Potential Problems for Livestock Producers to Consider in 2007
Dr. Mike Murphy, Toxicologist College of Veterinary Medicine, University of Minnesota

Please consult with your veterinarian, extension educator, nutritionist and other agriculture professionals to consider whether any of the following information pertains to your farm.

The dual effect of drought and hail in 2007 have left many producers wondering what toxins may impact their crops.

Grain

Corn: The three topics of greatest discussion are nutritional value, nitrate concentration and mycotoxins. The nutritional value of the corn and corn silage grown under drought conditions may be lower than that grown under more normal conditions. This is particularly true if the drought, then hail, caused considerable leaf loss. Consider testing the actual nutritional value of your crop this year if it had drought, hail, or moisture stress.

Nitrate is a storage form of nitrogen for corn and many other plants. In short, the crop takes up nitrogen from the soil and stores it as nitrate in order to support the synthesis of amino acids, proteins, and other nitrogen containing molecules as the plant grows and matures. Plants that have taken up nitrogen for growth then been stunted due to drought may have higher nitrate than normal. For example, corn that took up nitrogen then grew only 2.5 feet due to lack of moisture may have a much higher concentration of nitrate in it than corn that grew to 8 feet - especially if the soil nitrogen was high.

Most forages are expected to have between 100 to 1,000 ppm nitrate, even at maturity. When ruminants ingest feed with normal nitrate concentrations, the rumen microflora do a great job of reducing this nitrate to ammonia, then using this ammonia to make amino acids and proteins, just like non-protein nitrogen supplementation.

The risk that the rumen microflora cannot reduce all nitrate to ammonia increases as the TOTAL RATION nitrate exceeds 5,000 ppm (0.5 %) and many cattle are at risk of nitrate toxicosis when the TOTAL RATION exceeds 10,000 ppm (1%). NOTE: these values are for nitrate. Nitrate nitrogen should be multiplied by 4.4 to calculate the nitrate concentration.

Nitrate toxicosis is normally seen as a sudden death. Abortion of cattle in the second or third stage of gestation has also been observed. Dairy cattle, feedlot animals, and some other ruminants on full feed may tolerate more than 1 % nitrate in the total ration, but they should be adjusted to the ration slowly – just like any other diet change. Ensiling the corn MAY reduce the nitrate concentration a little - but it MAY NOT. Testing silage 3 or more weeks after filling the silo to determine the actual nitrate concentration is recommended.

Grass hays may also be checked for nitrate concentration. They are normally in the few hundred ppm range, but may be higher in drought years, especially with nitrogen fertilization. Alfalfa, clover, corn grain, soybeans, and cottonseed do not normally contain appreciable amounts of nitrate.

So, if corn silage contains 10,000 ppm (1%) nitrate and comprises 50 % of the ration, the haylage contains 1,000 ppm (0.1%) and comprises 25 % of the ration, and the corn and protein...
sources contain 100 ppm nitrate and comprise 25% of the ration, the nitrate concentration in the total ration will be slightly higher than 5,000 ppm. Late term abortions in cattle are rare at this dose. However, if the corn silage is at 20,000 ppm (2%) nitrate, the risk of both abortion and death increases in previously unexposed cows, since the total ration would then be more than 10,000 ppm (1%).

**Mycotoxins:** Mold spores are everywhere. Corn is commonly exposed to *Rhizopus*, *Cladosporium*, *Fusarium*, *Aspergillus* and other molds in the field. *Fusarium* sp molds are associated with stalk rot in wet years and with the pink mold on ears that have hail damage. Some strains of *Fusarium* mold may produce mold toxins – called mycotoxins. Mycotoxins produced by *Fusarium* include fumonisin, zearalenone, deoxynivalenol, and T-2 toxin. It is extremely rare, especially in dry years, for *Fusarium* molds to produce amounts of zearalenone, deoxynivalenol or T-2 toxin that are toxic to dairy cattle.

Strains of *Aspergillus* species may produce the mycotoxin called aflatoxin in hot humid weather. Aflatoxin is a carcinogen and its metabolite, aflatoxin M₁, passes into the milk of cattle ingesting aflatoxin containing feed. Consequently the US Federal Food and Drug Administration has regulations for the amount of aflatoxin allowed in feed for food animals. Specifically, grain may not contain more than 20 ppb (ppb- not ppm) aflatoxin if intended for use in dairy cattle. Milk is checked for aflatoxin at a sensitivity of 0.5 ppb and cattle ingesting as little as 20 to 50 ppb in the total ration may have more than 0.5 ppb aflatoxin M₁ in the milk they produce. Aflatoxin in milk is an adulterant so milk containing greater than 0.5 ppb aflatoxin M₁ is likely to be dumped with the costs associated with dumping that milk.

Use of corn containing greater than 20 ppb aflatoxin is strongly discouraged for lactating dairy cattle rations.

Although various feed additive products such as yeast cell wall components, zeosilicates, bentonite, and clays are useful to reduce moisture in grain handling equipment, they are not approved by the FDA as mycotoxin binding agents. Academic studies have show some efficacy in binding aflatoxin in swine and poultry rations, possibly due to the fast GI transit time in these species, but the additives are not approved for such use. The use of such binding agents in dairy rations does not guarantee that aflatoxin M₁ will not occur in the milk of lactating cattle ingesting aflatoxin containing feed. Consider testing corn and corn silage for aflatoxin this year.

