

Update on Guatemala through Reduction on Post-Harvest Losses of Corn

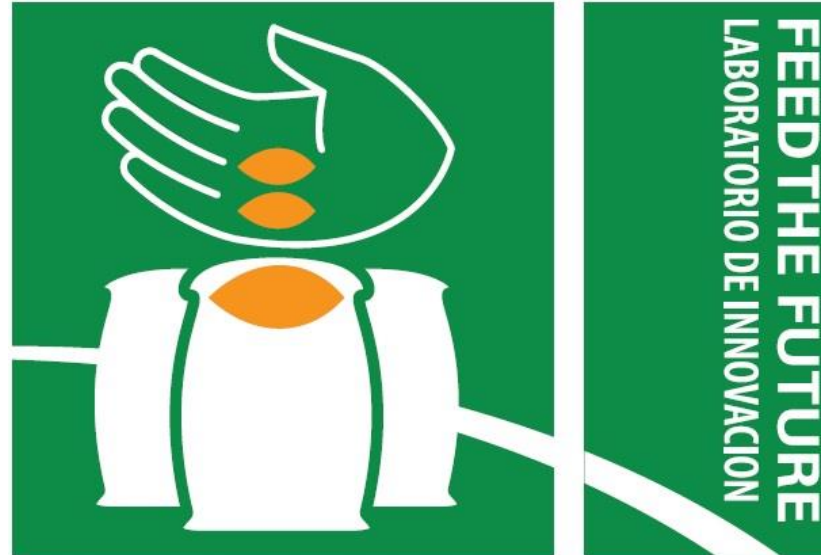
Carlos Campabadal, Ph.D. (KSU)

Andreia Bianchini, Ph.D. (UNL)

Guillermo Gonzalez (SHARE)

(www.reducePHL.org)

May, 2016



Reducción de Pérdidas en Poscosecha

Improving Food Security and Food Safety of Smallholders Farmers in the Western Highlands of Guatemala through Reduction on Post-Harvest Losses of Corn

KANSAS STATE
UNIVERSITY

UNIVERSITY OF
Nebraska
Lincoln®



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

Guatemala Team

- **Dr. Carlos Campabadal**, KSU (Co-leader)
- **Dr. Andreia Bianchini**, UNL (Co-leader)
- Dr. Jason Ellis, KSU (Engagement Leader)
- Dr. Heather Ledger-Adams, UNL (Mycotoxin Specialist)
- **Alejandro Morales-Quiros**, KSU (Graduate Student)
- Luis Eduardo Sabillon, UNL (Graduate Student)
- Rodrigo Mendoza, UNL (Graduate Student)
- Elizabeth Vega and **Guillermo Gonzalez**, SHARE Guatemala (Project Liaison)
- Walfer Martinez, SHARE Guatemala (Extension Specialist)
- Ada Rocina, Consultant (Equal Gender)
- Ana Silvia Colmenar de Ruiz, UVG (Professor & Liaison)

Guatemala

Over the **next five years** in Guatemala, Feed the Future aims to help an estimated **219,000 vulnerable Guatemalan women, children and family members**—mostly smallholder farmers—escape hunger and poverty. More than **166,000 children** will be reached with services to improve their nutrition and prevent stunting and child mortality.

More than 50% of children suffer from malnutrition



Huehuetenango Province
(69.5% malnutrition)



- Investigate **cultural, social and economic factors**, with specific attention to **gender issues**.
- Increase the quantity and quality of stored food staples and dietary diversity, along with country-specific nutrition education, thus increasing access to **nutritious food** and reducing under nutrition and food insecurity.

1. Quantification of the sustainability of corn production practices and mycotoxin presence as a key parameter for grain loss for smallholder farmers in the municipalities of Chiantla and Todos los Santos Cuchumatán (Huehuetenango).

1. Quantification of the sustainability of corn production practices and mycotoxin presence as a key parameter for grain loss for smallholder farmers in the municipalities of Chiantla and Todos los Santos Cuchumatán (Huehuetenango).
 - a) Determine the current grain production and post-harvest practices. (*Done*)
 - b) Determine the current health, nutrition (pending), and hygiene practices. (*Done*)
 - c) Understand, assess, and contribute for improvement to the current equal gender issues related to post-harvest and nutrition. (on going Ada Chavarría)
 - d) Determine the corn toxicological content, moisture and presence of insects.(on going SHARE-UVG)

Toxicological Content Study (fungi, aflatoxins, entomology and moisture content) / On going

Recording information per farmer per sample sent.

