Mycotoxin Alert!

Steps to Avoid Mycotoxins in Grains

by Mary-Howell Martens

Mycotoxins are toxic chemicals produced by certain types of fungi that grow on plant material, both in the field and in storage. Mycotoxins are a common problem worldwide, indeed, it is estimated that globally, more than 25 percent of field crops are affected annually with mycotoxins. In Europe, Napoleon's defeat in Russia might not have been due as much to the cold or to military skill but rather to mycotoxin-contaminated grain fed to their animals, which resulted in a catastrophic loss in horses. Here in the Northeast, we often are not aware of serious mycotoxin problems, although a recent study from Vermont estimates that over a 10-year period, nearly all dairy farms in that state will experience mycotoxin-related issues, even though most will not connect symptoms to actual cause. The cool, wet conditions and stressed crops in 2009 made it difficult for many of American farmers to not notice mycotoxins — serious animal health problems, poor-quality forage, and rejected grain brought the issue front and center for many people.

Many types of feedstuffs can develop fungal toxins, or mycotoxins, including grains, haylage, baleage, silage, dry hay, and high-moisture corn. Infection is most common on plants grown under stress, especially when damaged by insects, birds, mites, hail, early frost, heat and drought stress, windstorms, and other unfavorable weather. Mycotoxins also can form or increase when grains and forages are harvested and stored at undesirably high moisture levels, when grains are put into storage dirty, if plastic ag bags get torn or damaged, or if storage facilities leak.

Experts estimate there are more than 300 fungal toxins that can contaminate crops, but several are distressingly common and damaging. In the Northeast, the common soil fungus, Fusarium, causes ear rot in corn and scab or head blight in wheat, barley, oats and rye and produces several mycotoxins, including vomitoxin (DON), fumonisin, and zearalenone. Fusarium can also infect ensiled or bagged forage and silage. The risk increases when corn or forage is harvested late (especially after frost), gets moldy or lodged in the field, is rained on or sours in the windrow, or is not adequately packed to exclude oxygen. Silage corn cut after a frost or late in the season is often too dry to pack well, impairing normal fermentation and allowing Fusarium, already present on the corn, to proliferate. Several species of the Aspergillus fungus produce aflatoxin, but that is more likely a problem in hotter areas than in the Northeast. Greenish-colored Penicillium is most commonly seen in silage and can produce several different toxins.

A healthy wheat head (left) stands in contrast to one inoculated with Fusarium graminearum *showing severe symptoms of Fusarium head blight disease.*

How do you know whether your grain or forage contains mycotoxins? If feed is visibly moldy, that is a pretty good clue — just as you wouldn't eat moldy food, neither should your animals. However, it usually isn't that simple. Not all molds you can see produce toxins, and not all grain or forage containing toxins looks moldy. For that reason, although we rarely see moldy grain, we do often test often for mycotoxins. There are accurate lab tests available — Dairy One does a nice six mycotoxin scan for $65 — but these are expensive and slow, tests are only as accurate and representative as the sample was, and they are usually not done unless there is good reason to suspect a problem. What makes us suspicious? We generally test grain that is of light test weight, off color, musty, dusty, harvested excessively late, has many broken or damaged kernels, or just doesn't look, smell or feel *right*. A slight pink coloration to the grain can indicate the presence of Fusarium. We also usually recommend testing all on-farm feed supplies if a farmer complains of typical mycotoxin symptoms in their animals. Traditionally, aflatoxins have been detected by placing grain under a blacklight, but that is not a reliable test for Fusarium toxins.

At high levels, mycotoxins can cause liver damage, internal hemorrhaging, cancer, and reproductive failure in animals, but even at fairly low levels they can strongly suppress an animal's immune system resulting in other opportunistic infections such a salmonella, clostridia and *E. coli* to "break through," causing diarrhea, mastitis and other production and health problems. Often before more dramatic symptoms are seen, feed with

mycotoxins can result in reduced feed intake, impaired rumen functioning, poor vaccine take, reduced milk yield, reduced weight gain, and impaired reproductive function. The problem here, of course, is that other factors can cause similar low-grade symptoms, which is why farmers may not connect symptoms to cause. But, if you see such symptoms, mycotoxins in feed are one of the first things to address.