**Note:** The presence of mold does not mean that mycotoxins have been produced, and mycotoxins can be produced without mold being visible.

**Corn smut** is caused by the plant fungus *Ustilago maydis*. *U. maydis* replaces the normal corn kernels with large distorted growths called “galls.” Galls reduce yield and are a nuisance to corn farmers, but have not been associated with toxicity, they are actually used as a delicacy in some high end restaurants.

**Soybeans:** Weed seed contamination, especially nightshade seed contamination, is always a consideration with soybeans. Nightshade seeds, *may* produce gastrointestinal upset and/or neurological signs in cattle ingesting 0.1% body weight nightshade.

**Cottonseed:** A great deal of cottonseed is shipped into the Upper Midwestern states for use in livestock rations. Some of the cotton producing states also experienced a drought this year. Two toxins of concern in cotton seed are aflatoxin and gossypol. Gossypol is not normally a concern
unless fed at a rate greater than 6 to 7 pounds per head per day in mature cattle. Aflatoxin is more prevalent in cottonseed in drought years. Consider testing your cottonseed for aflatoxin this year.

Forages

Haylage/Hay: The nutritional value and weed infestation are two factors to consider in your haylage and hay crop this year.

Hay: Three issues arise - nutritional value, toxic plants, and dicumerol particularly if CRP land is harvested. This land should be checked for toxic plants to judge its value for hay. Sweetclover is found on many CRP acres. Moldy sweetclover may produce dicumerol. Dicumerol may induce abortions and bleeding in cattle ingesting toxic doses of it. Bales containing sweetclover can be probed to determine dicumerol content. Rotation of cattle off sweetclover hay and onto fresh alfalfa hay is one way to manage the dicumerol problem. See the dicumerol fact sheet for more detailed information.

Road ditch hay: The risks of using road ditch, and other similar, hay is always high - this year it is higher. Three issues arise nutritional value, toxic plants generally, and wild parsnip. The nutritional value of hay cut off non-improved land should always be checked. The presence of toxic plants on non-improved land should also always be checked.

Wild Parsnip (Pastinaca sativa) has been in the press this Summer. Hay from non-improved pastures should be checked for the presence of Wild Parsnip. Wild Parsnip may contain chemicals called furanocoumarins. The concentrations of these furanocoumarins in the parsnip may be higher than normal in many areas of the state. The concentration of furanocoumarins in Wild parsnip has been shown to be higher in the presence of the parsnip webworm, (Depressaria pastinacella). Furanocoumarins enhance the ultraviolet light effect of the sun. Severe sunburn may occur if furanocoumarins are on the skin because of contact or in the blood vessels just below the skin because of ingestion. Severe sunburn in cattle ingesting furanocoumarin containing hay is reduced if the cattle are shaded from the sun’s ultraviolet light. The rate of furancoumarin breakdown in hay is not well characterized.

Sampling

In the field: It is usually best to examine a crop in the field to determine the degree and scope of crop damage, mold or weed infestation. Although, getting a sample that represent the whole field is difficult, sampling for mycotoxins and nitrate may be done by selecting representative, or worst case scenario, areas of the field after this visual inspection.

After harvest: Probe samples can be taken of grains while in the truck or during unloading. Probe samples are commonly taken of hay for nutritional or dicumerol analysis. Collection of representative grab samples during unloading may be taken of corn silage, haylage, soybeans, and cottonseed for nutritional analysis and other tests suggested in the table below.

Check with your testing laboratory for the optimal sample collection for your analysis of interest. Generally samples for mold and yeast counts should be collected in to a paper bag, kept
cool on ice, but not frozen, and delivered to the laboratory within 24 hours. Samples of dry grain or hay may be sent in a paper bag for nutritional analyses, mold and mycotoxins testing, dicumerol and nitrate testing.

**Tests to Consider:**
*Please consult with your veterinarian, extension educator, nutritionist and other agriculture professionals to consider whether any of the above toxins are present in your particular area.*

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Nutritional Value</th>
<th>Nitrates</th>
<th>Aflatoxin</th>
<th>Other</th>
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<tr>
<td>Corn</td>
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<td>X</td>
<td></td>
</tr>
<tr>
<td>Cottonseed</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Gossypol</td>
</tr>
<tr>
<td>Soybeans</td>
<td>X</td>
<td></td>
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<td>Nightshade</td>
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<td>Haylage</td>
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<td>X</td>
<td></td>
<td>Weeds</td>
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<td>Silage</td>
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<td>X</td>
<td>If indicated</td>
<td>Mold count/ID</td>
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<tr>
<td>Hay</td>
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<td>Weeds</td>
</tr>
<tr>
<td>Hay w/Sweetclover</td>
<td></td>
<td></td>
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<td>Dicumerol</td>
</tr>
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**Places to Consider:**
Dairyland Laboratories: PO Box 580, St. Cloud, MN 56302, Phone: (320) 240-1737, Fax: (320) 240-1838, [http://www.dairylandlabs.com/](http://www.dairylandlabs.com/) (Nutritional value, Mold testing)

North Dakota Veterinary Diagnostic laboratory, 701-231-7529 (Mycotoxin testing, Dicumerol)

Pope Testing laboratories Inc, 2220 Hinton Dr, Irving, TX 75061, (972) 871-7188 (Gossypol)

University of Minnesota, Veterinary Diagnostic Laboratory, 1365 Gortner Avenue, St. Paul, MN 55108, 612-625-8787 (Nitrate, Weed Identification)