USAID KANSAS STATE UNIVERSITY Nebraska SHARE
Programa de Monitoreo de Muestreo por Campesino
Colección de muestras y datos de Grano, Humedad y Parasitos de Plantaciones
No. de Muestra: 01 Fecha de Muestreo: 20/07/2018
Nombre del Agricultor: Dobal Adriano Herrera Comarca: San Antonio las Alamos
C1 C2 Código del aplicador: 1-23
 Muestreo en el Presente: Grano Tablas Balcón
 Después de 30 minutos Almacenamiento:
CATEGORÍA DE MUESTREO Y COMPUESTO:
Almacenamiento para el estudio:
Tipo de Almacenamiento: Estaca Pila Cajas de plástico Saca
Tiempo de Muestreo en días: 0 30 60 90
Humedad de la Muestra: 11 20.8% 12 26.3% 13 28.2%
Temperatura de la Muestra: 11 16.3/18.2 12 18.2/18.7 13 16.1/16.6
Para cada Muestra (en g): 10 lbs 10.00 Para cada Muestra (en g) 36.2 3.00
Para ser Muestreado (Lbs): 7 CUBOS
Cálculo de Muestra de DGS: Muestra: 2 Litros 3 Litros
Muestra: 14 Litros
Estado de la muestra:



26 farmers actively supporting the research project provide samples of maize and answer questionnaires regarding gender and economic subjects.



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

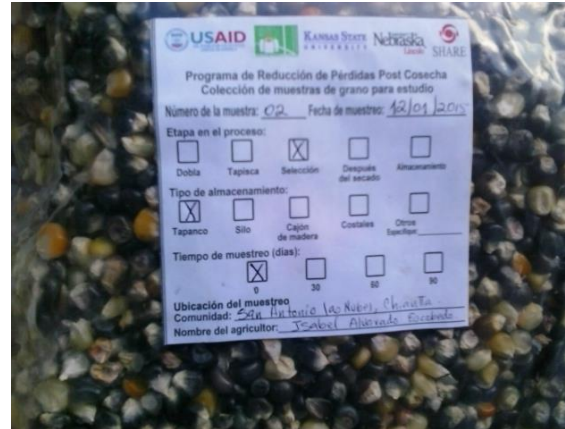


USAID

FROM THE AMERICAN PEOPLE

Toxicological Content Analysis (fungi, mycotoxins, entomology and moisture content) / Done

92 samples sent the Universidad del Valle de Guatemala: 34 grain corn and 34 on the cob "C1" and 24 samples of corn husking "C2".



"C1" Farmers who produce maize
"C2" Farmers who buy maize

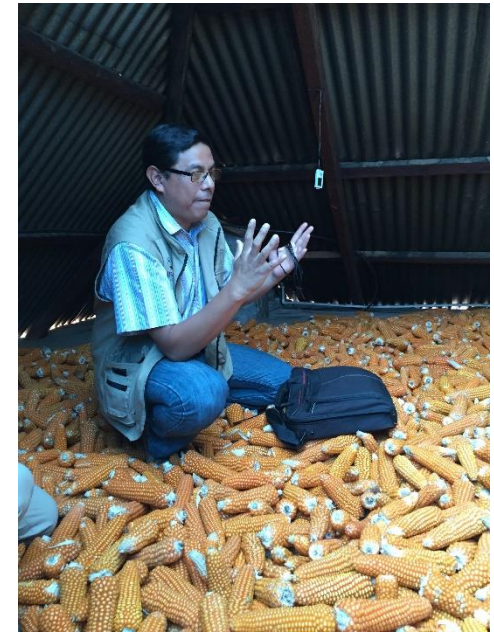
14 temperature and relative humidity sensors



