Pre- and Post-Harvest Management Linked with Aflatoxin Contamination of Maize in Different Ecologies of Nepal

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Introduction

- Aflatoxins are carcinogenic mycotoxins produced mainly by molds – *Aspergillus flavus and A. parasiticus*
- Chronic exposure to high levels causes stunting in children, immunosuppression, liver cancer (*Kimanya et al., 2010*)
- Government of Nepal regulates levels up to 20 ppb in food and 100 ppb in animal feed
- Extent of contamination varies with geography, agricultural practices, susceptibility of certain cultivars during storage (*Hell et al., 2008*)

A. flavus in maize cobs (1)

(1) ISU Extension Store, Iowa State University

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Introduction (contd.)

- Karmacharya (1984) surveyed 465 samples of food products from different parts of the country, and found aflatoxin B1/B2 as the most prevalent mycotoxin strain
- Joshi and Karki (1988) found *A. flavus* strain predominantly in Terai maize
- Rai et al. (2013) found at least 18% of food samples heavily contaminated with mycotoxins

Objectives

CIMMYT led Cereal Systems Initiatives for South Asia (CSISA) collaborated with Department of Food Technology and Quality Control (DFTQC) to:

- understand how pre-and post-harvest management practices affect aflatoxin contamination
- assess the level of aflatoxin contamination in maize under farmers' storage conditions in different production ecologies

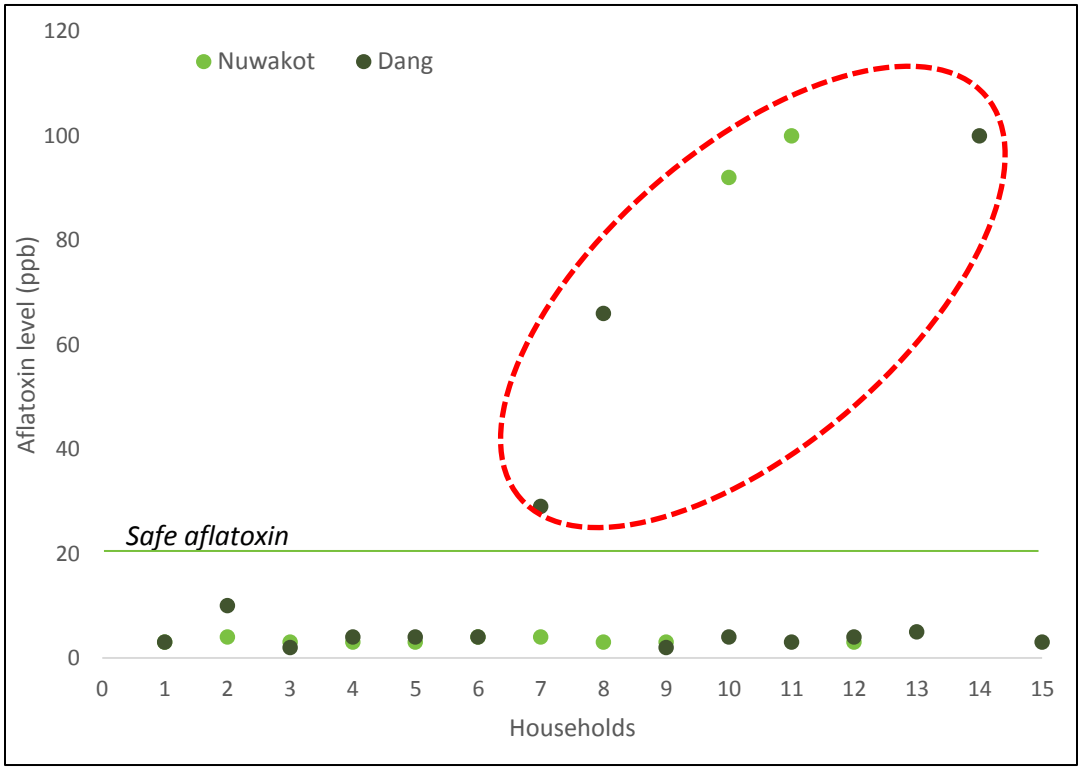
Specific Objectives

- Assess the level of aflatoxin contamination in spring-planted maize
- Study the effect of fertilizer management on pre-harvest aflatoxin contamination in summer maize
- Monitoring aflatoxin levels in local flour mills in Dang and Nuwakot
- Study the effect of storage methods (traditional and improved) on aflatoxin contamination in maize

