

## **AFLATOXIN IN DAIRY FEEDS**

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### **WHAT IS AFLATOXIN AND HOW IS IT PRODUCED?**

The widespread drought conditions in Louisiana and surrounding states last year resulted in a large percentage of the corn being contaminated with aflatoxin. Though there is reason for concern, problems with aflatoxin can be avoided with proper caution. Mycotoxins are toxic compounds produced by molds. Although aflatoxin is just one of the many mycotoxins that can cause problems, aflatoxin is readily measured in feeds. The development of aflatoxin depends primarily on the growth of the *Aspergillus* mold in corn. High temperatures and high humidity are the favorable conditions for the infection of corn kernels through the silks by the *Aspergillus* fungi. Therefore, *Aspergillus* infections and aflatoxin contamination are more common in the corn grown in the southeastern United States than other areas of the country. Drought stress has also been found to increase the number of *Aspergillus* spores in the air. Thus, when drought stress occurs during pollination, the increased population of *Aspergillus* spores in the air greatly increases the chance of infection. Also, drought stress, nitrogen stress and other stresses that affect plant growth during pollination can increase the level of aflatoxin produced by the *Aspergillus* fungi.

In the past, insect injury to the maturing ear of corn was considered necessary for infection to occur. This is now known to be false, but insect damage to ears can provide wounds that can increase *Aspergillus* infection rate of the kernels. Insects can also provide transportation for the *Aspergillus* spores to the silks and kernels. Therefore, insect damage to drought-stressed corn during pollination can greatly increase *Aspergillus* infection and the levels of aflatoxin.

Time of harvest has been shown to have an influence on aflatoxin levels because *Aspergillus* does not compete well with other molds when corn is above the 20 percent moisture. Thus, harvesting corn with a moisture content of above 20 percent and then drying it down to at least a moisture content of 15 percent, within 24 to 48 hours of harvest, will keep further *Aspergillus* growth and toxin production at a minimum.

Mature corn that remains in the field or corn that is stored without proper drying can be subject to *Aspergillus* growth and aflatoxin production. *Aspergillus* growth is optimum when temperatures are between 80 degrees F and 100 degrees F with a relative humidity around 85 percent (corresponding to 18 percent grain moisture.) Fungus growth is very low below 55 degrees F but, if the grain is moist enough, toxins can still be produced. Simply reducing the moisture content to 12 to 13 percent will stop fungus growth; however, this will not kill the fungus and does not influence the levels of toxins that may have already been produced. If moisture levels rise again above 13 percent anytime during storage and temperatures are high enough, then mold growth and toxin production will resume.

### **EFFECTS OF AFLATOXINS ON LIVESTOCK AND HUMANS**

There have been many loads of corn rejected at the grain elevators or sold for salvage prices due to aflatoxin contamination. Why all the fuss about aflatoxin in corn? Aflatoxin can be toxic to all classes of livestock and to humans. Also, aflatoxin can appear in the meat, milk, and eggs of food animals that have consumed aflatoxin-contaminated feeds. The aflatoxin group consist of B1, B2, G1, and G2. Aflatoxin B1 is the most potent of the group and has been shown to be a potent carcinogen. Aflatoxin M1 is metabolic breakdown product of aflatoxin B1 and can appear in the milk of lactating cows consuming significant quantities of aflatoxin B1. Aflatoxin M1 is not as carcinogenic as B1 but can be as toxic. The conversion of aflatoxin B1 in feed to aflatoxin M1 in milk is about 1% to 2%. The FDA regulatory level of aflatoxin in milk is 0.5 ppb.

All classes of livestock can be affected by aflatoxin but some are more susceptible than others. Poultry, turkeys and swine are more sensitive than beef and dairy cattle. Young animals in all species are more sensitive to the effects of aflatoxin than mature animals. Pregnant and growing animals are less susceptible than young animals, but are more sensitive to aflatoxin than mature non-pregnant animals. Even when fed at nonlethal levels, aflatoxin will reduce productive efficiency and may increase the disease susceptibility of the animals. Aflatoxins have negative effects on most aspects of the animal's metabolism and physiology; hence, diagnosis of aflatoxicosis per se difficult. As such, preventive detection in the feed is essential.