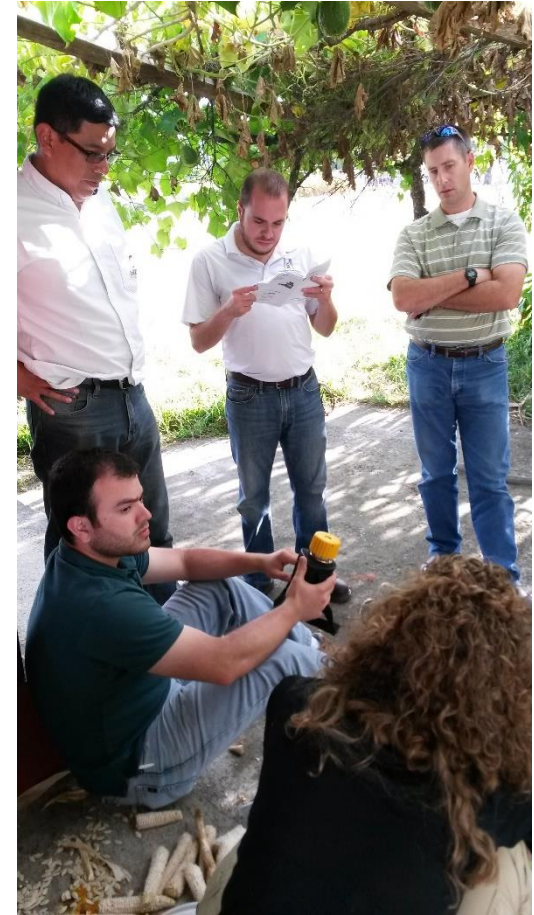
Collecting Maize Samples



Collecting Maize Samples



Training of promoters

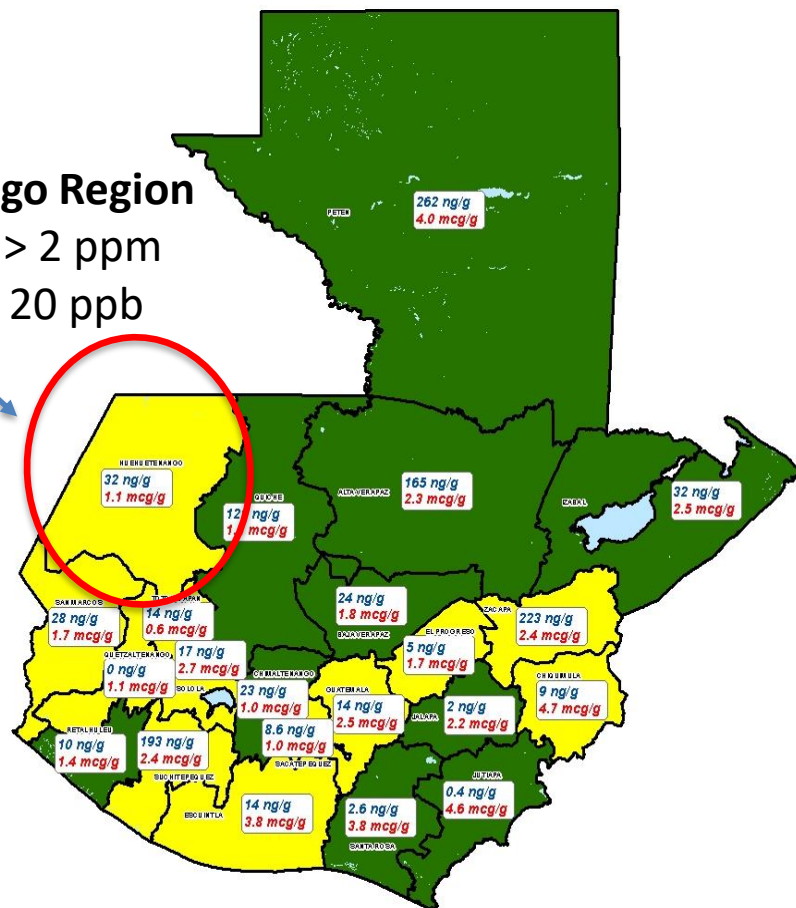


Grain Quality: Baseline

- Moisture
- Mycotoxins
- Insects
- Fungal counts

Huehuetenango Region

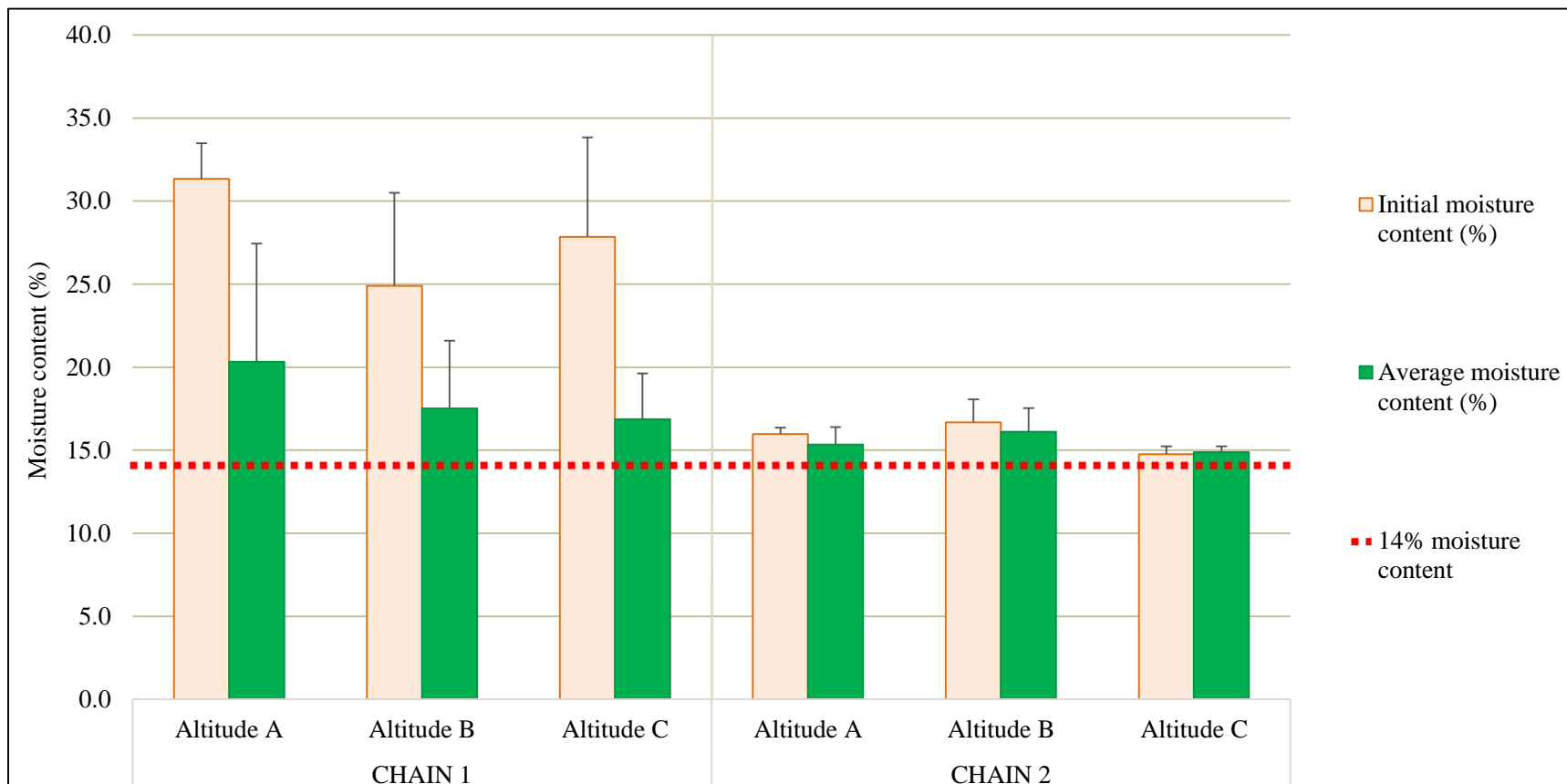
- Fumonisin > 2 ppm
- Aflatoxin > 20 ppb



