NUTRITION NOTES
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MOLD AND MYCOTOXINS

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Reports are coming in regarding mold and mycotoxins in feedstuffs this fall. The following information was derived from an Ohio State University (OSU) website that is a cooperative effort among numerous land grant universities. Table 1 summarizes the main mycotoxins that affect livestock production. Species, mycotoxin, upper limit of safety and their effects are noted. Also included in this OSU document are preventative practices pre-harvest and post-harvest, as well as steps and methods for testing.

MOLDY GRAINS, MYCOTOXINS AND FEEDING PROBLEMS

PREVENTIVE PRACTICES

Prevention is the best method to control mold growth and possible toxin formation. The following practices can help minimize mold growth and subsequent toxin production in storage:

PRE-HARVEST:

- Clean inside and outside of grain bins and dryers.
- Prior to storage, check the condition of the bin for possible water leaks, and clean it properly by removing dust, dirt, leftover grain and other foreign material.
- Crop rotation in many regions or tillage can reduce the risk of Gibberella ear rot in corn and Fusarium head blight of wheat. These practices have little effect on other corn ear rots.
- Some corn hybrids are more resistant to ear rots than others, but overall, resistance to ear rots is not widely available. Some Bt hybrids, those that produce BT in the kernels, have less ear rot due to insect control resulting in less toxin problems.
- Control of second generation European corn borers and other insect pests of corn ears can greatly reduce infection by Fusarium and Aspergillus.
- Few wheat varieties have high levels of resistance to Fusarium head blight (scab). Plant moderately resistant varieties when available. Planting several varieties that differ in maturity will reduce the risk of disease to the whole crop.
- As with any crop pest, early detection through scouting and early harvest can reduce serious losses and avoid crises. Decisions on handling moldy grain should be made before it is harvested. After harvest, spoilage can occur quickly if delays result from indecision.
- If extensive ear rot development is observed (10% or more of the ears with more than 10-20% mold), the field should be harvested as soon as moisture content reaches a level that can be harvested. Even if some drying costs are incurred, this will be less expensive than loss of crop value due to mycotoxins and resulting feeding problems.

POST-HARVEST:

- The crops should be allowed to mature in the field to the following moisture contents: shelled corn, 23-25%; ear corn, 20-25%; small grain, 12-17%; and soybeans, 11-15%.
- Harvesting equipment should be adjusted to minimize damage to seeds or kernels and allow for maximum cleaning. Cracked or broken seeds or kernels are more susceptible to mold invasion.
- Upon storage, dry the grain to 13-14%, if possible, within 48 hours. Long-term storage can be achieved at a uniform moisture of 18% for ear corn; 13% for sorghum, wheat and shelled corn; and 11% for soybeans.
- After drying, store under cool temperatures (36-44° F).
- Every few weeks check the condition of the grain for temperature, wet spots and insects.

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TESTING FOR MYCOTOXINS:

- The presence of a fungus known to produce toxins is not proof that the grain contains injurious levels of toxin.
- It may be a good investment to collect a representative sample and send it to a laboratory for chemical analysis.
- The first step in mycotoxin determination is sampling of the grain. Particular attention should be given to the sampling procedure because sampling error will be the greatest source of variation in the analytical procedure. This variation is primarily due to the uneven distribution of the mycotoxin contaminated kernels within a lot of grain or feed. The ideal sampling procedure should assure the highest probability of detecting mycotoxins even when contamination is low.
- One method of sampling grain is to use a probe sampler. Since mold growth usually occurs in spots in the grain lot, best sampling is done on recently blended lots of grain.
- Another method is to collect small samples from the moving stream of grain as it is moved in or out of the bins. With both sampling methods, the collected grain is pooled into a large aggregate sample that represents the lot.
- For shelled corn, it is recommended that the aggregate sample be about 10 pounds. The aggregate sample should be coarsely ground. Most analytical procedures need only about 25 grams (0.9 ounces) of ground corn, so it is important that the aggregate sample be thoroughly mixed after grinding. A one or two pound sub-sample is then taken and it is more finely ground. From this sub-sample a final sample is taken for analysis.
- A number of commercial, university and government laboratories perform mycotoxin analyses for a fee. Contact the lab to determine the proper way to obtain and ship the sample. For general information see: (http://www.oardc.ohio-state.edu/ohiofieldcropdisease/wheat/mycotoxin%20text2.htm).
- Blending is not an approved practice by the FDA for interstate commerce. Blending is a practice intended to reduce toxins to acceptable levels in small lots only for on-farm use.
- If the mycotoxin in the contaminated feed is known, it may be a good idea to channel the feed to animals that are more tolerant.

