



## Crop Production

# Grain quality and grain handling issues in drought areas

by Charles R. Hurburgh, Jr., Iowa Grain Quality Initiative Management Team

The continued shortage of rainfall in eastern Iowa has affected both yield and quality for corn and soybeans.



(Iowa State University)

### Soybean quality

Soybeans will be small seeded. In some cases, the seeds will be flat or oblong chips rather than developed beans. This situation happened several years ago in a dry year; the term “shrinkled” (shriveled and wrinkled) was coined to describe such soybean seeds. The small seed size relates directly to loss in yield. Areas that received late August rains will have fewer “shrinkled” seeds. Seed beans from drought areas will be small.

The 2005 soybeans from dry areas are likely to be lower than average in protein unless late season rains occurred before the plants started to turn color. Because protein is formed at the end of the growing season, conditions that shorten the growing season reduce protein levels. Normal protein content for Iowa soybeans is about 35 percent, and for the United States as a whole, it is about 35.5 percent. Expect one to two percentage points of protein less in areas where the growing season was shortened. Lower protein means more difficulty in producing 48 percent protein soybean meal, more concerns for export buyers, and more mill-feed (hulls) for a processor to market. Food-quality soybeans with contract limits for protein and seed size may be most affected. Much of the dry area typically serves the export market.

Oil content is likely to be more normal, around 19 percent (on a 13 percent moisture basis). However, oil yields per bushel may be lower from flat and small soybeans because extraction is harder, leaving more residual oil in the soybean meal.

Soybean moisture levels will likely be low at harvest, but stressed grain does not store well. Soybeans above 12 to 13 percent moisture should be dried with aeration.

If bean leaf beetles were prevalent, there may be considerable mottling and brown staining. Discoloration does not affect oil and meal yields, but food-grade soybean users prefer normal-colored beans and have a higher percentage of cleanout from discolored lots. The impact of aphids on soybean color and quality is not known.



(Natural Resources Conservation Service)

### Corn quality

Corn quality is also affected by drought. Protein and other quality traits are determined early in the growing season. Drought reduces kernel fill. Corn protein should be average to above average (8% or better). Test weights will be reduced. If the drought was persistent through the entire season, corn test weights could average 52–54 lb/bu, which is less than the acceptable limits for No. 2 corn.

Test weight is a good indicator of corn storability. Corn that is below 54 lb/bu after drying should not be stored into warm weather and should be dried to less than 14 percent moisture before storage of any duration. Lighter corn also will break more in handling. Corn

normally gains 0.25 lb/bu per percent of moisture removed, but drought-stressed corn normally does not experience as much, if any, test weight gain.

Be selective about what corn is placed in storage versus moved at harvest. Low test weight corn should not be put in temporary storages or outdoor piles. It is also not wise to mix corn of different crop years in the same storage bin; the mix is generally much less stable than each year's crop stored separately.

Extreme drought creates susceptibility to aflatoxin in corn. Aflatoxin is produced by the fungus *Aspergillus flavus* that invades stress-weakened corn in the field. If nighttime low temperatures in August remain above 75 °F for several days, the fungus is more likely to produce toxin. The earliest harvested, most stressed corn is at the highest risk. It is recommended to spot check 2005 corn in severely dry areas before feeding or marketing. Consult with your veterinarian if you suspect a problem.

Aflatoxin testing by the United States Department of Agriculture is required for all corn exports. Elevators serving river and rail export markets will undoubtedly check corn they receive. Likewise, feed markets serving dairy herds should check because of the potential for

pass through into fluid milk. The tolerance for aflatoxin in fluid milk is 0.5 ppb compared to 20 ppb in whole corn. Dry and wet grind ethanol plants must be especially careful because the distillers' grains and corn gluten feed are often used in dairy rations. Processing in these plants concentrates aflatoxin or any other feed toxin about 4:1 in the feed products after starch is fermented or removed.

If corn is dried uniformly, aflatoxin is not likely to increase in storage; storage conditions of 18 percent moisture and above 60 °F are needed to support the *Aspergillus flavus* in storage, and even then, this fungus is often crowded out by more aggressive storage fungi that do not produce toxins.

The Iowa Grain Quality Initiative Web site has additional information about aflatoxin and aflatoxin testing. See <http://www.extension.iastate.edu/grain/resources/specialtopics/aflatoxin/aflatoxin.htm>.

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## Plant Diseases

# Risk of aflatoxin contamination increases with hot and dry growing conditions

by Alison Robertson, Department of Plant Pathology

**A** *Aspergillus* ear rot in corn fields has been reported by Iowa State University Extension field crop specialists in southeast and south central Iowa. The concern with this disease is the production of aflatoxins, which are extremely toxic chemicals produced by two molds *Aspergillus parasiticus* and *Aspergillus flavus*. Aflatoxin accumulation is usually associated with poor storage conditions. However, hot, dry conditions during grain fill increase the risk of *Aspergillus* infection and aflatoxin contamination in the field.