Aspergillus & Fusarium presence



Corn Moisture



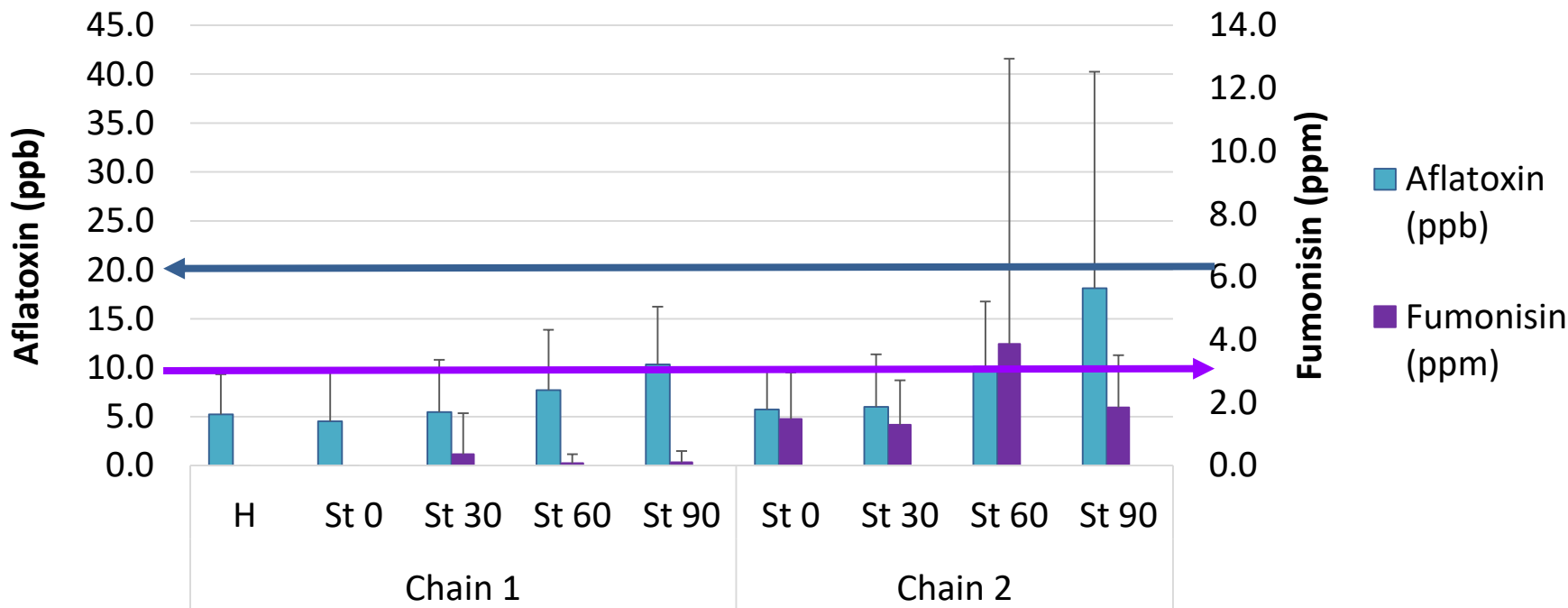
Toxin Levels in Corn

↔ FDA Mycotoxin Regulatory Guidance. 2011.

A Guide for Grain Elevators, Feed Manufacturers, Grain Processors and Exporters.