Table 1 Mycotoxins Reported Detrimental Feed Concentrations (ppm=parts per million)

ZEARALENONE

Swine	Concentration	Duration	Effect
Prepubertal gilts	1-5 ppm	3-7 days	Hyperestrogenism, prolapse
Sexually mature open gilts	3-10 ppm	Mid-cycle (day 11-14)	Anestrus, pseudopregnancy
Bred sows	15-30 ppm	1st trimester	Early embryonic death, small litters
Juvenile boars	10-50 ppm	Indefinite	Reduced libido, small testicles
Mature boars	200 ppm	Indefinite	No effect
Cattle			
Virgin heifers	12 ppm	Open Heifers	Reduced conception
Dairy cows	50 ppm	Open cows	Reduced conception
Poultry			
Broilers & turkey poults	200 ppm	Indefinite	No effect

DEOXYNIVALENOL (vomitoxin, DON)

Swine	Concentration	Duration	Effect
Feeder pigs	1-3 ppm	1-5 days	Reduced feed intake
Feeder pigs	5-10 ppm	1-5 days	50% reduction in feed intake, vomiting
Feeder pigs	10-40 ppm	1-5 days	Complete feed refusal, vomiting
Sows	3-5 ppm	Gestation, lactation	Lower fetal weights, or no effect
Cattle			
Feeder cattle	10 ppm	Indefinite	No effect
Dairy cows	6 ppm	6 weeks	No effect or slightly reduced feed intake
Dairy cows	12 ppm	10 weeks	No effect on milk production
Poultry			
Broilers and turkey poults	50 ppm	Indefinite	No effect

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FUMONISINS (FB1 and/or FB2)

Horses	Concentration	Duration	Effect
All classes and ages	>10 ppm	30 days	Liver damage, leucoencephalomalacia, death
Swine			
All classes and ages	>25 ppm	30 days	Reduced gain and feed efficiency, mild liver damage
All classes and ages	>50 ppm	10 days	Reduced gain and feed efficiency, moderate liver damage
All classes and ages	>100 ppm	5 days	Severe pulmonary edema, death
Cattle and Sheep			
All classes and ages	>100 ppm	30 days	Slightly reduced gain, mild liver damage
All classes and ages	>200 ppm	14 days	Reduced feed intake and gain, moderate liver damage
Turkeys			
All classes and ages	>100 ppm	7-21 days	Reduced feed intake, liver damage, diarrhea, rickets, tibial lesions
Chickens			
All classes and ages	>200 ppm	7-21 days	Reduced feed intake, liver damage, diarrhea, rickets, tibial lesions

FDA's guidance level for total fumonisins in corn and corn by-products (not to exceed 20% of the diet) used for equine and rabbit feed products is 5 ppm (1 ppm in finished feed).

AFLATOXINS (ppb=parts per billion)

Swine	Concentration	Effect
All classes and ages	200 ppb	Slow growth, reduced feed efficiency
All classes and ages	400 ppb	Liver damage and immune suppression
Feeder Cattle		
All classes and ages	400 ppb	Tissue residues
All classes and ages	700 ppb	Mild liver damage, reduced growth and feed efficiency
All classes and ages	1000 ppb	Moderate liver damage and weight loss
All classes and ages	2000 ppb	Severe liver damage, jaundice, death
Dairy Cows		
Lactating cows	20 ppb	Detectable aflatoxin in milk
Lactating cows	1500 ppb	Decreased milk production
Poultry		
Broiler chicks	210 ppb	No effect
Turkeys	250 ppb	Reduced growth
Broiler chicks	420 ppb	Lose weight, moderate liver damage after 3 weeks
Horses		
All classes and ages	400 ppb	Liver damage and immune suppression

Munkvold, G., Osweiler, G., Hartwig, N. 1997 Iowa State University Ext. PM-1698

FDA has set a maximum limit of 20 ppb for aflatoxins in commercial grains used in feed for immature animals, dairy animals, poultry, horses, turkeys, and for unknown use.