Characterizing the Prevalence of Mycotoxins in Value-Chain Crops and Livestock Feed in Western Nepal

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Background

Mycotoxins are a group of toxic secondary metabolites produced by certain fungi in agricultural crops and known to be harmful to humans and animals. Chronic exposure to high levels of mycotoxins, especially aflatoxins (produced by species including *Aspergillus flavus* and *A. parasiticus*), can cause cancer, is associated with growth stunting in children, and immunosuppression, while acute exposure can be fatal (Kimanya et al. 2009). Mycotoxins can arise upon fungal contamination of crops in the field and after harvest, with a range of solutions already known that can be applied at various points in each value chain. By characterizing mycotoxin occurrence and related practices in Nepal, the Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss's (PHLIL) Nepal mycotoxin project is working to characterize mycotoxin contamination of food and feed, enhance in-country technical capacity to apply research to address this challenge, and identify short-, medium- and long-term strategies to mitigate mycotoxin contamination and exposure, in consultation with key stakeholders. Local partners include the Nepal Development Research Institute (NDRI), Nepal Academy of Science and Technology (NAST), Tribhuvan University and Helen Keller International (HKI-Nepal), and key stakeholders who have been consulted during the design and implementation phases. International partners including the University of Nebraska – Lincoln, the Institute of Sciences of Food Production in Italy, the Commonwealth Scientific and Industrial Research Organization in Australia, and collaborations with the Tufts University-led Nutrition Innovation Lab and Mars Global Food Safety Center.

The program aims to provide global leadership to reduce post-harvest loss of stored product crops. Led by Kansas State University (Manhattan, KS, USA), PHLIL has been working in developing countries such as Afghanistan, Bangladesh, Ethiopia, Ghana, Guatemala, and Honduras. Solutions for post-harvest challenges in Nepal are being sourced from across our program and globally.

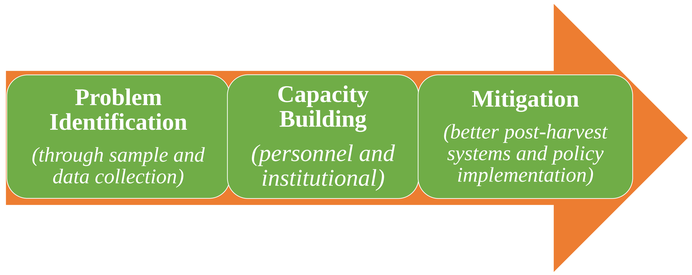
Objectives

The main objective of the project is to determine and characterize the prevalence of distinct types of mycotoxins present in value chain crops and animal feeds that may underlie human exposure.

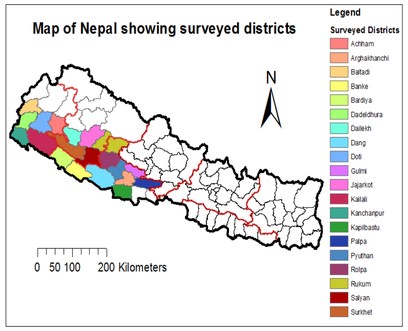
Specific objectives:

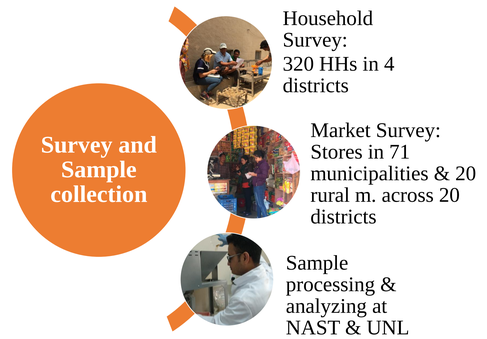
- Screen and assess mycotoxin contamination in maize, groundnuts, chilies, rice, complimentary foods and animal feed products (due to carry over in some animal source products)
- Determine the types of toxigenic fungal species and their ecological distribution
- Investigate prevailing post-harvest practices and recommend associated solutions to mitigate the problem
- Assess post-harvest and mycotoxin mitigation strategies designed and used around the world and gauge their applicability/feasibility in Nepal, in consultation with key stakeholders
- Build human and institutional capacity of local institutions through short- and medium- term training and direct collaboration

Theoretical Framework



Methodology and Implementation





Capacity Building Initiatives

Scientists from Nepal Academy of Science and Technology (NAST) and Nepal Development Research Institute (NDRI) at University of Nebraska-Lincoln (Nov 13-22, 2017)

Participants from Nepal completed their first training program on understanding and analyzing mycotoxins at UNL.

Scientists from NAST and NDRI at MARS Inc. International, Hyderabad, India (June 4-6, 2018)

MARS is supporting the project through capacity development of scientists from Nepal in the use and set-up of analytical equipment for mycotoxin analysis.

Establishment of Mycotoxin Analytical Laboratory at NAST Research Facility, Lalitpur

PHLIL is providing the laboratory at NAST with processing and analytical equipment required to perform mycotoxin analysis of cereal grain, oilseeds, spices, and other crops.

Current and Future Work

- Processing of samples from first round of survey (March-April 2018) at NAST – *ongoing*
- Second round of survey and sample collection (October-November 2018) – *completed*; storage of samples at NAST
- Analysis of first and second round samples at UNL, including by a Tribhuvan University faculty member (USA) – *ongoing*
- Analysis of partial samples from the first and second round of surveys at NAST – *near future*
- Analysis of survey data across collaborators– *ongoing*
- Demonstration and trial of low-cost grain dryers – *near future*

BAU-STR dryer developed at Bangladesh Agricultural University in association with PHLIL.

Program Implications

- Maintain a state-of-the-art laboratory at NAST to continue testing for mycotoxins in food and feed materials for research as well as public service.
- Investigate and implement efficient drying and storage systems, and other practices, to reduce mycotoxins and other post-harvest loss factors.
- Develop the right policies to ensure safe consumption of food products and improve the status of nutrition and food security in the country.

Partner Organizations

References

M. E. Kimanya, B. De Meulenaer, D. Roberfroid, C. Lachat, and P. Kolsteren, "Fumonisin exposure through maize in complementary foods is inversely associated with linear growth of infants in Tanzania," Mol. Nutr. Food Res., vol. 54, no. 11, pp. 1659–1667, 2010.

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