Supporting the Management of Fall Armyworm in Africa and Asia: Best Practices and Lessons Learned

Speakers:
- Robert Bertram, USAID Bureau for Resilience and Food Security
- Joseph Huesing, Huesing Agricultural & Educational Consulting LLC
- Dan McGrath, Oregon State University
- Prasanna Boddupalli, The International Maize and Wheat Improvement Center
- Sarah Page, Catholic Relief Services
- Paul Jepson, Oregon State University

Moderator:
- Zachary Baquet, USAID Bureau for Resilience and Food Security

Date:
- June 18, 2020
Robert Bertram, USAID Bureau for Resilience and Food Security

Rob Bertram is the Chief Scientist in USAID’s Bureau for Resilience and Food Security, where he serves as a key adviser on a range of technical and program issues to advance global food security and nutrition. In this role, he leads USAID’s evidence-based efforts to advance research, technology and implementation in support of the U.S. Government’s global hunger and food security initiative, Feed the Future. He previously served as Director of the Office of Agricultural Research and Policy in the Bureau for Resilience and Food Security, which leads implementation of the Feed the Future research strategy and related efforts to scale innovations in global food security efforts, working with a range of partners. Prior to that, he guided USAID investments in agriculture and natural resources research for many years. Dr. Bertram’s academic background in plant breeding and genetics includes degrees from University of California, Davis, the University of Minnesota and the University of Maryland. Before coming to USAID, he served with USDA’s international programs as well as overseas with the Consultative Group on International Agricultural Research (CGIAR) system.
Joe Huesing, Huesing Agricultural and Educational Consulting LLC (HAEC)

Joe Huesing is an independent consulting entomologist, educator and Fall Armyworm IPM advisor. Currently he works in the area of assessing, designing and implementing IPM approaches for control of the FAW.
Dan McGrath, Oregon State University

Dan McGrath, Professor Emeritus Oregon State University, worked for three decades in Oregon’s Willamette Valley where he conducted applied research and Extension programs in vegetable production, integrated pest management, and sustainable agriculture. He served as Linn County Staff Chair for fourteen years. Since his retirement in 2016, Dr. McGrath has worked across sub Saharan Africa and Asia, helping smallholder farmers to manage Fall Armyworm in maize using an integrated pest management approach.
Prasanna Boddupalli, The International Maize and Wheat Improvement Center

Dr B.M. Prasanna is the Director of CIMMYT’s Global Maize Program and CGIAR Research Program MAIZE. Based in Nairobi, Kenya, Prasanna has been leading CIMMYT-led multiinstitutional efforts in fighting the challenges of devastating transboundary diseases and insect-pests on maize, including the Fall Armyworm.
Paul Jepson, Oregon State University

Dr. Paul Jepson, director, Integrated Plant Protection Center, Oregon State University provides expertise on pesticide impacts on beneficials and other non-target organisms and supervises the information technology experts who design and maintain the online interface. Paul’s research interests in IPM include the study of pest and natural enemy population dynamics in agricultural systems and have focused particularly on pesticide management and side effects, biological pest control and the development of ecological risk assessment for beneficial invertebrates.
Sarah Page, Catholic Relief Services

Sarah Page is a Technical Advisor for Sustainable Livelihoods and Landscapes with Catholic Relief Services. Based in Baltimore, Sarah supports global programming at the nexus of inclusive value chains, natural resource management and land restoration. She also contributes to the agency’s research and learning efforts around farmer communications, capacity building, and farmer organizational strengthening. She’s worked with smallholder coffee, horticulture and basic grains farmers in East Africa, Latin America and the United States.
Fall Armyworm

Best practices and lessons learned by USAID partners in supporting the management of Fall Armyworm

Joseph (Joe) Huesing PhD
USAID FAW Contractor
Huesing Agricultural & Educational Consulting LLC
Huesingaged@gmail.com
First detected in Nigeria in 2016 but likely in Africa Sooner.
- FAW most similar to populations from FL & Caribbean.
- Maize/sorghum biotype predominates.
FAW Will Be Endemic In Much Of The Ag World

- Migration as seen with African Armyworm & Locusts not the main dispersal process
- FAW Endemic – must be managed every year
- Multiple overlapping generations per year
- Must be managed at the farm level – GAP/IPM critical
What to expect?
FAW damage and yield loss are a function of:
- The maize variety
- The agronomic conditions under which the crop is grown (fertilizer, soil pH etc.)
- The stage of the maize attacked (seedling, early/late whorl, tassel & cob)
- The intensity of the attack (% infestation)
- The number of FAW generations in the season

