Sanitary and Phytosanitary Issues to Achieving the Global Food Security Strategy: Cases on Fall Armyworm and Aflatoxin

**Speakers:** Kelley Cormier, USAID Bureau for Food Security, Lee Gross, USDA Foreign Agricultural Service, Chris Peterson, USDA Foreign Agricultural Service, Ken Shenge, USDA Agricultural Research Service, Elisa Loeser, USDA Foreign Agricultural Service

**Moderator:** Julie MacCartee, USAID Bureau for Food Security

**Date:** June 20, 2018
Kelley Cormier is Division Chief of MPI's Inclusive Market Development Division, where she leads a team that addresses access to finance, market systems strengthening, risk management and resilience, agribusiness enabling environment and trade and commercialization of technologies. Before joining USAID, Kelley worked with USDA designing, implementing and evaluating sanitary and phyto-sanitary programs and explored how policies and institutions affect agricultural markets and market actors. She has held fellowships with AAAS, Fulbright, NCEER and IREX. She was a Peace Corps volunteer in Kazakhstan, holds a PhD in Development Studies from the University of Wisconsin-Madison, and a MS in Agricultural Economics from Michigan State University.
Lee Gross is a Senior Program Manager with the USDA Foreign Agricultural Service. He leads the Food Safety Network, an inter-agency partnership between the USDA, USAID and FDA to help build food safety capacity worldwide. An economist and natural resource development professional by training, Mr. Gross has spent his career working to advance market and trade-based solutions to poverty reduction, environmental conservation and sustainable agricultural production. He holds an M.S. in Natural Resources and a B.S.E.S in Environmental Economics.
Dr. Chris Peterson is a toxicologist and entomologist serving as a program manager and team lead for the Food Safety in Africa Team at OCBD. He also manages activities globally in pesticides and laboratory development. He received his PhD from Iowa State University before conducting pest management research for the USDA-Forest Service, then coordinating food security and agribusiness projects as a Volunteer Leader for the Peace Corps in Uganda. He joined FAS in January, 2016
Dr. Ken Shenge is a Plant Pathologist with USDA’s Agricultural Research Service with over 10 years’ experience in international agriculture, plant health, food safety and public health. Dr. Shenge has a Ph.D. in Plant Pathology and a MPH in Public Health. In addition to teaching and mentoring students, he led a team in charge of plant diagnostics, and investigated the postharvest pathology of field crops, transmission mechanisms of plant pathogens, and human pathogens on Nigerian tomatoes. Dr. Shenge worked in the Food Animal Health Research Program at The Ohio State University from 2012 to 2014, with emphasis on human pathogen association with plants. In his current position, he applies advanced molecular biology techniques (such as quantitative pyrosequencing) to assist the World Bank’s AgResults Initiative to assess farmer implementation of aflatoxin biocontrol in Nigeria.
Elisa Loeser is a Food Safety Program Manager with the USDA Foreign Agricultural Service. She oversees food safety and aflatoxin capacity building programs in Africa and Central America. Elisa has worked for USDA/FAS for four years and served as the FY17 President of the FAS Junior Professional Advancement Community. She has a Master’s of Arts in Food Studies and speaks French.
The Food Safety Network

Bringing the best of Food Safety Practices to the World

Online library of best practices

Rapid needs assessments for USAID Missions

Coordinated U.S. government expertise

Links to animal, plant health and food safety

Online interactive sanitary and phytosanitary training

Agrilinks.org/activities/food-safety-network
“YOU’RE ONLY AS GOOD AS YOUR WEAKEST LINK”

SPS: A HOLISTIC PERSPECTIVE

Speakers: Lee Gross, USDA Foreign Agricultural Service
Date: June 20, 2018
Measures that are taken to protect humans, animals and plants from diseases, pests or contaminants.