METHODS, RESULTS AND DISCUSSION

Assessing Aflatoxin Levels in Spring-seeded Maize

Samples were collected immediately after harvest of the spring maize (in June)



Aflatoxin levels in maize among households in Dang and Nuwakot

- 17% household samples in Nuwakot (2 out of 12) and 20% samples in Dang (3 out of 15) had aflatoxin level higher than the regulatory standard (20 ppb)

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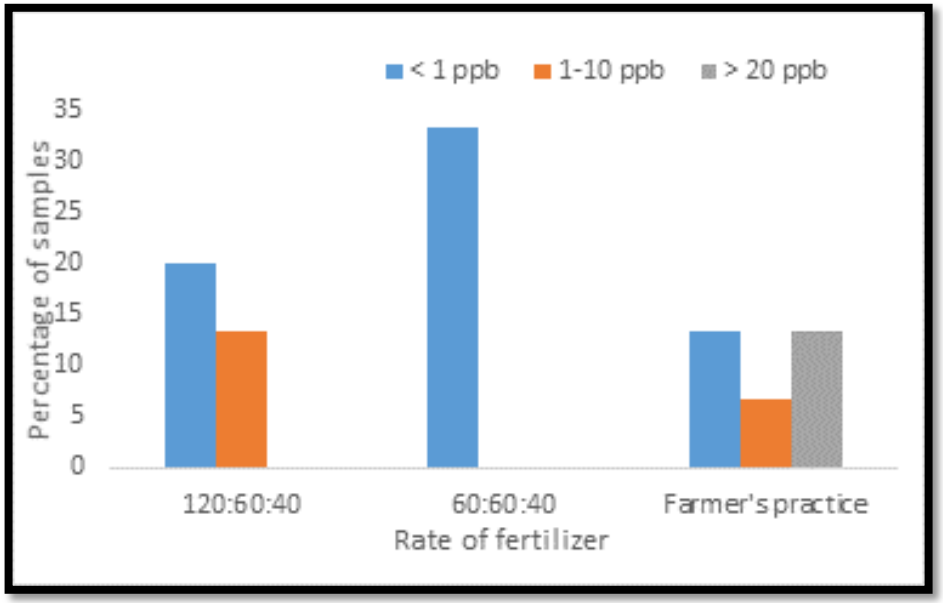
Better fertilizer management reduces risk of pre-harvest aflatoxin contamination in maize

On-farm evaluations of summer maize under three different fertilizer management regimens

- *Farmers' practice (urea only)*
- *Medium fertility: (60:30:30 kg NPK/ha)*
- *High fertility: (120:60:40 kg NPK/ha)*



Aflatoxin levels in maize for different fertilizer regimens

- Maize grown under farmers' fertilizer management had high levels of aflatoxin contamination
- Under moderate fertilizer application (60:30:30), all of the samples had very low aflatoxin levels (< 1 ppb).
- With high level of fertilizer application (120:60:40), ~ 40% of samples had aflatoxin levels of 1–10 ppb and 60% of the samples had aflatoxin levels below 1 ppb.
- The higher level of aflatoxin under farmers' fertility management was also associated with the appearance of stalk rot disease in the field.