Some Guidelines
- De Groote and co-workers (2020) - Kenya farmer survey data showed losses at 54% in 2017 and 42% in 2018.
- AATF GM MON810 Trials – 6 GM hybrids showed average 34% yield advantage.
- Babendrier et al, 2020 – Use of insecticide emamectin benzoate yields more than doubled.
- Prasanna et al., 2019 CIMMYT trials showed that under natural, low to moderate FAW damage levels, the yield loss of OPVs, FAW-tolerant hybrid maize, and FAW-susceptible hybrid maize was between 36% and 57% in the absence of chemical control.
- Overall, the data suggest low to moderate levels of FAW infestation lead to 10% - 50% yield reductions.
Fall Armyworm Integrated Pest Management

Maize Grain Is Your Protection Goal!

Host Plant Resistance (HPR) (Improved Maize Varieties)

Conservation Biocontrol (BioC)

Good Agricultural Practices (GAP)
- Soil Health
- Fertilizer
- Soil pH
- Planting Date

Cultural Controls

Pesticides (Conventional & Biopesticides)
The idea is NOT TO SPRAY! The idea is to spray correctly

USAID
From the American People
How Do We Make Sure The Best Science-Based Advice Is Available For Farmers?

GAP IPM Framework

Knowledge
- Help farmers & Ag specialists access Science-based Knowledge for management

Tools
- Develop & Validate Tools - Private/Public Sector

Policy
- Support policies that ensure access to and safe use of management options

Cost, Efficacy, Safety, Scalability, Sustainability
Next Level Monitoring and Scouting

Dan McGrath

Fall Armyworm Two Years Later: Learning and Implications for Future Response
PRESENTATION OVERVIEW

• High versus low density monitoring systems
• Scouting as a multi-audience educational platform
• Efficacy testing
High-Density Monitoring System

- Detect arrival (pest alert)
- Track spread, deploy resources
- Engage Community, phone
Monitoring Station as Education Platform
Demonstrate: Low-Density Networks

- Detect egg laying pressure
- Decision support (high/low)
- Promote integration
Fall Armyworm in Maize - Moth Counts
Brong Ahafo Region, Ghana 2017

Average Moths/Trap/Day

15-Apr, 29-Apr, 13-May, 27-May, 10-Jun, 24-Jun, 8-Jul

Heavy Rain

Ten sites across 39,557 km²
Scouting

- Multi-audience education
- Smallholder key messages
What do smallholders need to know?

- Just because you have FAW, does not necessarily mean you need to spray.
Mature plants? Large larvae?
What do smallholders need to know?

- Check seedlings.
- Control small larvae before they move into whorl.
Tassel pushes larvae out of whorl.
Where do they go?
What do smallholders need to know?

- Check during early cob development.
- Control larvae before they penetrate the husk.
Scouting

- Ag professional messages
- Protect crop, control cost
Assess risk of crop loss

Growth Stage
- Seedling vs Mature
- Tassel & Cob

Pest Population
- Egg laying pressure
- Larval density & size

Weather
- Heavy Rain
- Dry & Warm @ Tassel
Cost-effective scouting.
Less than fifteen minutes per hectare.
Efficacy Testing

Monitor:

- Egg laying (pest pressure)
- Maize Growth stage (vulnerability)
- Larval size (vulnerability)
KEY RESULTS TO DATE

- Widespread utilization of IPM Manual for Training of Trainers
- Key messages reaching smallholders
WHAT IS NEEDED TODAY?

Next-level Training:

• Help missions to deploy FAW 2020 IPM Manual & Training

Decision Support:

• Help transition to cost effective monitoring systems
Host Plant Resistance for Fall Armyworm Management

B.M. Prasanna

Director, Global Maize Program, CIMMYT & CGIAR Research Program MAIZE
Breeding for insect resistance in maize at CIMMYT is more than four decades old...
Source germplasm with insect resistance developed at CIMMYT-Mexico through dedicated efforts....

“We concentrate on attempting to identify and use more stable resistance to larval feeding: of the antibiosis, strong non-preference, or plant tolerance mechanisms (in order of priority), and as expressed in a no-choice situation under field conditions.”

