, Sokoine University of Agriculture	bojatetesha@gmail.com
9.	Paddy Likhayo	KARLO	paddy.likhayo@gmail.com
10.	Dr. Menale Kassie	Head of Social Science and Impact Assessment Unit, icipe-Kenya	mkassie@icipe.org
11.	Korir, Josphat	PhD student, University of Nairobi	jkorir@icipe.org
12.	Dr Ferdu Azerefe	Hawassa University	azeref@gmail.com
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20.	Denberu kebede	MSc student, Addis Ababa University	denberuk@gmail.com
21.	Nana Amiri	MSc Student, University of Dar Es Salaam	nanaamiri91@gmail.com
22.	Prof. William Hutchison	University of Minnesota	hutch002@umn.edu ; lwasilwa@gmail.com
23.	Geoffrey Muricho	Economist icipe-Kenya	gmuricho@icipe.org
24.	Nebiyu Solomon	Program Management Officer (icipe-Ethiopia)	N.Solomon@cgiar.org
25.	Desalegne Tadesse	Communications Officer (icipe-Ethiopia)	dtadesse@icipe.org

2. Meeting Agenda

Rice, Maize and Chickpea IPM Project for East Africa

Annual Review & Planning Meeting

Haile Resort, Hawassa, Ethiopia, July 16-18, 2017

**Arrival to Addis on July 15 (overnight at Friendship Hotel); July 16 morning travel to Hawassa;
July 17 & 18, review and planning meeting at Haile Resort; July 19 morning field visit,
afternoon back to Addis; July 20 departure**

Activity	Time	Responsible
Day 1: July 17, 2017		Chairman: T Tefera
Registration	7:30-8:00	Nebiyu Solomon/ Desalegne Tadesse
Introduction of participants	8:00-8:10	Chairman
Welcoming remarks by icipe	8:10-8:15	Dr Tadele Tefera, icipe Ethiopia
Welcoming remarks by IPM Innovation Lab	8:20-8:30	Dr Fayad Amer, Associate Director, IPM Innovation Lab, USA
Welcoming remarks by KARLO	8:30-8:40	Dr Lusike Wasliwa, Director Crop Systems, KARLO, Kenya
Welcoming remarks by ARI	8:40-8:50	Dr Sophia Kashenge, Centre Director, Dakawa Research Centre, Tanzania
Opening remarks by EIAR	8:50-9:00	Dr Eshet Derso, Director, Crops Research, Ethiopia
Objective of the meeting and brief over view of achievements	9:00-9:30	T Tefera, Rice, Maize and Chickpea IPM for East Africa Project Leader
Kenya		Chairman: Dr Sophia Kashenge
Maize stem borers IPM in Kenya	9:30-9:45	Dr Paddy Likhayo, KARLO
Distribution, damage and host range of fall armyworm in Kenya	9:45-10:00	Josephine Wetangula, MSc student, Moi University, Eldoret, Kenya
Discussion (10 min)	10:00-10:10	
Tanzania		Chairman: Dr Lusike Wasliwa
Maize stem borers and striga management in Tanzania using the push pull technology	10:10-10:25	Nsami Elibariki
Health Break	10:25-10:45	
Screening and verification of rice varieties against blast, yellow mottle rice virus and blight diseases	10:45-11:00	Dr Charles Chuwa
Discussion (10 min)	11:00-11:10	
		Chairman: Dr Eshetu Derso
Integrated management of rice blast in Tanzania	11:10-11:25	Ibrahim Hashim, PhD student, Sokoine University of Agriculture
Integrated management of rice stem borers in Tanzania	11:25-11:40	Bonaventure January, PhD student, Sokoine University of Agriculture
Endophytes associated with rice in Tanzania and their interaction with rice pests	11:40-11:55	Nana Amiri, MSc Student, University of Dar Es Salaam
Discussion (15 min)	11:55-12:10	
Ethiopia		Chairman: Chairman: Dr Ferdu Azerefeqn, Hawassa University

Maize termite IPM in Bako	12:10-12:25	Dr Girma Demissie, Center Director, Bako EIAR
Chickpea wilts, blight and pod borer IPM in East Shoa	12:25-12:40	Asrat Zewdie, Plant pathologist EIAR, Debrezeit
Discussion (10 min)	12:40-13:00	
Lunch	13:00-14:00	
		Chairman: Dr Paddy Likhayo, KARLO
Seasonality, biology and management of chickpea pod borer	14:00-14:15	Tarekegn Fite, PhD student
Integrated management of chickpea diseases, Fusarium wilt and Ascochyta blight, in Ethiopia	14:15-14:30	Gezahegn Getaneh, PhD student
Discussion (10 min)	14:30-14:40	Discussion (10 min)
		Chairman: Dr Charles Chuwa, ARI
Developing management options for fall armyworm in Ethiopia	14:40-14:55	Birhanu Sisay, MSc Student, Haramaya University
Endophytes Associated with Maize and Pathogenicity of Selected Entomopathogenic Fungi against the Spotted Stem Borer <i>Chilo partellus</i>	14:55-15:10	Denberu Kebede, MSc student, Addis Ababa University
Discussion (10 min)	15:10-15:20	
Health Break	15:20-15:40	
		Chairman: Dr Girma Demissie
Economics of rice, maize and chickpea IPM in East Africa	15:40-15:55	Josphat Korir, PhD student, University of Nairobi
Impact of women empowerment and PPT technology adoption on women nutrition and farm labor	15:55-16:10	Geoffrey Muricho, Economist icipe
Discussion 10 min	16:10-16:20	
		Chairman: Nsami Elibariki, In-charge-National Biological Control, Tanzania
Digital IPM: Developing pest diagnosis using mobile app	16:20-16:35	Prof William Hutchinson, University of Minnesota
Communication plans	16:35-16:50	Desalegne Tadesse, Communication Expert
Discussion 10 min	16:50-17:00	
End of day 1	17:00	
Tuesday July 18, 2017	8:00-11:00	Field visit to PPT demo sites
		Chairman: Dr Fayad Amer
Base line study reports (chickpea, maize and rice)	14:00-14:20	Dr Menale Kassie
Reports on indicators and gender mainstreaming	14:20-14:40	Dr Menale Kassie
		Chairman: Dr Menale Kassie
General discussions	15:00-16:00	Participants
July 19, 2017	8:00-12:00	Travel back to Addis

Workshop Dinner at Yodi Abbysinia / 2000 Habesha Restaurant	From 18:00	Nebiyu Solomon
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