**Sanitary** → relating to **human** or animal life or health

**Phytosanitary** → relating to plant life or health

**SPS = Safe & Nutritious Food**
SYSTEMS APPROACH TO FOOD SAFETY

Animal Health
+ Plant Health
+ Food Monitoring

Improved Human Health
Market Systems and Value Chains

A Framework for Inclusive Market System Development, Leveraging Economic Opportunities (LEO). USAID
Goal: Sustainably reduce global hunger, malnutrition, and poverty

Objective 1: Inclusive and sustainable agricultural-led economic growth
- IR 1: Strengthened and expanded access to markets and trade
- IR 2: Strengthened inclusive agriculture systems that are productive and profitable
- IR 3: Increased employment and entrepreneurship
- IR 4: Increased sustainable productivity, particularly through climate-smart approaches
- IR 5: Improved proactive risk reduction, mitigation, and management
- IR 6: Improved adaptation to and recovery from shocks and stresses

Objective 2: Strengthened resilience among people and systems
- IR 7: Increased consumption of nutritious and safe diets

Objective 3: A well-nourished population, especially among women and children
- IR 8: Increased use of direct nutrition interventions and services
- IR 9: More hygienic household and community environments

Cross-Cutting Intermediate Results (IR)
- CC IR 1: Strengthened global commitment to investing in food security
- CC IR 2: Improved climate risk, land, marine, and other natural resource management
- CC IR 3: Increased gender equality and female empowerment
- CC IR 4: Increased youth empowerment and livelihoods
- CC IR 5: More effective governance, policy, and institutions
- CC IR 6: Improved human, organizational, and system performance

Effective response to emergency food security needs

Complementary Results
Long-term food security efforts benefit from and contribute to complementary work streams that promote:
- Economic growth in complementary sectors
- Healthy ecosystems and biodiversity
- Stable, democratic societies that respect human rights and the rule of law
- A reduced burden of disease
- Well-educated populations
SPS & PUBLIC HEALTH

The Burden of Food Safety

An estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food and 420,000 die every year, resulting in the loss of 33 million healthy life years (DALYs).

Children under 5 years of age carry 40% of the foodborne disease burden, with 125,000 deaths (or 30%) every year.

In Africa, more than 91 million people are estimated to fall ill and 137,000 die each year.

Some 60 million children under the age of 5 fall ill and 50,000 die from foodborne diseases in the South-East Asia Region every year.

http://www.who.int/mediacentre/factsheets/fs399/en/
SPS & NUTRITION

Agriculture Influenced

- Diet (Quality & Diversity) ((F&V, ASF, legumes, production, SBCC))
- Environmental (EE, gut microbiome, environmental toxins)
- Food Safety (pathogens, pesticides, Mycotoxins, processing, storage)

Nutritional Status

Key factors affecting Nutritional Status

Nutrition Sp. Interventions (Breastfeeding e.g: MNS, Fe/Fo, SAM/MAM mangt, etc.)
Agricultural Value Chains

Inputs

Production

Processing

Consolidation/Transport

Local Use/Sale

Packaging

Inspection

Commercial Sale

Consumers
EXTERNAL INFLUENCES

INPUTS
- Socio-Cultural
- Environmental
- Economic
- Technological
- Legal

PRODUCTION
- Consolidation/Transport
- Input

PROCESSING
- Packaging
- Inspection

LOCAL USE/SALE
- Commercial Sale
- Consumers

CONSUMERS

EXTERNAL INFLUENCES

FEED THE FUTURE | KNOWLEDGE-DRIVEN AGRICULTURAL DEVELOPMENT PROJECT

USAID
FROM THE AMERICAN PEOPLE

AGRILINKS
FOOD SAFETY HAZARDS

INPUTS

PRODUCTION

CONSOLIDATION/TRANSPORT

LOCAL USE/SALE

PROCESSING

INSPECTION

COMMERCIAL SALE

CONSUMERS

PACKAGING

EXECUTIVE SUMMARY

The food safety hazards in the food supply chain include:

- **Inputs**: This stage involves the initial resources used in food production, such as seeds, water, soil, and labor. Issues at this stage can include contamination from pesticides or pathogens.
- **Production**: Here, the raw materials are transformed into food products. Hazards can arise from improper handling, cross-contamination, or use of unapproved substances.
- **Consolidation/Transport**: At this stage, food is transported from the production site to distribution centers. Hazards can include foodborne illness outbreaks caused by inadequate food handling or transport conditions.
- **Local Use/Sale**: This stage involves the sale of food to local consumers. Hazards can occur due to improper storage conditions, inadequate refrigeration, or cross-contamination.
- **Processing**: This stage includes food preparation steps such as cooking, canning, and drying. Hazards can include undercooking, improper handling of raw materials, or the use of contaminated equipment.
- **Inspection**: Inspections are conducted to ensure that the food meets safety standards. Hazards can be detected and addressed at this stage.
- **Commercial Sale**: This stage involves the sale of food to consumers at retail outlets. Hazards can include packaging that does not protect against contamination or tampering.
- **Consumers**: Final consumption of food involves risks such as improper storage at home, which can lead to foodborne illnesses.