Intensive screening of tropical maize germplasm against FAW under artificial infestation since 2017...

CIMMYT’s FAW Screening Facility at KALRO-Kiboko, Kenya

- 3124 inbred lines and 3269 hybrids screened so far against FAW under artificial infestation
- Identification/validation of promising FAW-tolerant inbred lines and pre-commercial hybrids
- Disseminated key CMLs (e.g., CML71, CML125, CML330, CML338, CML370, CML574) with native genetic resistance to FAW to partners in Africa and Asia
Important criteria:
- Foliar damage ≤5.0
- Ear damage ≤3.0
- Grain yield under FAW artificial infestation (under choice and no choice)
- Other key traits relevant for smallholders

FAW-susceptible Commercial Check
FAW-tolerant CKHFAW 180299
CIMMYT’s FAW-tolerant Pre-commercial Maize Hybrids

Ongoing On-Station and On-Farm Validation Trials in Kenya

8 promising FAW-tolerant pre-commercial hybrids + 4 FAW-susceptible commercial checks

- No-choice experiment under FAW artificial infestation at Kiboko, Kenya, in compartmentalized nethouses
- On-station trials under FAW natural infestation at six locations in Kenya: Kitale, Kakamega, Katumani, Embu, Kiboko and Mtwapa
- On-farm trials (16 sites) in Kenya under FAW natural infestation (under farmer management conditions)

The first-generation FAW-tolerant hybrids will be announced to partners in Africa in the last quarter of 2020, based on analysis of on-station and on-farm data.
Kirinyaga (Kenya) FAW On-farm Validation Trial

CKHFAW190267

WE3106
Native Genetic Resistance: Next Steps

- Similar to the MLN success story, we need to accelerate development of elite maize varieties with climate resilience and FAW tolerance in diverse genetic backgrounds relevant for Africa and Asia using genomics-assisted breeding.

- Channelize extensive public-private partnerships for deploying elite FAW-tolerant varieties (with faster varietal turnover).

- Demonstrate the benefits of integrating native genetic resistance with other IPM tactics, especially GAP and biological control.
Bt Maize – Important Tool in the IPM Toolbox!

- Numerous GM maize hybrids, including various combinations of cry and vip genes, commercially available in Brazil and North America.
- Insect resistance management and product stewardship are important.
**Bt Maize in Africa and Asia: Status**

**Africa**
- **MON89034** in South Africa showing high levels of FAW control.
- **MON810**: CFTs in TELA Project target countries in Africa showing partial but significant control under FAW natural infestation.
- A total of 49 unique CIMMYT inbred lines used so far under TELA project for Bt trait introgression; of these, 38 lines were have been introgressed with **MON810**, and 29 with **MON89034**.

**Asia**
- **Bt** maize presently being commercialized in the Philippines (~630,000 ha) and Vietnam (~49,000 ha); approved recently in Pakistan.
- **MON89034** (*Cry1A.105 + Cry2Ab2*); Syngenta’s **Bt11** (*Cry1Ab*); **MIR162** (*Vip3Aa20*) alone or stacked.
Bt-based resistance and native genetic resistance to FAW can be highly complementary...
Thanks!

• Partners in Africa, Asia, and the USA
• Funding agencies, especially USAID (FAW Project)
• MAIZE CRP W1&W2 donors
• CIMMYT colleagues for their commitment to the Mission
Pesticides in Fall Armyworm Management

Paul C. Jepson & Katie Murray, OIPMC, OSU, USA)
Micter Chaola (CRS, Malawi), Makhfousse Sarr (FAO, Senegal)
paul.c.jepson@gmail.com
MALAWI PEST MANAGEMENT NEEDS ASSESSMENT (OSU, USAID, CRS) (MURRAY ET AL., 2019)

Recommendations:

- Evaluate and register low risk pesticides
- Improve communication about IPM & pesticides
- Strengthen research and extension
- Monitor progress towards IPM adoption
- Build upon local knowledge
- Conduct country-wide pesticide risk management education
- Continue maize variety improvement

https://repository.cimmyt.org/bitstream/handle/10883/20170/60695.pdf?sequence=1&isAllowed=y
KENYA PEST MANAGEMENT NEEDS ASSESSMENT (OSU, USAID, RTI, FIPS)
(MURRAY ET AL., 2020 IN PREP.)