There are threshold levels of concern for different mycotoxins depending on the animal species being fed. According to Dairy One, ruminants can tolerate a total toxin level of around 5 ppm of vomatoxin while other experts caution not to exceed 1-2 ppm. Pigs and chickens are much more sensitive. The acceptable threshold for organic human food grains is essentially zero. Animals under stress for other reasons tolerate lower levels of mycotoxins than healthy animals.

It is important for livestock farmers to recognize that as far as the animal is concerned, it is the total cumulative intake level of all mycotoxin-infected feed that counts. Even if each individual feed/forage item tests "below threshold levels" (including baleage, silage, grain, ground feed, high-moisture corn, etc.), if eaten together by one animal, the overall level may exceed the threshold and adverse effects will be seen. Also, frequently contaminated feed or forage contains more than one toxin, further complicating the decision of whether you have reached a level for concern.

While there are products available to bind or adsorb toxins, none are 100 percent reliable, so it is best to avoid feeding suspect feed whenever possible. If you need to use a toxin binder, try to match the correct binder to the toxin present. In the feed industry, mycotoxin binders are often termed flow agents to avoid making actual efficacy claims. Those allowed under organic standards fall into two primary categories — the clay- or silicate-based products (Desert Dyna-Min, Redmond conditioner, bentonite, etc.) which are fairly effective against aflatoxins; and the newer lower-inclusion rate oligosaccharide/beta-glucan products (Check-M, ImmunoWall, FloMatrix, Fuse 207, Mycotex, etc.) which are much more effective against the Fusarium toxins. If you suspect a mycotoxin problem and can't avoid using the feed or forage, the best approach would probably be to use a combination type product (*i.e.* FloMatrix) or use a couple of products with different efficacy (*i.e.* Fuse 207 and Mycotex).

STEPS TO MINIMIZE MYCOTOXIN LEVELS IN GRAIN & FEED

1. Always use cleaned, high-quality seed that is not carrying seed-borne diseases. If you plant back your own small-grain seed, make sure it was not infected with scab or head blight (Fusarium) the previous year. Seed-borne diseases that do not produce mycotoxins can weaken the plant, making it more vulnerable to mycotoxin-causing fungi. Resistant varieties are often a good idea.

2. Harvest at maturity, as soon as the moisture content allows minimum grain damage. This means harvesting shelled corn at 23-25 percent moisture, ear corn at 25-30 percent, small grains at 12-17 percent, and soybeans at 11-15 percent. Dry suspected grain to at least 14 percent moisture as rapidly as possible, at least within 24-48 hours after harvest. Safe, long-term storage can be achieved at a moisture level of 13 percent or below. Cool grain after drying so hot grain doesn't absorb new moisture.

3. Adjust the harvesting equipment for minimum grain damage and maximum cleaning. Especially where scab or head blight is evident in the field, the combine should be set for maximum cleaning, with higher blower speeds to remove the small, shriveled, diseased kernels.

4. If harvested grain contains wet weed or plant material, run it through a rotary cleaner soon after harvest so the moisture doesn't migrate into the grain. Rotary cleaning also will remove broken and diseased kernels and fines, which are more vulnerable to insect and mold damage in storage, and removal of chaff and debris will reduce the possibility of dryer fires. During harvest, we routinely use the rotary cleaner between truck or wagon and the grain bin to make sure that grain goes into storage as clean as possible.

5. Roasting does *not* deactivate mycotoxins, but it may reduce the level by blowing off surface mold. If you roast moldy grain, make sure you run a mycotoxin test after roasting to check if the level is safely reduced.

6. Thoroughly clean all bins before storage to remove dirt, dust and old grain. Store in water-, insect-, and rodent-tight structures. Keep grain well aerated and monitor regularly.

7. For ensiled forages in bags or silos, make sure forage is tightly packed, that oxygen is excluded and the "package" is kept sealed since mycotoxin-causing fungi require oxygen to live. Be prepared to discard forage from around torn areas of ag bags, as it is more likely to be contaminated.

8. If you have reason to suspect mycotoxin problems, contact a forage testing lab and test before feeding it or representing it to a buyer as sound grain. If you must feed contaminated grain, identifying the toxins present will help you choose the most effective toxin binder.

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