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

Post-Harvest Loss Reduction
FEED THE FUTURE INNOVATION LAB

POST-HARVEST LOSS INNOVATION LAB

Addressing Mycotoxins in the Food Supply

Building lab capacity for detection and research

Fungal toxins (mycotoxins) are a pernicious, hidden threat to human and livestock health, food security, trade, economic development, and global and national security. Mycotoxin exposure can lead to death or cancer, and has been associated with stunting children's development in humans, as well as domesticated animals. In addition, mycotoxin contamination creates major non-tariff trade barriers for agricultural products.

Mycotoxin research is at the intersection between agricultural development and nutrition and health, two sectors deeply connected, but searching for more evidence-based work related to improving both agricultural output and health of communities. Appropriate post-harvest storage, drying and sorting of grains is an effective method for addressing aflatoxin and other mycotoxins in the ag value chain, and will have significant positive nutrition and health outcomes.

The fungi responsible for creating mycotoxins are pervasive in the soil and environment, posing a particular challenge in the tropics, subtropics and in the southern USA. Identifying mycotoxin outbreaks before consumption is a challenging, expensive undertaking, typically relying on field surveys that are expensive and slow to produce an answer in developing countries. Mycotoxin contamination of food and feed varies by orders of magnitude between regions, seasons, farms and even kernels; variation at each scale ranges from undetectable to hundreds or even thousands of times the maximum allowable limit. Farmers have to safeguard against mycotoxin contamination year-round, since they can affect crops before harvest, and even clean harvests can become contaminated during drying and storage. There are a number of pre- and post-harvest factors known to contribute to mycotoxin contamination, each of which has known biophysical drivers such as temperature and rainfall, often relating to crop infection and subsequent toxin production.

Since 2014, The Post-Harvest Loss Innovation Lab has established laboratories necessary for post-harvest loss and mycotoxin research in **7 countries** (Afghanistan, Bangladesh, Ethiopia, Ghana, Guatemala, Honduras and Nepal). Providing the appropriate equipment and lab training builds the institutional capacity to detect and research mycotoxins for our in-country partners, including universities and national-level laboratories. In-fact, the PHLIL-established mycotoxin lab in Bangladesh was the first functioning mycotoxin analysis lab in the country. The presence of these labs in addition to the lab training for local scientists and students is essential to the reduction of post-harvest losses today and for years to come.

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Research in Progress: Risk-Mapping in Nepal

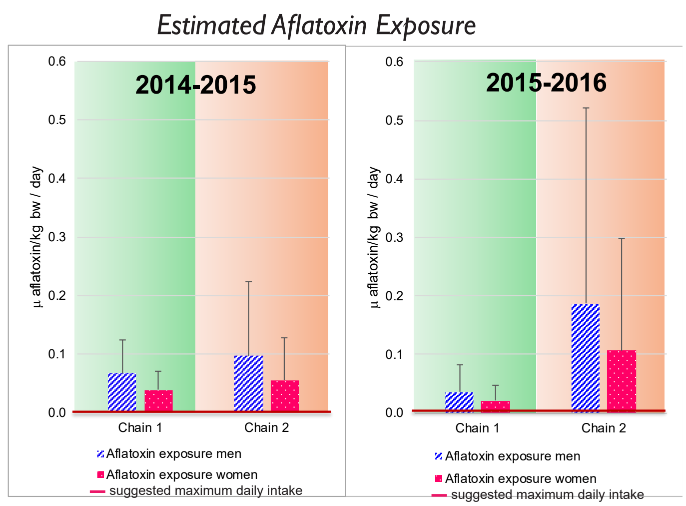
The PHLIL Mycotoxin Buy-In in Nepal includes conducting a mycotoxin assessment across the Feed the Future Zone of Influence in Nepal to determine the prevalence of various types of mycotoxins in the food and feed supply. This activity was designed as a follow up, and partly as a collaboration (specifically in Banke district) with the Nutrition Innovation Lab's study on mycotoxin exposure and stunting of children's development. National partners from the Nepal Development Research Institute, Tribhuvan University and the Nepal Academy of Science and Technology (NAST) are collaborating with Helen Keller International to deploy the household surveys.

Pre- and post-harvest mechanistic risk models based on mycotoxin contamination factors have previously been developed (Chauhan et al, 2015). The research in Nepal is designed to provide first-order information about mycotoxins present in the food and feed supply, related agricultural practices, and ultimately in-country research capacity and a national system-driven plan to mitigate this challenging food safety risk into the future. The household and market surveys are also providing data, combined with historical climatic data for modeling, across 20 Zone of Influence districts (roughly one quarter of the country) that are being translated into potential risk levels for aflatoxin in maize in different areas. Beyond the scope of the Buy-In, the models can be further validated and adapted to other crops and other Feed the Future countries, to potentially serve as an early warning system for emerging high mycotoxin risk areas as the crop approaches harvest, which can help guide deployment of limited post-harvest mitigation resources where they are needed most. Ultimately, we seek to further the development of predictive risk modeling to better understand, track and target interventions for mycotoxin risk globally.

Nepal Risk Mapping lead: Dr. Ross Darnell, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.

Other Results: Guatemala

Research carried out at the mycotoxin testing laboratory at the Universidad del Valle in Guatemala and the University of Nebraksa-Lincoln, determined that maize from the Western Highlands contained aflatoxin and fumonisin at levels below international guidelines, but may still be a food safety concern because of the large amount of maize consumed by highland residents. This research finding led the PHLIL Guatemala team to promote nutritional diversity in communities in the highlands.



Major Season (Sept.-Dec.) Maize Post-Harvest Losses in the Middle Belt of Ghana

Activity	% Loss
Field (Over-Maturity, Harvesting, Heaping)	5.0
Shelling or Threshing	1.5
Drying	0.5
Storage (Mold)	15.0
Storage (Insect Pests)	8.0
Total	**30.0**

Minor Season (Jan.-Apr.) Maize Post-Harvest Losses in the Middle Belt of Ghana

Activity	% Loss
Field (Over-Maturity, Harvesting, Heaping)	6.0
Shelling or Threshing	1.0
Drying	0.2
Storage (Mold)	2.0
Storage (Insect Pests)	10.0
Total	**19.2**

Other Results: Ghana

The research performed in Ghana indicated that aflatoxin levels in the major season were detected at significantly higher levels than in the minor season. One of the potential causes for the increased levels of aflatoxin in the major season is the increased grain moisture content, likely a result of higher rainfall during major season harvesting. Harvest in the minor season overlaps with the dry season, giving farmers a drier environment to harvest and store their harvested grain during the minor season. The dryness of the season discourages the growth of the toxin-producing fungi, lowering the presence of aflatoxin.

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