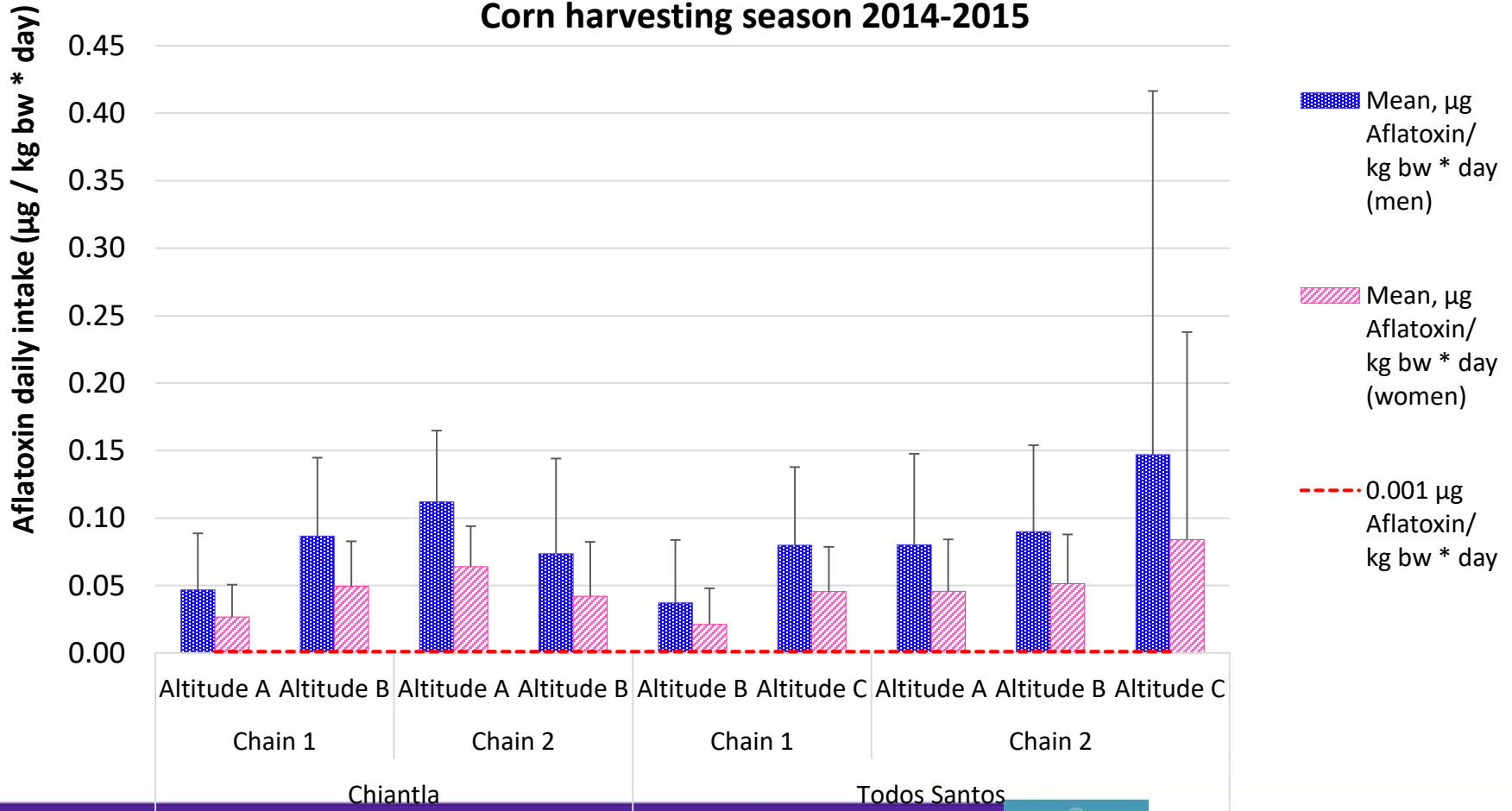
National Grain and Feed Association

Average mycotoxin exposure during harvest and throughout storage in Todos Santos and Chiantla, 2014-2015 season