Key needs:
- Farmers lack access to basic information on:
  - Pest biology and life cycle
  - Efficacious control methods and treatment timing
  - Safer use of pesticides including selection and application
- Lack of capacity among extension and spray service
- Agro-dealers lacking PPE on-site; seeking training on FAW management
An example of pesticides favored in Malawi
These (profenophos & deltamethrin) are not compatible with natural enemies.
Or smallholder farmers

And they are therefore not compatible with IPM
RISK ASSESSMENT AND FIELD DATA CAN IDENTIFY THE PESTICIDES THAT MEET THE NEEDS OF AFRICAN FARMERS

- At least 56 pesticides recommended against FAW in Africa
- 13 Highly Hazardous
- 32 others high environmental and/or health risk
- 11 lower risk
- 7 Potentially efficacious and lower risk
Measuring pesticide ecological and health risks in West African agriculture to establish an enabling environment for sustainable intensification

P. C. Jepson¹, M. Guzy¹, K. Blaustein¹, M. Sow², M. Sarr³, P. Mineau⁴ and S. Kegley⁵

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⁴Pierre Mineau Consulting, 124 Creekside Drive, Salt Spring Island, British Columbia, Canada V8K 2E4
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Selection of pesticides to reduce human and environmental health risks: a global guideline and minimum pesticides list

Paul C Jepson, Katie Murray, Oliver Bach, Maria A Bonilla, Lars Neumeister

Summary

Background Pesticides present widespread risks to human and environmental health, yet selection criteria for end-users that factor in differences in risk between compounds are scant. We developed a system to classify pesticide risks and hazards with respect to human and environmental health and produce a minimum (lower risk) pesticide list.

Methods We classified 659 pesticides by acute and chronic risks to human health (e.g. respiratory and carcinogenic effects) and by environmental risks, including biomagnification and atmospheric ozone depletion and risks to aquatic ecosystems.

pouches in current use against the fall armyworm in Africa, our guideline identified chemicals that are effective and of lower risk to human and environmental health. We argue that a minimum (lower risk) pesticides list, which meets IPM needs, could be developed from our classification system.

Interpretation As far as we are aware, our analysis is the first to propose a method for implementing the idea of a

Phil Trans R Soc - Food and Environmental Security:
http://rstb.royalsocietypublishing.org/content/369/1639.toc

Lancet Planetary Health - Pesticides Minimum List: https://doi.org/10.1016/S2542-5196(19)30266-9
<table>
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<th>LEVEL OF RISK</th>
<th>Unknown effect on fall armyworm</th>
<th>Not effective against fall armyworm</th>
<th>Effective against fall armyworm</th>
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<tr>
<td>1</td>
<td><img src="image1" alt="Images" /></td>
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<td>LOW RISK TO HEALTH, &amp; ENVIRONMENT</td>
<td>pyriproxifen</td>
<td>Bacillus thuringiensis (var Kurstaki), Beauvaria bassiana, Metarhizium anisopliae</td>
<td>Azadirachta indica, Bacillus thuringiensis (subsp Aizawai), chlorantraniliprole, flubendiamide, methoxyfenozide, SfNPV, pyrethrur</td>
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<td>HIGH RISK TO HEALTH &amp; ENVIRONMENT</td>
<td>cartap hydrochloride, pyradalyl</td>
<td>abamectin, acetamiprid, benfurcarb, carbaryl, chlorpyrifos, diazinon, dimethoate, fenitrothion, malathion, pirimiphos-methyl, profenofos, thiocarb</td>
<td>acephate, bifenthrin, cyhalothrin-gamma, cyhalothrin-lambda, cypermethrin, cypermethrin-alpha, cypermethrin-beta, deltamethrin, diflubenzuron, emamectin benzoate, fenvalerate, indoxacarb</td>
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<tr>
<td>DOUBLE LAYER CLOTHING, EYE &amp; RESPIRATORY PROTECTION, RESTRICT ENTRY TO TREATED FIELD</td>
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<tr>
<td>HIGHLY HAZARDOUS TO HEALTH &amp;/OR ENVIRONMENT</td>
<td>fipronil, methamidophos, monocrotophos, phorate</td>
<td>carbofuran, carbosulfan, dichlorvos, imidacloprid, thiamethoxam, trichlorphon</td>
<td>cyfluthrin-beta, cyfluthrin, methomyl</td>
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<tr>
<td>DO NOT USE</td>
<td><img src="image19" alt="Images" /></td>
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REMAPPING BARRIERS TO IPM ADOPTION