To mitigate these hazards, a comprehensive risk management approach is necessary, including effective monitoring, proper handling, and stringent regulatory standards.
CONTROL POINTS

- SPS Regulatory Environment
- Physical Infrastructure
- Practices: Production, Processing, and Handling
Strengthening SPS systems and the SPS-enabling environment can:

- break down constraints in value chain programming;
- assist countries to adopt science-based regulatory systems that ensure domestic food supplies are safe and nutritious;
- harmonize domestic regulations with international standards; and
- improve a country’s ability to trade regionally and globally.

To be effective, all these things need to be done collaboratively.
Fall armyworm in Africa: A case study in Zambia

Speakers: Chris Peterson, USDA Foreign Agricultural Service
Date: June 20, 2018
Fall armyworm is a devastating pest in Africa

Crop damage estimates reach into the billions
Can destroy 100% of an infested field

Climate permits continuous life cycle
Is present anywhere corn is growing
Other strains attack rice, but over 80 plants can be affected
For information on FAW control options, please consult the following publication:

Fall Armyworm in Africa: A GUIDE FOR INTEGRATED PEST MANAGEMENT
First Edition

https://reliefweb.int/sites/reliefweb.int/files/resources/FallArmyworm_IPM_Guide_forAfrica.pdf
Arrived from the Americas, but not sure how

By sea or air, could not have flown on its own

Port inspections failed to intercept it

Once on the continent, had unopposed access
Fall armyworm detected in Zambia in late 2016

Affected 130K ha first year, 350K ha second year

Government resources overwhelmed

   Emergency declaration mobilized resources

Pesticide rescue treatments and seed distributed free

But season half over and too late for most crops
Despite FAW being more widespread, second year response was better

Rapid development and distribution of educational materials

Mass and social media campaigns

Pest monitoring

Better pest management tools
However, several gaps remain in being able to respond to the issue

Extension services to monitor for the pest and to reach farmers remain understaffed and underfunded

Pesticide regulation remains weak, allowing sub-standard, counterfeit, and contaminated products to be used

Lost efficacy = lost food
Contaminants = food safety risk

Only a few products widely used
Coordinated multi-sectorial communication is lacking

No permanent body with mandate to address issues proactively

Cooperation with NGOs, private sector, universities, etc. spotty,
- Not covering whole country, or only reaching certain farmers
Export inspection facilities are understaffed

Could allow FAW to reach the Middle East, Europe and Asia

Vulnerable to import bans

Quarantine pests

Pesticide or contaminant residues
Fall armyworm continues to cause significant crop losses in Zambia.

Zambia has no permanent, overarching body to anticipate and respond to future issues.

Extension and public outreach efforts are underfunded and uncoordinated.

Availability and management of pest control tools (including pesticides) a challenge.

High awareness and engagement are working toward a solution.

Ongoing research and lessons learned are addressing the problem.
Promoting Food Security Through Aflatoxin Biocontrol

Speakers: Ken Shenge, USDA Agricultural Research Service, Elisa Loeser, USDA Foreign Agricultural Service

Date: June 20, 2018
The major concern with *Aspergillus flavus* is crop contamination with aflatoxins.

**Acute aflatoxicosis:** vomiting, abdominal pain, pulmonary edema, and fatty infiltration and hemorrhagic necrosis of the liver, bile duct proliferation, lethargy, death.

**Chronic aflatoxicosis:** Growth impairment, liver cancer, lung cancer, immune suppression, synergy with HBV and HBC, nutritional interference → stunted growth.
Aflatoxin Contamination: A Perennial Concern in Warm Climates

Certain weather events make contamination worse. During droughts the contaminated zone enlarges.

