9-6-2012

Aflatoxin: Testing Corn

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Abstract
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Keywords
Agricultural and Biosystems Engineering

Disciplines
Agricultural Science | Agriculture | Bioresource and Agricultural Engineering

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Aflatoxin: Testing Corn

By Charles Hurburgh, Department of Ag and Biosystems Engineering

Early harvest reports are confirming that there is some incidence of aflatoxin in 2012 corn. The highest potential is in the areas of extreme drought and in cases where August storms put corn on the ground. Three earlier ICM News articles have described the biology and the impact of aflatoxin on the grain market.

1. Aflatoxin Detected in Fields in Central and Southern Iowa
2. Crop Quality Issues from the Drought of 2012
3. Aspergillus Ear Rot and Aflatoxin Production

The most sensitive corn users will be dairy, pet food, direct human consumption (snack foods, etc.) and processors that either export or sell some products to sensitive uses. Ethanol plants and corn wet mills concentrate the toxin in their protein co-product streams. Many ethanol plants export distillers grains (DDGS) as well as sell to local feed markets.

Testing for aflatoxin

Testing for aflatoxin is very challenging because of very high sampling error. Individual kernels can contain up to 400,000 parts per billion (ppb). With the typical weight of a kernel, one very high kernel in a 5-pound sample will cause the sample to be about 52 ppb. This individual kernel effect is why large samples and grinding of entire samples is necessary to get useful results. If the sample with the very high kernel were divided as whole corn to get 1/20 for the actual analysis, there would be 19 possible divisions with none and one that would test over 1000 ppb! **The more grain is moved and mixed the more homogenous the aflatoxin will become. Samples taken farther down the grain distribution chain are, in general, more accurate, but action to control problems is more complicated after the first point of delivery.**

Samples should not be divided as whole kernels to reach the smaller size needed for testing. A minimum of 5 pounds is required to have statistical validity; even then the sampling error for aflatoxin testing is 25-40 percent.

Most testing for aflatoxin in market channels is done with immunoassay test kits. An antibody binds with toxin that has been extracted with a solvent from a small ground sample. The antibody is also attached to a molecule that glows (fluoresces); if the flourescence is read optically, then a quantitative (actual ppb) value can be determined. If the color change is just visual at a certain level, then a qualitative (yes or no) value above the preset threshold of the kit is determined. The USDA GIPSA has evaluated and approved test kits for various toxins. See this link for a current list of approved kits.

Test kits take 5-10 minutes per sample at a cost of about $10-15, including labor time. In high throughput operations, testing every inbound load would require additional personnel in the grading area, and will cause 10-15

Summary

• Accurate analysis for aflatoxin is difficult because of sampling error.

• Accurate analysis requires large samples to be fully ground for testing.

• Black light screening can be very useful if a strict protocol is followed.

• A scale-up testing process can help optimize testing programs to levels required by specific markets.

• The best sample of any large lot is one containing portions of every sublot.

• Marketing corn with known levels of aflatoxin in excess of the 20 ppb action level requires clear documentation.

• Aflatoxin is covered by multi-peril crop insurance with specific stipulations regarding adjustment and marketing.

minute delays for each truck before unloading.

Many buyers prefer to use off-site labs for testing; this is also true for crop insurance settlements where the adjuster has taken a sample on which to base the settlement. A list of labs in Iowa is available on the Iowa Grain Quality Initiative website. USDA-GIPSA grading agencies, as well as several private labs and the Iowa State University Veterinary Diagnostic lab, can do toxin testing on submitted samples.

Scanning with a black light (366nm) has been used to identify samples that potentially contain aflatoxin. Kojic acid, also formed by actively growing Aspergillus flavus, will fluoresce blue-green-yellow under the black light. A tinopal color standard (Seedburo, Inc, Chicago, IL) is strongly suggested to provide the comparison for fluorescence in the corn, because many compounds will fluoresce other colors under the black light. Historically, the black light gives about 30 percent combined false positives (glow but not aflatoxin >20ppb) and false negatives (no glow but aflatoxin >20 ppb). However, in the 1983 and 1988 outbreaks, we found that when 5-pound samples were scanned, samples with one or more glowing particles per pound (five in a 5-pound sample) had a much higher chance of aflatoxin over 20 ppb than those with less than 1 particle per pound. The average aflatoxin of those with glowing particles but fewer than one per pound was 6 and 10 ppb for the two years respectively. A more complete protocol for using the black light as an initial screening method is posted at www.iowagrain.org.

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This article was published originally on 9/6/2012 The information contained within the article may or may not be up to date depending on when you are accessing the information.