**HHP Phase out**

**High Risk Pesticide Phase out**

Build skills and capacity in bio-rational IPM

*Pilot trainings based on needs assessments and new pesticide classification system with >100 extension workers in Malawi and Kenya*

**Resilient and bio-rational IPM**

Timeline for reducing vulnerability and increasing IPM adoption

**FEED THE FUTURE**
The U.S. Government’s Global Hunger & Food Security Initiative

**USAID**
FROM THE AMERICAN PEOPLE
Communication Strategies and Effects on FAW Management in Uganda: A Case Study

Agrilinks Webinar
June 19, 2020
Sarah Page, Technical Advisor, CRS
Dai Peters, Independent Consultant
Austen Moore, Senior Technical Advisor, CRS
STUDY BACKGROUND & RESEARCH QUESTIONS

Impetus
- Is information reaching all farmers?
- What two-way communication channels exist?
- Need to improve the response to FAW and adoption of management practices among different stakeholders.

Study Questions:
1) Information sources
2) FAW management practices
3) Results of FAW management
4) Feedback loops

Case Study in Uganda
METHODS AND ACTIVITIES

- 409 farmer surveys, 60 qualitative farmer interviews, 16 key informant interviews, desk review
**HOW FARMERS ACCESSED INFO ON FAW**

- Relationship between wealth and gender and information access
- Groups were preferred venue for information sharing
- Main sources of information differed by control method
- Limited use of ICTs, especially by poorer farmers

*Where did farmers learn about applying chemical pesticides?*
HOW CAN WE BETTER FACILITATE ACCESS TO INFORMATION ACROSS FARMER SEGMENTS?

- Use ICTs/social media more effectively and as a complement
- Identify ICT connectors
- Ensure inclusivity of farmer groups
FARMER MANAGEMENT OF FAW AND RESULTS

- The information campaign was effective in changing farmer behaviors.
- There was a reduction in maize yield loss.
- Costs for different FAW control practices are prohibitive for some farmers.
- Evidence of misuse of synthetic pesticides.

Are farmers applying synthetic pesticides to control FAW?

<table>
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<th>Segment 1 (n=102)</th>
<th>Segment 2 (n=102)</th>
<th>Segment 3 (n=102)</th>
<th>Segment 4 (n=104)</th>
<th>Large farm (n=6)</th>
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<td>50</td>
<td>66</td>
<td>82</td>
<td>76</td>
<td>100</td>
</tr>
</tbody>
</table>
FARMER MANAGEMENT OF FAW AND RESULTS

- Farmers still perceive FAW to be a threat to their maize production.

- Many farmers are not able to save to purchase synthetic pesticides.

Is FAW still a threat to your maize production?

Do you set aside money to purchase pesticides?
HOW CAN WE SUPPORT FARMERS TO IMPROVE MANAGEMENT OF FAW?

- Provide more specific guidelines for pesticide use.
- Design information campaigns to better reflect the diversity of contexts and farmer segments.
- Address economic barriers to adoption.
- Help farmers understand costs and returns.
- Continue to train on GAPs.
HOW FARMERS ARE PROVIDING FEEDBACK

- Little validation or documentation of farmer experimentation
- Learning and feedback mechanisms are weak
- Most feedback was delivered in person
- Limited use of ICTs to provide feedback or solicit information
HOW DO WE STRENGTHEN FARMER FEEDBACK LOOPS AND BECOME MORE DEMAND-DRIVEN?

- Continue to advance research on efficacy of farmer-derived approaches
- Develop and update technical content using an iterative process
- Strengthen farmer feedback mechanisms for demand-driven extension
- Reconsider farmer group models, but emphasize:
  - Collaboration, peer-to-peer learning, and innovation
  - Inclusivity/accessibility for women and youth
  - Example: Farmer Learning Centers
KEY TAKE-AWAYS

- Pesticide use is widespread; farmers and other actors need more specific information
- ICTs offer immense opportunity to scale information dissemination, but there is still an important place for farmers groups and face-to-face interactions
- Information flows continue to be top-down
- Information campaigns should be iterative and reflect diverse contexts and realities of different farmer segments
Questions?

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Questions and Answers
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