CAN MANAGEMENT IMPACT AFLATOXIN IN CORN?

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Introduction

Aspergillus ear rot is caused by the fungus *Aspergillus flavus* and is recognized as an olive-green powdery mold that usually occurs at the ear tip or in association with damaged kernels. The fungus infects corn ears soon after pollination when the silks are yellow-brown but still moist. Infection and colonization of kernels are favored by hot (>86F), dry conditions during grain fill.

The fungus, *A. flavus*, may also produce a potent mycotoxin called aflatoxin. Hot, dry conditions with warm (>70F) nights and low kernel moisture (<35%) favor the production of aflatoxin. Not all strains of *A. flavus* produce aflatoxin. Grain contaminated with aflatoxin can cause feeding and reproductive disorders in swine, cattle and poultry, and has been associated with esophageal cancer in humans. For these reasons, the FDA has established an "action level" of 20 ppb for aflatoxins in corn for interstate commerce.

Aflatoxin does not occur uniformly throughout a load of grain, thus sampling grain to test for aflatoxin can be very difficult. It is recommended that a composite sample of at least 10 lb of corn be collected from a load of grain. Two methods may be used to test for aflatoxin contamination. The black light test tests for the presence of the fungus in the grain (not aflatoxin) by detecting "glowers", which are kernels that glow greenish-gold, within the sample. If there are greater than eight "glowers" in a 5-lb sample, the sample should go for further testing. There are several commercial test kits available that can quantify the level of aflatoxin in a grain sample.

Aflatoxin in Iowa in 2012

The 2012 growing season in Iowa was hot and dry and thus favorable for development of Aspergillus ear rot and aflatoxin contamination. Concerns about aflatoxin were high. The FDA approved a temporary blending policy for aflatoxin in Iowa so that corn containing more than 20ppb of aflatoxin could be blended with corn containing less than 20 ppb for use in appropriate animal feed when a compliance agreement was filed with the Iowa Department of Agriculture and Land Stewardship (IDALS) before the grain was used (Hurburgh and Robertson, 2012).

To monitor Aspergillus ear rot development in Iowa, the disease was assessed in seven corn fungicide trials that were done in various parts of the state. Percent ear rot was recorded on five ears per plot within 48 hours prior to harvest. Grain samples were collected and harvested and transported to the Grain Quality Initiative Laboratory on central campus. Grain characteristics and the number of "glowers" in each sample were measured. The concentration of aflatoxin in grain samples is currently being determined.

Aspergillus ear rot was amongst the ear rot found in three of the seven fungicide trials; at Armstrong (two trials), and Ames (one trial) (Table 1). Mean ear rot severity was very low and

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ranged from 0 to 1.55 percent at Armstrong, and was less than 1.0 percent at Ames and Nashua. The number of "glowers" in the trials at Armstrong ranged from 0 to 4.7 (mean 1.1) per lb of grain and were found in 50 percent of plots, and 0 to 6.1 (mean 2.3) per lb and occurred in 30 percent of plots. At Nashua and Ames, there were far fewer "glowers". In Ames, 10 of 80 plots had 0 to 3.1 (mean 0.1) per lb "glowers". The aflatoxin content in these grain samples is currently being tested. There was no evidence of a fungicide effect on ear rot severity.

Table 1. Mean percent ear rot severity and mean number of "glowers" in grain samples collected from fungicide trials at 7 locations in Iowa in 2012.

Location	Mean ear rot severity (range) (%)	Mean number of "glowers" /lb (range)
Ames	<0.1 (0 to 2.0)	0.1 (0 to 3.1)
Armstrong 1	0.2 (0 to 1.2)	1.1 (0 to 4.7)
Armstrong 2	0.4 (0 to 2.0)	2.3 (0 to 6.1)
Crawfordsville	0.1 (0 to 2)	0
Kanawha	0.5 (0 to 11.0)	0
Nashua	<0.1 (0 to 3.0)	0
Sutherland	0.1 (0 to 0.8)	0

The mean aflatoxin level of Iowa corn in 1983 and 1988 was 20ppb, however, despite similar weather conditions; the incidence of aflatoxin in Iowa corn in 2012 was far less than expected – less than 20 percent of the crop with greater than 20ppm aflatoxin (Hurburgh and Robertson, 2012).

Managing Aflatoxin Contamination

To reduce aflatoxin contamination in corn, farmers must start by managing Aspergillus ear rot in the field. The following practices can be done to reduce development of ear rot and aflatoxin production:

- control insects that may damage ears or grow hybrids with insect resistant traits;
- manage crop stress, e.g., plant at recommended populations, fertilize adequately, manage weed competition
- scout for ear rot at black layer and target fields in which more than 10 percent of ears have signs of ear rot for an early harvest;
- adjust combine settings to minimalize damage to grain;
- ensure storage bins are clean, and cool (<40F); and
- dry grain to 14 percent moisture immediately after harvest to prevent further mold development in the bin.

Syngenta Crop Protection does have a product Afla-Guard® that is registered on corn to reduce aflatoxin contamination. The product contains a strain of the fungus that does not produce aflatoxin. The product is applied prior to tasseling/silking and the idea is that this atoxigenic strain of the fungus colonizes the ear and thus prevents endemic toxigenic strains from colonizing the ears. In field trials over several years at the University of Texas, an application of Afla-Guard® has usually (but not always) lowered levels of aflatoxin in corn compared with an untreated control (Isakeit et al., 2009; Isakeit et al., 2011). No such data are available for the Midwest.

It is possible to reduce aflatoxin levels in contaminated grain. Removal of fines using a rotary screen may reduce the level of aflatoxin since damaged and broken kernels usually have the highest levels of the toxin. Ammoniation by a trained professional may also reduce aflatoxin levels in the grain, but can only be done for on-farm livestock feeding use since the FDA does not allow ammoniated grain to be shipped for interstate commerce.

References

Hurburgh, C., and Robertson, A. 2012. The impact of the drought on grain quality and grain processing. Proceedings of the 24th Annual Integrated Crop Management Conference, Nov 28-29, 2012, Ames, IA.

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