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)*
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)

- 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)
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)

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

- 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.

Aflatoxin level in maize grains collected from the local floor mills in Nuwakot (left) and Dang (right/above)
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 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.
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
Thank you for your interest!

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References