### Disease cycle and aflatoxin formation

*Aspergillus* fungi survive in plant residues. Numerous spores are produced in hot, humid conditions and carried by wind throughout the field. Infection occurs through corn silks, when they are yellow-brown and still moist, or in association with insect or bird damage to the developing kernels. High temperatures (80–100 °F)



Yellow-green powdery growth of *Aspergillus flavus* on a corn rootworm-damaged ear.

and high relative humidity (85%) favor the growth of *Aspergillus* in the field. Ear rot symptoms on corn ears can be recognized as gray-green or yellow-green powdery mold growth on and between the corn kernels (see photo).

Although the presence of *Aspergillus* mold does not necessarily indicate aflatoxin contamination, there is certainly an increased risk. Aflatoxins are produced under certain conditions, which include temperatures from 55–104 °F (optimum 81–86 °F), and 17–18 percent and higher moisture content. In addition, aflatoxin contamination does not occur uniformly from kernel to kernel.

The U.S. Food and Drug Administration regulate aflatoxin levels in food and livestock feed. An “action level” of 20 parts per billion (ppb) for aflatoxins in corn has been established for interstate commerce. Since this appears to be a high risk year in southeast and south central Iowa for aflatoxin contamination, it is likely that aflatoxin screening will be done at local elevators.

### Management recommendations

There is little that can be done this late in the season to reduce the risk of *Aspergillus* preharvest aflatoxin contamination. However, postharvest aflatoxin contamination can be reduced. Corn in high risk areas should be scouted at, or just prior to, black layer (physiological maturity), and again two weeks prior to harvest. If greater than 10 to 15 percent of the ears show extensive mold growth, a sample should be collected for aflatoxin analysis.

Contaminated fields should be harvested as soon as possible after the field matures. Adjust the combine to reduce kernel damage and reduce the amount of lightweight infested grain being harvested. Ensure storage bins are clean of debris from the previous season. Shelled corn should be dried to 15 percent moisture or less within 24 to 48 hours of harvest, and cooled to 35–40 °F for the duration of winter to reduce fungal growth and aflatoxin production.

### Uses for aflatoxin contaminated grain

Corn that is contaminated with aflatoxin at levels greater than 20 ppb may not be sold for interstate commerce, but it does have uses. Since aflatoxin levels are usually highest in damaged kernels, cleaning the grain using a rotary screen or gravity table may reduce their levels. However, this is expensive and not always successful since aflatoxins levels also can be high in undamaged kernels.

Contaminated grain may be used for feed using the guidelines in Table 1. This is probably the best use of contaminated grain available. Obviously, it is vital that a good estimate of aflatoxin concentration is obtained so that an educated decision can be made.

**Table 1. FDA guidelines for acceptable aflatoxin levels in corn based on intended use**

Intended Use	Aflatoxin Level (ppb)
Milk	None detected
Corn of unknown destination	< 20
Corn for young animals	< 20
Corn for dairy cattle	< 20
Corn for breeding meat cattle, swine, mature poultry	< 100
Corn for finishing swine	< 200
Corn for finishing cattle	< 300

Source: PM 1800, *Aflatoxins in Corn*

Blending aflatoxin-contaminated corn is not legal except for on-farm use. Ensiling will not reduce aflatoxin concentrations, although if the silage is properly managed, concentrations will not increase. Ethanol production is an option for aflatoxin-contaminated grain; however, accumulation of the aflatoxin in the distiller’s dried grains with solubles (DDGS) will occur. If the grain is to be used on-farm, anhydrous ammonia can be used to reduce aflatoxin contaminations.

### Fusarium ear rot and fumonisin contamination

In addition to *Aspergillus* ear rot, there also have been reports of *Fusarium* ear rot. The pathogen which causes this disease, *Fusarium verticillioides*, produces the mycotoxin fumonisin, to which swine are particularly susceptible. Similar to *Aspergillus*, the *Fusarium* fungus infects kernels via the corn silk or in association with insect damage. Symptoms of *Fusarium* ear rot are a white-to-pink mold on scattered kernels about the ear.

Much of this information and more on aflatoxins and fumonisins in corn can be found in the ISU Extension publications, PM 1800, *Aflatoxins in Corn* (<http://www.extension.iastate.edu/Publications/PM1800.pdf>) and PM 1698, *Corn Ear Rots, Storage Molds, Mycotoxins, and Animal Health*, and also the University of Kentucky publication, ID-59 *Aflatoxins in Corn* (<http://www.ca.uky.edu/agc/pubs/id/id59/id59.pdf>).

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