## DETECTING AFLATOXIN

Aflatoxin is a chemically stable compound that is odorless, colorless and tasteless. Due to the low concentrations involved and the uneven distribution in grain bins, aflatoxins are difficult to detect. The blacklight has been used for years as a gross screening device for the presence of aflatoxin. However, this test is not quantitative and may detect other compounds that fluoresce. The regulatory standard is thin layer chromatography. In recent years, a simple and inexpensive test kit has been designed and can be used by virtually anyone. The test kits approved by the Federal Grain Inspection Service are listed below:

### **Quantitative Test Kits** (those that provide an actual aflatoxin concentration)\*

Veratox - AST	Neogen Corp.	800-234-5333
	620 Leshar Place	
	Lansing, MI 48912	
	Attn: Chuck Bird	
Aflatest-P	VICAM, L.P.	800-338-4381
	313 Pleasant St.	
	Watertown, MA 02172	
	Attention: Thomsen Hansen	

### **Qualitative Test Kits** (those that provide a yes or no answer at 20 parts per billion total aflatoxin content):\*

EZ-Screen	EDITEK	800-334-1116
	1238 Anthony Rd.	
	Burlington, NC 27215	
	Attn: MelRee Krivanic	
CITE Probe	IDEXX Laboratories, Inc.	207-856-0300
	1 IDEXX Dr.	
	Westbrook, ME 04092	
	Attn: Bill Thomas	
Alfa-Cup-20	International Diagnostic	616-983-3122
	Systems Corp.	
	P. O. Box 799	
	St. Joseph, MI 49085	
	Attn: E. Lewis	
Agriscreen	Neogen Corp.	800-234-5333
	620 Leshar Place	
	Lansing, MI 48912	
	Attn: Chuck Bird	

Another option for producers would be to send a sample to one of the aflatoxin testing stations that have been setup throughout the state or to the Louisiana Department of Agriculture and Forestry's Feed and Fertilizer Laboratory on the LSU Campus. Producers should test every load of corn before receiving or feeding it, particularly dairy producers.

In order to get accurate and reliable test results, the single most important factor is a good representative sample of the grain. At least ten pounds of corn should be collected, composited from many small samples taken randomly from many different spots in the truck or bin or at different time intervals during the unloading. The final mixed composite sample should be placed in a container that can breathe (plastic bags or air-tight containers allow continued growth of the *Aspergillus* fungus and the production of aflatoxin). A paper bag will work very well.

## LOWERING AFLATOXIN LEVELS

Anhydrous ammonia or aqua-ammonia has been used to chemically alter aflatoxin and thus rendered inactive in the feed. For more information on this procedure, contact your local Extension Agent and ask for the Georgia Cooperative Extension Service Bulletin "Treating Aflatoxin Contaminated Corn with Ammonia". Be aware that this and other methods do not have FDA approval for corn sold for interstate shipment. However, these methods can be used for the treatment of contaminated corn on the farm or locally. Screening corn to clean it of broken and damaged kernels can lower the level of aflatoxin because aflatoxins are highest in damaged corn. This also means that producers should be extremely suspicious of aflatoxin when buying corn screening to use in rations.

Hydrated aluminosilicates and various types of clays are often advocated for reducing the effects of aflatoxins in the animal. These products are used as anticaking agents in the feed industry but are commonly included in feeds known to have aflatoxin present. These products act like "chemical sponges" by sequestering and immobilizing the aflatoxin in the gastrointestinal tract of livestock or poultry, thereby preventing its normal uptake by the blood and then being carried to target organs such as the liver. However, be aware that this "treatment method" has variable effectiveness and is implicitly illegal, because the most of these products are approved only for uses such as anticaking and not for use in aflatoxin treatment.

The simplest method for lowering the level of aflatoxin in feed is to blend down the contaminated corn with clean corn or other feed ingredients to dilute the level that is in the total ration or grain mix.

For example:

500 lb Corn containing 300 ppb aflatoxin  
500 lb Corn containing 0 ppb aflatoxin  
300 lb Cottonseed Meal  
300 lb Soy Hulls  
300 lb Cottonseed Hulls  
100 lb Molasses  
2000 lb Total

This grain mix would contain only 75 ppb aflatoxin instead of 300 ppb aflatoxin, because the contaminated corn only represents 25 percent of the total ration.

## USING CONTAMINATED CORN

There are no clear-cut safe levels established for feeding aflatoxin-contaminated feed to different animal species regarding their resistance or tolerance to aflatoxin. To feed at a level other than 0 ppb is a risk assumed by the producer making the decision to do so. For those who have decided to feed aflatoxin-contaminated feeds, the following general guidelines may assist you in your decision making:

**Lactating dairy cows** should not receive more than 20 ppb of aflatoxin because of the possibility of going above the 0.5 ppb level in the milk.

**Beef cattle** can probably tolerate higher levels of aflatoxin; however, due to the possible effects during pregnancy and subsequent lactation, the recommended level should be no more than 100 ppb aflatoxin for all beef cattle.

**Poultry, swine and horses** are more sensitive to aflatoxin. Rations formulated for these animals should contain no more than 20 ppb aflatoxin.

## SUMMARY AND APPLICATIONS

The information give herein should only be used as guidelines. Safe levels for aflatoxin feeding vary with each individual animal. The ingestion of aflatoxin at levels even lower than those given above may cause some undesirable side effects. Moreover, these effects are dependent on factors such as age, sex and general health of the animals. Monitor animal health closely and discontinue use of contaminated feed immediately if undesirable effects are noticed.