The Effects of Mycotoxins

What are mycotoxins?
Mycotoxins are poisonous substances produced by molds and fungi. They grow on cereal grains including corn, wheat and barley. They can also grow on peanuts, hay, silage and other types of animal feed or feed ingredients.

Visual evidence of mold does not necessarily mean that mycotoxins are present nor does the absence of mold guarantee that mycotoxins are not present.

The young in all animal species are the most susceptible to mycotoxins. If mycotoxins are ingested the residues can be found in animal tissue (meat, milk, eggs) and may endanger human food supply.

Primary types of mycotoxins encountered in the United States

- Aflatoxin - affects liver and are cancerous
- Zearalenone- hyper-estrogen, which may result in reproductive failure
- Vomitoxin - feed refusal, vomit
- T-2 toxin - affects epidermal tissue
- Ochratoxin - affects kidney and reproductive system

Mycotoxicosis characterized as:

- Acute primary mycotoxicosis- high dose, rapid problem due to toxin
- Chronic primary mycotoxicosis- slow development due to toxin
- Secondary mycotoxic disease- secondary to toxin due to compromise of immune system

Susceptibility to mycotoxins varies by species, age, diet, dose, time and combinations of toxins.
How many mycotoxins are present to date?
Over 300 different mycotoxins have been identified in grain worldwide as feed contaminants.

When do they occur?
Mold growth and mycotoxin production are related to weather extremes (causing plant stress or excess hydration of stored feedstuffs), inadequate storage practices, low feedstuff quality, and faulty feeding conditions. In general, environmental conditions such as heat, water, and insect damage cause plant stress and predispose plants in the field to mycotoxin contamination.

How do mycotoxins affect animals?
If animals consume contaminated hay or feed, the mycotoxins can increase incidence of disease and reduce production efficiency. Some of the gross effects of mycotoxins can include:
1) Reduce feed intake and feed refusal
2) Reduction in nutrient absorption and metabolism
3) Digestive disorders including hemorrhage and necrosis
4) Tissue and organ damage
5) Gangrene of the extremities
6) Endocrine effects and skin lesions
7) Reproductive disorders, embryonic death, abortions and oral lesions
8) Nervous disorders, tremors and poor coordination
9) Suppression of the immune system
10) Death

Table 1. U.S. Food and Drug Administration action levels for total aflatoxins in food and feed.

<table>
<thead>
<tr>
<th>Food or feedstuff</th>
<th>Concentration (ppb)</th>
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<tbody>
<tr>
<td>All products, except milk, designated for humans</td>
<td>20</td>
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<tr>
<td>Corn for immature animals and dairy cattle</td>
<td>20</td>
</tr>
<tr>
<td>Corn and peanut products for breeding beef cattle, swine, and mature poultry</td>
<td>100</td>
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<tr>
<td>Corn and peanut products for finishing swine (&gt;100 lbs.)</td>
<td>200</td>
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<tr>
<td>Corn and peanut products for finishing beef cattle</td>
<td>300</td>
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<tr>
<td>Cottonseed meal (as a feed ingredient)</td>
<td>300</td>
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<tr>
<td>All other feedstuffs</td>
<td>20</td>
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<tr>
<td>Milk</td>
<td>0.5</td>
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Symptoms of mycotoxicosis will be dependent on the mycotoxins present. In the field, animals experiencing mycotoxicosis may exhibit a few or many symptoms. They may simply be unthrifty, with a rough or dull hair coat, have a malnourished appearance, impaired reproduction, and a mixed infectious disease profile. Generally, some symptoms observed with mycotoxicosis may be secondary, which results from other bacteria taking advantage of the animal’s weak immune system.

**Binding agents and deactivators**
The harmful effects of mycotoxins can be reduced by using binding agents such as clays and other products such as yeast. When these substances are added to contaminated diets fed to rats, poultry, swine and cattle, they help reduce the harmful effects of mycotoxins. In most cases, clay has been added to the diet at about one percent. Activated carbon at one percent of the diet effectively reduced aflatoxin in milk.

**Economic costs**
The economic costs of mycotoxins are virtually impossible to accurately determine. However, computer models have now been used by the United States Food and Drug Administration to estimate losses based on selected mycotoxins. The estimated losses range from $418 million to $1.66 billion annually with mean estimated cost of about $932 million.

**Conclusion**
Overall, with the persistent drought conditions throughout the United States, the occurrence of mycotoxins has significantly increased, therefore farmers should be vigilant in assessing hay and grains used as feed material for their livestock. The incidence of mycotoxicosis may be more common than suspected. It is easy to attribute the symptoms of acute mycotoxin poisoning to other causes. Finally, in the absence of appropriate investigative criteria and reliable laboratory tests, the mycotoxicosis will remain elusive to unsuspecting farmers.

**References**
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