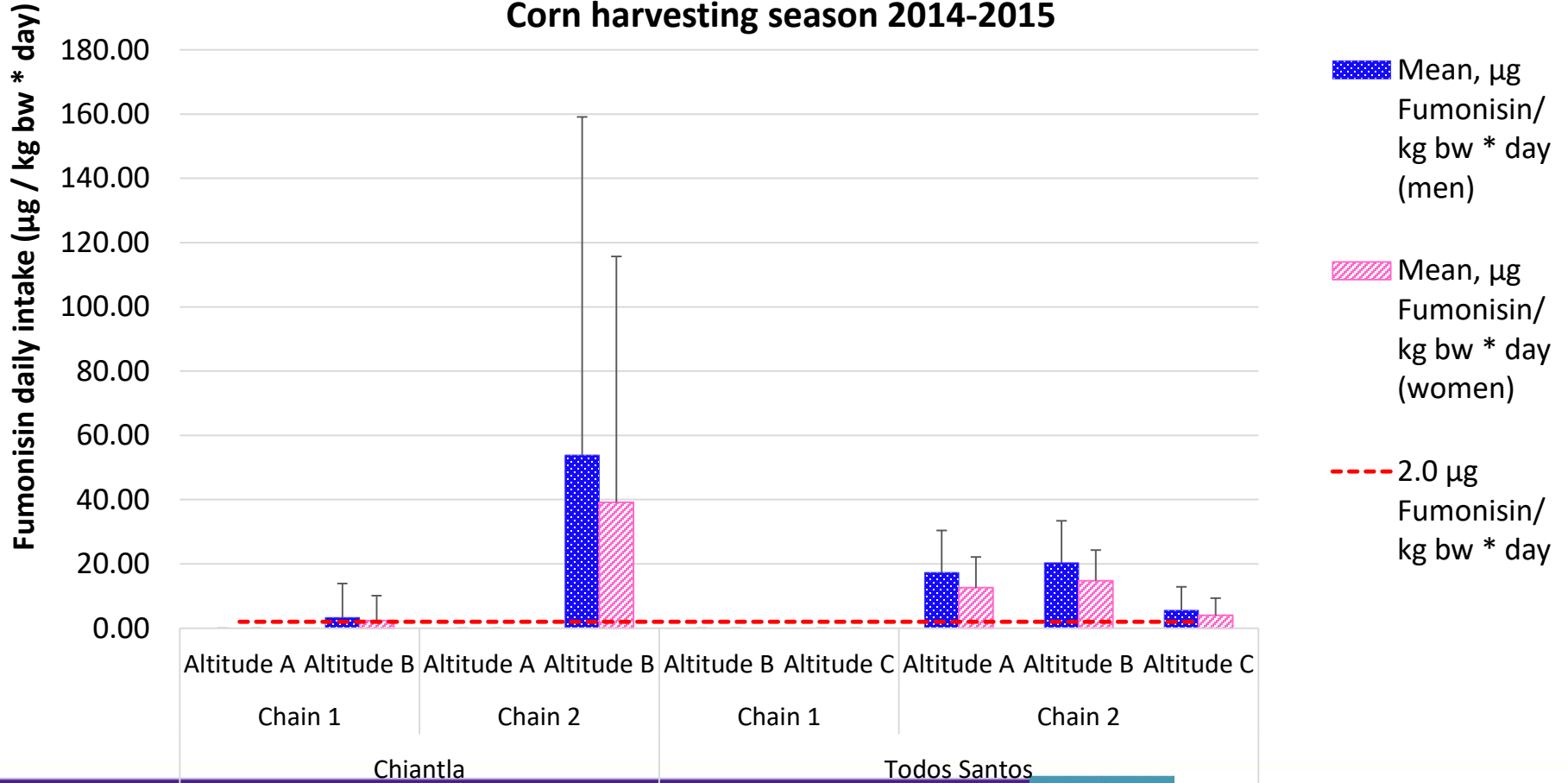
Toxin Exposure Levels

Aflatoxin daily intake for Todos Santos and Chiantla, Corn harvesting season 2014-2015



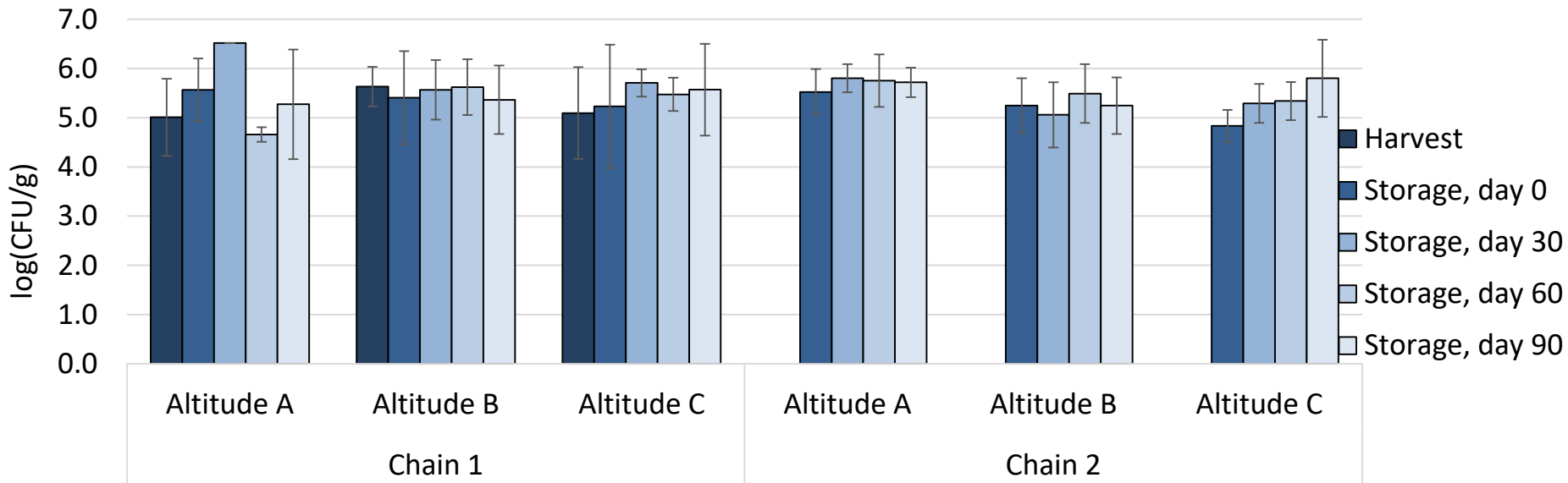
Toxin Exposure Levels

Fumonisin daily intake for Todos Santos and Chiantla, Corn harvesting season 2014-2015

