

Minimizing Aflatoxin in Corn



Aflatoxin is a naturally occurring toxic chemical byproduct from the growth of the fungus *Aspergillus flavus* on corn and other crops such as peanuts and cottonseed. Grain containing aflatoxin is toxic to animals, especially young animals and poultry; therefore, facilities that handle grain routinely test loads before accepting delivery.

Aflatoxin problems are more likely in Mississippi than in the Corn Belt because the state's hot, humid climate is ideal for fungal growth. Also, little hybrid resistance exists, and few if any decontamination methods have proven successful and been granted federal approval.

Stressful Conditions

Because of the Midsouth's climatic conditions, aflatoxin will continue to threaten corn producers until control measures are identified. Aflatoxin problems have historically developed during years with severe high-temperature stress, particularly when coupled with water deficiency and insect ear and stalk damage. In 1977 and 1998, Mississippi had severe problems with aflatoxin-contaminated corn.

Aflatoxin can infect corn by airborne spores in the field during grain filling or during storage and handling. Kernel infection may occur through the silk, cob, or direct contact. Fungus spores overwinter on plant residue on the soil. However, management practices to reduce the inoculum level have little impact on aflatoxin development in subsequent years because the fungus is abundant in the Midsouth nearly every year.

Producers can minimize the likelihood of developing a problem by using sound agronomic practices, properly storing and drying grain, maintaining grain quality, and sanitizing grain-handling equipment.

Management Practices

Aflatoxin develops in the field when corn is exposed to severe environmental conditions known to stress kernel development and promote fungal infection within the ear. Management practices that improve plant health strongly discourage aflatoxin development.

Timely planting, adequate fertility, good weed and insect control, supplemental irrigation, suitable plant

population, and hybrid selection should help reduce aflatoxin potential. Although hybrid evaluations conducted in Mississippi in 1998 indicated little aflatoxin resistance in commercially available hybrids, hybrids that perform well in drought conditions generally have lower aflatoxin concentration than hybrids that yield poorly in drought conditions.

Harvest Timing

Producers may reduce the likelihood of aflatoxin buildup in the field by harvesting corn before it reaches the industry standard of 15.5 percent moisture. This system reduces the time when ears may be exposed to unfavorable drying conditions that promote aflatoxin development in the field.

Corn reaches physiological maturity at about 30 percent moisture and can be harvested anytime thereafter. Mississippi research indicates corn will normally lose around 0.6 percent moisture per day during the dry-down period. This rate is not influenced much by hybrid maturity. Thus, you can reduce field exposure by at least 1 to 2½ weeks by harvesting corn at 20 to 25 percent moisture, compared to letting the corn dry in the field to 15 percent moisture.

The disadvantage of early harvest is that wet, warm grain is an ideal environment for rapid aflatoxin escalation if it is not handled properly. Dry your high-moisture grain (16–30 percent) to below 15 percent moisture within 24 hours after harvest, or immediately haul the grain to an elevator that will dry the grain.

Storage

Do not store grain in trucks, combines, bins, or any nonaerated site for more than 4 to 6 hours. These conditions quickly escalate aflatoxin levels and deteriorate grain quality, because fungal growth and grain respiration will rise quickly in high-moisture grain, particularly with normal Mississippi August and early-September air temperatures.

Conversely, aflatoxin approaches dormant levels when grain moisture drops to about 12 percent, especially when air temperatures decline to around 55°F. If you plan to dry

the grain yourself, do not harvest more corn than you can dry within these constraints.

Aflatoxin problems often develop in grain bins being used to dry corn. Minimize grain depth (commonly 3–6 feet deep) to quickly dry high-moisture corn using an in-bin drying system. Stirring devices may help but cannot overcome aeration problems that limit the drying rate in deep-layered grain. Other drying systems, such as continuous flow and portable batch driers, normally dry grain within these constraints, as long as harvest progress does not exceed the capacity of your drying system.

Harvest and Handling Practices

Altering harvest and handling procedures may improve grain quality. Fungi readily invade kernels with cracked or damaged seed coats. If you suspect a problem, keep obviously stressed, stunted, or damaged areas and field edges from healthy corn.

Increase fan speed, open sieves, and reduce ground speed to enhance the quality of grain collected by a combine. Postharvest screen cleaners and gravity separators help reduce moderate aflatoxin levels (50 to 100 ppb) below the FDA standard (20 ppb).

Spores from fungi on infected grain may readily disperse during handling, so it is important to clean out corn and debris left in combines, trucks, pits, grain carts, and augers daily. Clean bins before use because these are potential contamination sources. A chlorine cleaning solution (¾ cup bleach per gallon of water) kills fungal growth.

Detection

Methods historically used for aflatoxin detection range from visual observations to complex lab analyses. A “black light” test uses long-wave ultraviolet light to illuminate a bright yellow-green fluorescence indicative of a fungal metabolism product that often precedes aflatoxin. This product is called Kojic acid and should not be confused with aflatoxin. The “black light” test has limited use as a preliminary test to a more accurate chemical analysis.

Elevators or grain markets should use chemical analyses to determine aflatoxin content. You may also submit samples for analysis to the Mississippi State Chemical Lab or buy an aflatoxin test kit from chemical supply companies.

Sampling and Testing

Substantial aflatoxin testing variability is common because few kernels are normally contaminated with aflatoxin (less than 0.1 percent), but the concentration in individual kernels is often very high. Increasing the sample size and using proper sampling techniques may improve sampling efforts.

Chemical extraction of aflatoxin requires grinding the grain sample. Testers should grind the original sample before removing a subsample. This improves distribution of contaminated particles to the subsample. Testers may also grind particles finer, increase the size of the subsample, and increase number of analyses per sample to reduce variability. The latter two recommendations, however, will increase the time and expense involved with the procedure and may be impractical in some situations.

Action Levels

The United States Food and Drug Administration action levels for corn contaminated with aflatoxin establish guidelines for specific uses (Table 1). Research indicates that aflatoxin-contaminated corn within these action levels will not injure the health of specific animals listed or humans consuming foods derived from these animals.

Table 1. FDA action levels for aflatoxin-contaminated corn.

Maximum level	Use
20 ppb	Feed for dairy animals, immature animals, or other species, or uses not specified
100 ppb	Feed for breeding cattle, breeding swine, or poultry
200 ppb	Feed for finishing swine of greater than 100 pounds
300 ppb	Feed for finishing beef cattle

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