Crop nutritional composition
Crop genetic susceptibility
Environmental stress

Zone with Perennial Contamination Risk
Human and Animal Exposure

**Biological Factors**
- Susceptible crop
- Compatible toxigenic fungi

**Environmental Factors**
- Temperature
- Moisture availability
- Mechanical injury
- Insect/bird damage

**Harvesting**
- Crop maturity
- Temperature
- Moisture
- Handling

**Humans**

**Processing & Storage**
- Structure
- Moisture
- Temperature

**Distribution**
- Detection/diversion

**Animal Products**

**Animals**
Prevention strategies

**Biocontrol**
- Primary prevention
  - Storage practices
  - Breeding

**Secondary prevention**
- Sorting
  - Detoxification
  - Destruction

**Tertiary prevention**
- Regulation
Tertiary prevention

- Aflatoxins are highly regulated in more than 100 countries.

- In the United States, the maximum allowable limits for aflatoxin content of all foods (except milk [0.5 ppm]) is 20 μg/kg.

- Although highly effective, requires strong institutions, highly trained manpower, and a lot of $$$

Based on scale, cost of adoption, and proven efficacy, aflatoxin biocontrol strategies have increased in popularity.

http://poisonousplants.anisci.cornell.edu/toxicagents/aflatoxin/aflatoxin.html
Biocontrol with atoxigenic strains of *A. flavus* is the most effective method for preventing aflatoxins contamination of maize, groundnut, and other crops.
Application of Atoxigenic Strain AF36 in Commercial Cotton Influences the Composition of Fungi on Crops in both Treated and Nearby Fields

Soil Community Before Treatment

<table>
<thead>
<tr>
<th>AF36</th>
<th>AF36</th>
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<tbody>
<tr>
<td>4%</td>
<td>1%</td>
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Application Rate = 10 lb/acre

0.5 miles

Community on Crop After Ginning

<table>
<thead>
<tr>
<th>AF36</th>
<th>AF36</th>
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</thead>
<tbody>
<tr>
<td>57%</td>
<td>42%</td>
</tr>
<tr>
<td>60%</td>
<td>92%</td>
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</tbody>
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Treated Field

Treated Field

Blue dots represent the percent of the *A. flavus* community composed of AF36
Aflatoxin Biocontrol in the US

- 1st Conference with U.S. Environmental Protection Agency: 1992
- Used on commercial crops in US since 1996.
- Three Products with Unrestricted Registrations (more coming).
- Over 1 Million Acres Treated Annually
- Registered Target Crops: Maize Grain & Silage, Pistachios, Cottonseed, Peanut (Almond & Fig expected in 2017).

Aflatoxin Biocontrol in Africa

- Severe Human Exposure to Aflatoxins in Several Nations.
- Products registered in Nigeria, Burkina Faso, Ghana, Kenya, & Senegal/Gambia.
- Target Crops: Maize & Groundnut.

Aflatoxin Biocontrol in Europe

- Target Crop: Maize.
- 15,000 ha treated in 2015 – very effective.
- Maize required to be below 3 ppb for cheese industry.
Some biocontrol products consist of multiple *A. flavus* genotypes. Several of these are registered for commercial or experimental use in Nigeria, Burkina Faso, Ghana, Kenya, & Senegal/Gambia.

FourSure™ is registered for experimental use in Texas, USA, through a collaboration between USDA-ARS and the Texas Corn Producers Board.

These biocontrol products have reduced Aflatoxin contamination in Maize significantly, ensuring safe and wholesome food in many parts of the world.
Recommendations

❖ Aflatoxin biocontrol technology transfer (labs, training, production facilities).

❖ Emphasis on GAPs.

❖ Premium per product payments.

❖ SPS (regulatory) capacity building.

For more information, visit: https://cals.arizona.edu/research/cottylab/
Role of Partnerships in Aflatoxin Biocontrol

Distribution plan

Regulatory approval

Field efficacy trials

Native atoxigenic strains

Baseline data

Private sector

International organizations

Government bodies & key actors (national, regional, continental)

Donor community & development partners

Academia, research, & labs
Long term collaboration within USDA between FAS and ARS

Aflatoxin control in Africa as a case study for collaboration

- Established aflatoxin as key concern for continent
- Emphasized biocontrol as important solution
  - The International Institute of Tropical Agriculture (IITA) took the lead with support from USDA and many partners
    - www.aflasafe.com
  - Developed body within the African Union Commission (AUC)
    - The Partnership for Aflatoxin Control in Africa (PACA)
      - http://www.aflatoxinpartnership.org/

Being collaborative, communicative, and sharing resources and responsibilities creates positive and sustainable impact!
Questions and Answers
Contact: jmaccartee@usaid.gov

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