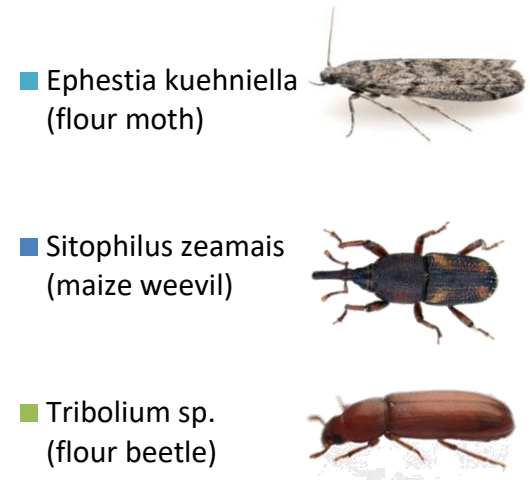
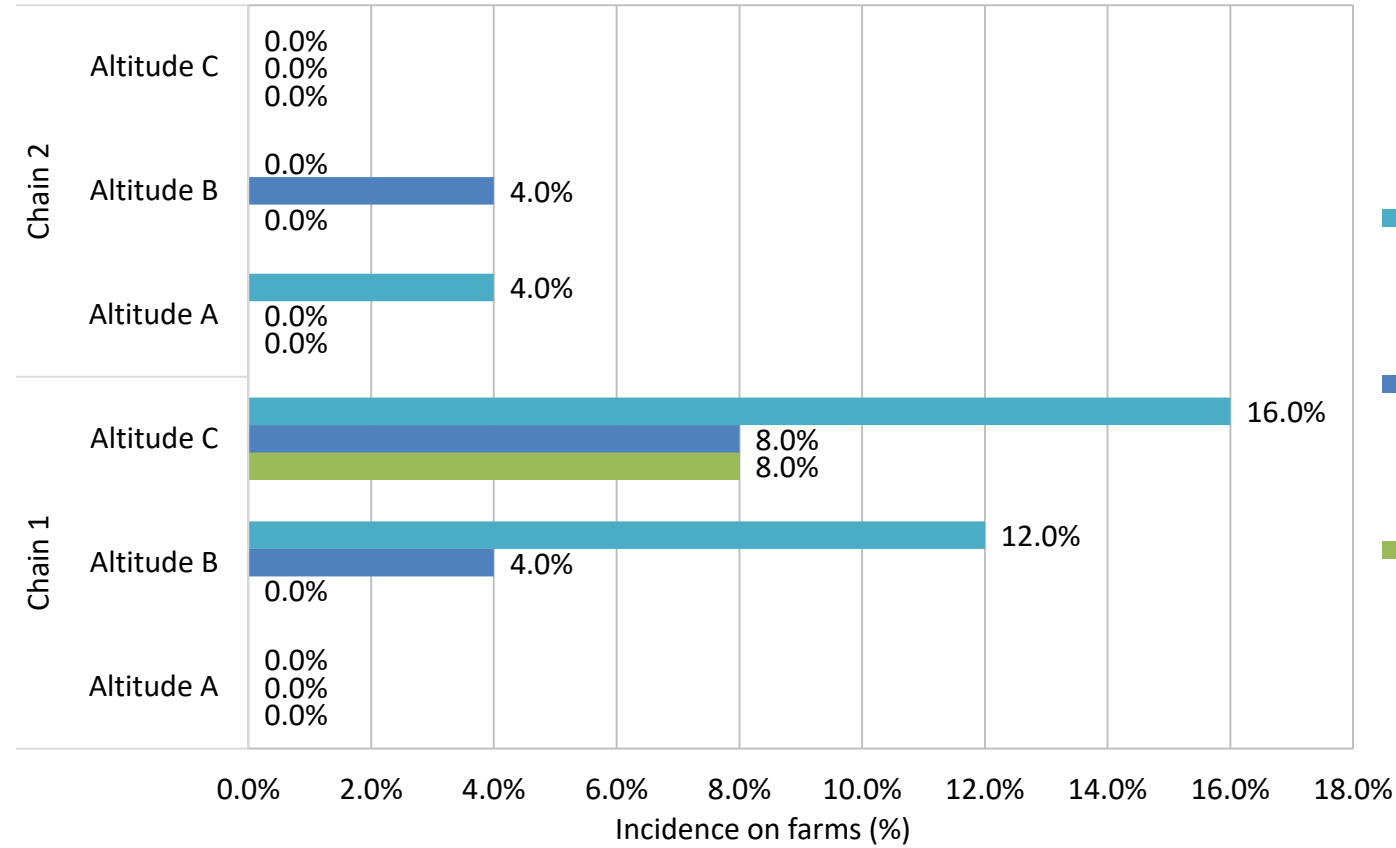


Results Grain Quality

Mold Counts in Corn



Insect Analysis



Summary Results Goal 1

- Survey of more than 200 households provided insights on the current and traditional practices used in the region
- Baseline data did not indicate that storage had a significant impact in toxin production (differences were not statistically significant)
- Exposure levels for population in the Highlands of Guatemala are very concerning

Summary Results Goal 1

- Fungal analysis showed the presence of *Aspergillus*, *Fusarium*, *Penicillium*, and *Cladosporium*.
- Mold counts were on average in the 10^5 CFU/g range
- Limited issues with insect infestation
- On going: Expanding baseline data by collecting additional samples outside of the farms under evaluation

2. Implementation of key-post-harvest techniques to improve grain drying, storage time, reduce mold growth and mycotoxin presence.

