Nitrate Poisoning in Drought Damaged Corn, Grain Sorghum and Sorghum Sudangrasses

Often in years like 2011, drought stressed corn and sorghum plants may have high level of nitrates and may not be safe for livestock consumption.

In healthy cattle, the nitrate consumed in normal forages is converted into protein in the rumen: nitrate $\rightarrow$ nitrite $\rightarrow$ ammonia $\rightarrow$ amino acids $\rightarrow$ proteins

When plants are stressed from drought this process slows or stops, allowing nitrates to accumulate. Also, nitrates are nonvolatile and remain in plants after cutting, curing, and baling for hay.

Research at the Texas Veterinary Medical Diagnostic Laboratory (TVDML) at Texas A&M University has found that it is safe to feed forage containing 1 percent nitrate (on a dry-matter basis) to healthy ruminants. Forage with a higher percentage (>1%) of nitrate could be fed if it is ground and mixed with nitrate-free forage to reduce overall nitrate levels to less than 1 percent (dry-matter basis). However, this grinding and mixing method should not be used for forages containing more than 2.5 percent nitrate. Do not use the baled forage for livestock feed or bedding.

Forage containing 0.5 to 1 percent nitrate should not be fed to weakened cattle unless your veterinarian has approved it. The 1 percent nitrate level set by the TVDML is significantly higher than levels suggested by other southern universities. This levels assumes that cattle are healthy, well conditioned, and being fed a high-energy diet.

Symptoms of nitrate poisoning

If forages contain too much nitrate the animals cannot complete the conversion process to protein and nitrite levels build up. Nitrite is adsorbed directly into the bloodstream through the rumen wall, where it combines with hemoglobin to form methemoglobin. Hemoglobin carries oxygen in the blood, but methemoglobin does not. The formation of methemoglobin can cause an animal to die from asphyxiation, or lack of oxygen. The animal’s blood turns brown instead of the normal bright red.
Sampling for nitrates

Type of grazing system will influence what part of the plant to sample. If limit-grazing corn, grain sorghum, sorghum-sudangrass, sample only the plant leaves. When rotational grazing or single-field grazing systems are used, a more conservative sampling approach is warranted because livestock will consume not just the leaves and upper plant parts but also the stems (which contain more nitrate). Samples should be taken from the lower one-third of corn, grain sorghum and sorghum-sudangrass stalks.

To sample corn, grain sorghum, and sorghum-sudangrass standing forage, create a composite sample from plant parts taken from at least 10 to 15 areas with the same fertility and moisture conditions. Do not mix plants from “good” and “bad” parts of the field. Create different composite samples for these areas. Ship samples to the laboratory in clean paper sacks. Do not use plastic bags because the high moisture content will cause the samples to mold, which interferes with the nitrate analysis.

To sample corn, grain sorghum and sorghum-sudangrass in bales, the bale must be split open and the lower stems of individual plants must be collected. If the bale is going to be ground before it is going to be fed, then representative core samples can be taken with a bale probe.

Samples can be submitted to the Texas AgriLife Extension Service Soil, Water, and Forage Testing Laboratory. Submittal forms are available online at http://soiltesting.tamu.edu

Nitrate Management

Never turn hungry animals into possibly high nitrate forages. During drought, producers sometimes “turn onto” temporary forages to help animals in poor condition. The combination of poor body condition, high nitrate levels in the forage and high consumption can be deadly.

Turning one old cow into a new field to observe is not an effective test for nitrates, because cattle tend to bite the tops of plants first, where the concentration is the
lowest. As cattle are forced to eat low plant parts, poisoning could occur later when it is not suspected.

Have hay tested before feeding if you suspect that is is high in nitrate. Nitrate levels remain constant in hay.

If hay is high in nitrate, feed carefully with an energy supplement or in combination with low protein forages, or other hay low in nitrates. Never feed high-nitrate hay free choice.

*References:

L-5149 Preventing Nitrate Problems in Drought-Damaged Corn
L-5231 Nitrate and Prussic Acid Poisoning
L-5433 Nitrates and Prussic Acid in Forages
E-273 Hay Production in Texas

*Reference publications can be found at http://soilcrop.tamu.edu