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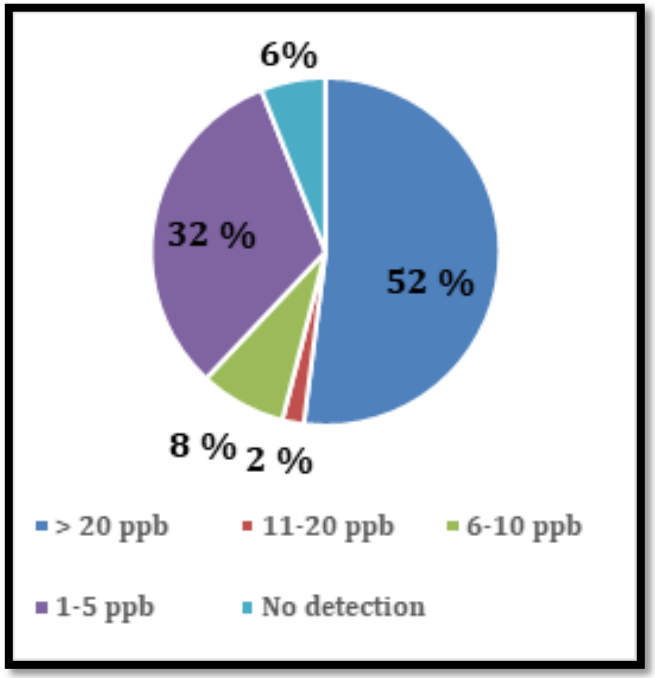
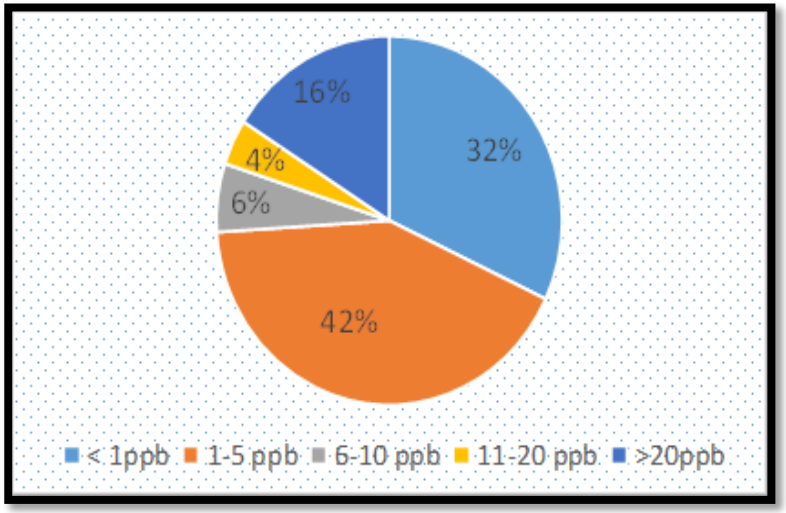
Contamination of maize consumed by farmers and fed to animals exceeds safety standards





Aflatoxin level in maize grains collected from the local floor mills in Nuwakot (left) and Dang (right/above)

- 100 maize samples collected from 10 local flourmills in Nuwakot and Dang, where farmers from different areas brought maize for grinding.
- Most of the samples had been stored for 5–6 months without de-husking, stacked inside the house.
- 52% of the samples in Nuwakot and 16% in Dang had aflatoxin levels that exceeded the safety standard, i.e. > 20 ppb.

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Storage practices – old and new

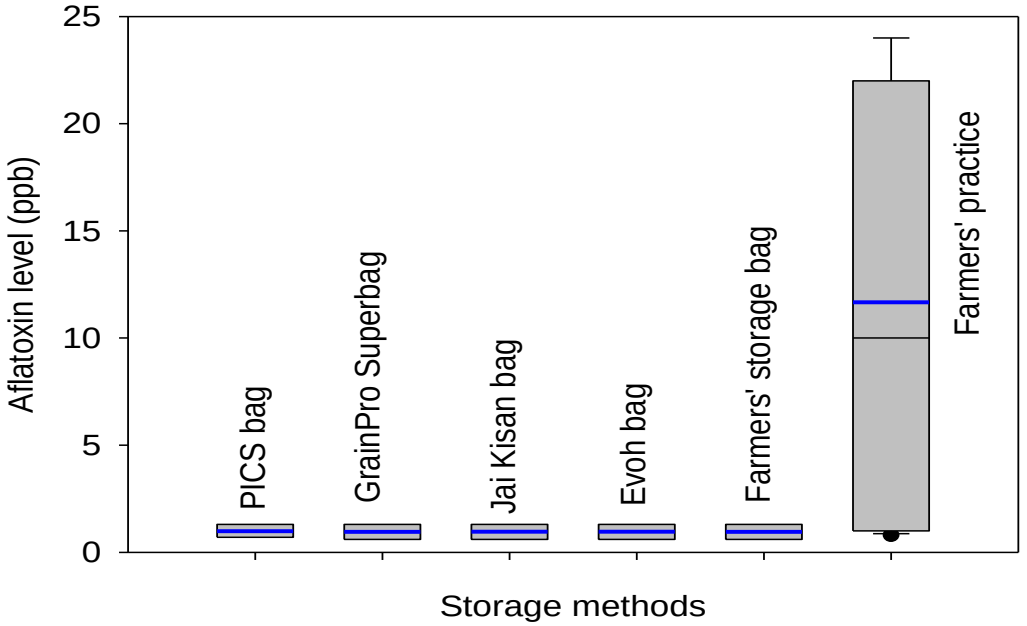
Traditional storage of maize

Maize grain stored in hermetic bag

Better post-harvest management reduces aflatoxin contamination in maize in wet summers

Four different brands of hermetic storage bags together with non-hermetic plastics and farmers methods of storage were compared (for 3 months)

- Maize cobs were shelled and dried immediately after harvest



Aflatoxin level in maize grains stored in different methods

- Aflatoxin levels under all improved practices were < 1 ppb.
- Under farmers' storage practices – storing without de-husking – more than 50% of the samples had aflatoxin levels exceeded the safety standard of 20 ppb.