2. Implementation of key-post-harvest techniques to improve grain drying, storage time, reduce mold growth and mycotoxin presence.
 - a) Evaluation of their current drying systems versus utilizing “on-shelf” technologies (current work).
 - b) Evaluation of their current storage practices versus utilizing “on-shelf” technologies (current work).
 - c) Develop best practices and technologies for the reduction of grain quality loss (moisture content, mold, mycotoxin, etc) (current work).

- **Current drying practices:**



Field



Attic (accumulated heat & sun)
or on top of the roof



Hanging seed corn



Solar: husk
outside or in bags

Traditional Drying



Separation of “good” and “bad” corn



Traditional drying in the field



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

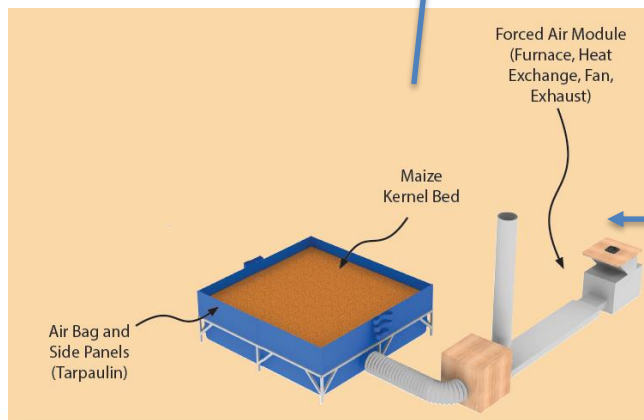
- Use “On-shelf” drying practices:



Furnace type dryer



STR furnace dryer



AflaStop Dryers:

- Shallow bed developed by UVG students

Solar dryer by S4S



Weather Conditions in Huehuetenango

- Temperature: 0 to 25 °C
- Usually very cloudy
- Altitude: 1500 to 3000m



Fifth trip. June 2015



Seventh trip. December 2015



- **Solar & Furnace Dryer**



Added a furnace to help with cloudy conditions

Drying rate \approx 0.5% per hour
with shelled corn



Solar dryer based on the S4S model

January 2016

STR Dryer



Drying rate \approx 1.0% per hour
with shelled corn



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

Grain Quality Assessment (done):

- Harvest, drying, storage (0, 30, 60 & 90 days)
- Extension & Universidad del Valle – Guatemala



Measuring moisture content with John Deere handheld equipment



Shelling of corn

Measuring ambient temperature & relative humidity conditions



- Current storage practices:



Attic on top of kitchen or room



Pile with husk



Metal Silo



Bags

Outdoor in piles



Hanging on a beam



- “On-shelf” storage practices:



PICS bags



Grain Pro bags



Metal Silos (0.5 to 1 MT)

Plastic Drums

- Potential Work “On-shelf” storage practices:



Improved attic with channeled smoke to control pests

On-Going Storage Trials

Farmers	Altitude	Storage Technologies	Samples	Data Loggers Ambient	Data Loggers inside storage
15	3	3	129	6	9
1	1	5	11		10

- Grain dried with the traditional method and STR dryer
- Use several available on-site storage technologies



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

Storage Technologies:

- Grain Pro Bags, PICS Bags, Arroberas Bags, Plastic Drum, and Metal Silos





Between 2015 and 2016 six visits by the KSU and UNL team



Engagement

- First meeting in Huehuetenango (October 2015):



- Participants:
 - Local manufacturer of silos
 - Local NGO
 - Farmer leaders from Todos los Santos and Chiantla
 - University researchers
- Second Meeting (August 2016)
- Leader: Jason Ellis KSU



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

Equal Gender

- Survey in two communities (Chiantla and Todos los Santos in 2015)
- Two workshops with women leaders in each community



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID

FROM THE AMERICAN PEOPLE

Equal Gender

- Workshops based on WEAI (Women Empowerment in Agriculture Indexes)
- Local consultant: Ada Rocina Chavarria



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID

FROM THE AMERICAN PEOPLE

Nutrition

- Study that will be conducted in Year 3 and 5
- Leader: Brian Lindshield



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



USAID
FROM THE AMERICAN PEOPLE

- Improvement of post-harvest techniques for grain drying and storage.
- Reduction of aflatoxin and fumonisin levels in masa (tortillas) and improvement of its nutritional values.
- Use local artisans, business people and workers to create and develop locally-produced tools and technology to aid in sustainability of resources and practices.

- Educate farmers and extension workers in best post-harvest practices to reduce grain quality loss.
- Employee advanced information technology-based systems to more rapidly evaluate and disseminate information.



Courtesy of Dr. M. Tambo.

- CIMMYT
- Legume Innovation Lab
- Universidad de San Carlos de Guatemala in Huehuetenango
- Central Agricola
- Brock grain silo distributor
- Molinos Modernos Foundation

Questions???



Excelencia que trasciende

Results Grain Quality

- The analyzed maize samples had an average aflatoxin level of 7.9 ppb and all of them were below 20 ppb with only 9 of them between 10 and 20 ppb. The highest value was of 17.6 ppb.
- The analyzed maize samples had an average fumonisin level of 3.4 ppm and only 3 of them were above 2 ppm with the highest values of 31 and 17.6 ppm.