

General Mycotoxin and Aflatoxin Facts

By Susan Day PhD

What are Mycotoxins?

- Mycotoxins are produced by certain molds that infect grains. Aflatoxins are a specific group of Mycotoxins which can reduce feed efficiency and reproductivity of livestock.
- The mycotoxins of greatest interest to livestock producers are aflatoxin, deoxynivalenol (also known as vomitoxin or DON), fumonisin, zearalenone and occasionally ochratoxin and T-2 toxin.
- It is important to note that molds may be present without the production of mycotoxins, but mycotoxins cannot be produced in the absence of molds. Mold may be treated and controlled with propionic acid. Propionic acid will inhibit additional mold growth, but it will not decrease mycotoxins already in the grain, as they are extremely stable compounds.
- Aflatoxin is perhaps the mycotoxin of greatest concern because it represents a risk to human as well as animal health. Because aflatoxin can accumulate in meat and milk, it is a public health issue that cannot be ignored.
- The commodities with the highest risk of aflatoxin contamination are corn, peanuts and cottonseed.
- Corn with aflatoxins can be used for ethanol production. Aflatoxins do not accumulate in the ethanol but will be concentrated in the distiller's grains co-product. In wet-mill processing, aflatoxins concentrate in the gluten co-products. A rough estimate is that aflatoxin levels in feed co-products will be three times those in whole corn.

What are the health effects to livestock and humans from aflatoxin?

- Aflatoxins cause liver damage, decreased milk and egg production, and recurrent infection as a result of immunity suppression (eg. salmonellosis). In addition, even low dietary concentrations of aflatoxins can cause embryo toxicity.
- While the young of a species are most susceptible, all ages are affected, but in different degrees for different species. Clinical signs of aflatoxicosis in animals include gastrointestinal dysfunction, reduced reproductivity, reduced feed utilization and efficiency, anemia and jaundice.
- Most commonly, aflatoxin reduces the feed efficiency and reproductivity of livestock. It can suppress the immune system of animals, leading to more frequent occurrence of infectious diseases. Unfortunately, the most abundant aflatoxin, aflatoxin B1, is a carcinogen. This raises human health concerns because aflatoxin can appear in the milk of dairy cows fed contaminated corn.
- The FDA has established specific guidelines on acceptable levels of aflatoxins in human food and animal feed by establishing action levels that allow for the removal of violative lots from commerce. The action level for human food is 20 ppb total aflatoxins, with the exception of milk which has an action level of 0.5 ppb for aflatoxin M1 (a metabolic derivative of aflatoxin B1). The action level for most feeds is also 20 ppb.

How do we test for aflatoxin?

- Because aflatoxin does not occur uniformly through a lot of grain and is usually localized in a small area, the best approach is to make a composite sample consisting of subsamples from every part of a load, bin or unit of corn.
- Fields that vary in cropping history, tillage practices, planting date, soil type or hybrid can differ greatly in aflatoxin vulnerability. Sample a minimum of 10, preferably up to 30, locations within each field. To reach the same sampling frequency as testing grain in trucks, collect one sample (5-10 lb) for about every 5 acres. Immediately dry samples to 12-14 percent moisture to prevent aflatoxin development during transit or storage.

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- Two types of screening tests are often used: black light tests and commercial test kits.
 - The black light (also called ultraviolet light) test is a quick preliminary test that is a visual inspection for the presence of a greenish-gold fluorescence under light at a wavelength of 365nm (nanometers). The greenish-gold fluorescence looks like a firefly glow, and indicates the presence of an acid that is produced by actively growing *A. flavus* in the kernel. However, remember that this test is an initial screening for the presence of the fungus, NOT the toxin, and the results must be verified by laboratory analysis. If there are less than eight glowing particles per 5 lb. sample, this does not guarantee that the sample is free of aflatoxins, nor is it certain that the same count will work in future outbreaks. Furthermore, kernels with glowing particles are not necessarily the ones contaminated with aflatoxin.
 - Commercial test kits with immunoassay or ELISA techniques are available for on-site tests for aflatoxin. Immunoassay analysis is based on the detection of specific proteins found in aflatoxins using antibodies to identify these proteins. The tests are very specific for aflatoxin, but they require operator training and practice to be accurate.
 - Screening indicates which samples could need further testing at an analytical laboratories using thin-layer chromatography, mini-columns, gas chromatography or mass spectroscopy to determine aflatoxin levels. These procedures are highly accurate and quantitative.

What do you do if you have feeds contaminated by aflatoxin?

A new approach to the detoxification of aflatoxins is the addition of inorganic sorbent materials, known as chemisorbents, such as hydrated sodium calcium aluminosilicate (HSCAS) to the diet of animals. HSCAS possesses the ability to tightly bind and immobilize aflatoxins in the gastrointestinal tract of animals, resulting in a major reduction in aflatoxin bioavailability. Binding agents such as sodium bentonite and aluminosilicates may reduce the effects of aflatoxins on livestock. These products are approved for use in feed as flow agents, although the FDA does not recognize their aflatoxin management properties.

Table 1. FDA guidelines for acceptable aflatoxin level in corn based on intended use (www.fda.gov).

Intended use	Aflatoxin level (ppb)
Milk (Dairy Feed)	None detected
Corn of unknown destination	<20
Corn for young animals	<20
Corn for dairy cattle	<20
Corn for breeding beef cattle, swine, and mature poultry	<100
Corn for finishing swine	<200
Corn for finishing cattle	<300

Sources:

<http://www.ansci.cornell.edu/plants/toxicagents/aflatoxin/aflatoxin.html>

Patience, J. and S. Ensley. Mycotoxin contamination of corn. Iowa State University

<http://www.extension.iastate.edu/Publications/PM1800.pdf>

For assistance in formulating rations to utilize aflatoxin infected feeds and minimize the potential damage, please contact your Area Sales Manager or our nutrition staff at 1-800-821-3070.