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Conclusions

- The results highlight the importance of improving soil fertility management to limit the entry of aflatoxin into the food chain
- Drying practices and storage methods of maize after harvest have a significant impact on aflatoxin contamination in any ecology
- Storing maize after taking the grain off the cob and drying immediately after harvest minimizes aflatoxin contamination during storage

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- Participating farmers and flour mills from Nuwakot and Dang

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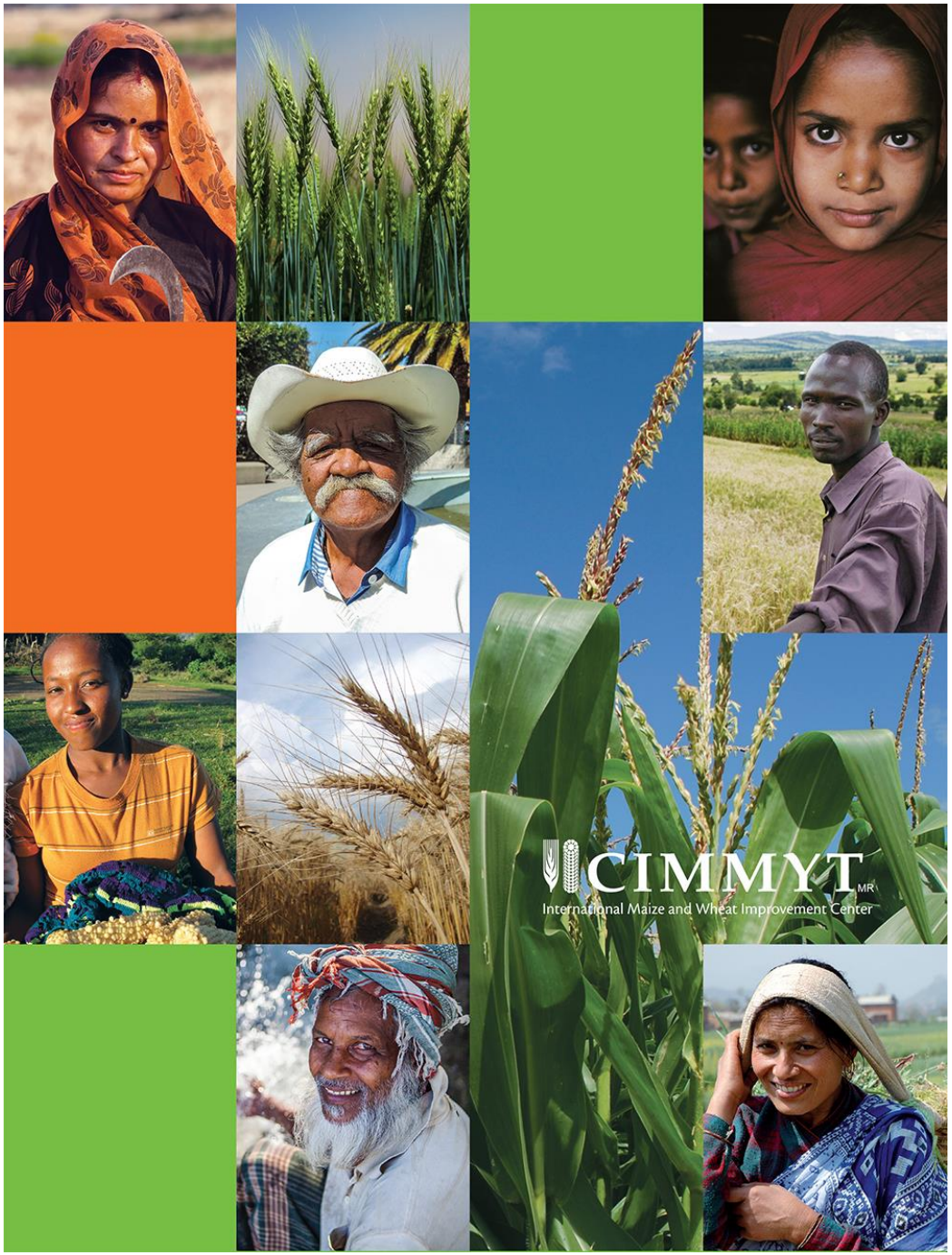

Thank you for your interest!

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