



# Vet Call

► by **Bob Larson**, professor of production medicine, Kansas State University

## Take precautions to avoid toxicities when feeding sorghum, Sudan crops

*As we move into late summer and early fall, cattle producers in many parts of the United States utilize warm-season cultivated forages such as Sudan grass, forage sorghums and sorghum/Sudan grass hybrids in their feeding programs. These forages are planted fairly late in the year and are drought-tolerant. In addition, they can be grazed until frost or even after frost if precautions are taken. However, two risks are possible when feeding or grazing these forages: nitrate toxicity and cyanide or prussic acid toxicity.*

### Cyanide, prussic acid toxicosis

Rapidly growing sorghum, Johnsongrass, and Shattercane produce a sugar, which can be converted to prussic acid and then cyanide. Some types of Sudan grass do not produce as much prussic acid as other plants in this class. Stress that retards plant growth (including drought or frost) causes a buildup of the building blocks of prussic acid in the plant. Rapid regrowth will then increase the level of prussic acid within the plant. Prussic acid is released very rapidly from frozen leaves. This is the reason that frosted sorghum is dangerous to feed until it dries. Prussic acid poisoning is most commonly associated with regrowth following a drought-ending rain or a non-killing frost.

Prussic acid concentrations are higher in fresh forage than in silage or hay because cyanide levels will decrease as the forage dries. However, if the forage had extremely high cyanide content before cutting, or if the hay was not properly cured, hazardous concentrations could remain. (See Table 1 for concentrations considered dangerous.)

Cyanide is rapidly absorbed into the bloodstream where it acts to tie up oxygen. This causes the blood to be a very bright red color. The signs of prussic acid toxicity include rapid and difficult breathing, muscle tremors and convulsions.

Treatment is available but will only be successful if the diagnosis can be made in time.

Some guidelines to reduce the risk of prussic acid toxicity include:

- 1) Do not graze or green-chop dangerous forages before plants are 18 inches (in.) tall.
- 2) Wait at least 4 to 6 days after a killing frost until the plants are dry and brown before grazing to allow time for the cyanide to dissipate.

### Nitrate toxicosis

Nearly all plants contain nitrate, but some species are more likely to accumulate nitrate than others. Forage sorghum, grain sorghum, Sudan grass, and pearl millet are notorious nitrate accumulators. Weed species such as kochia, lamb's-quarter, sunflower and pigweed are routinely high in nitrate.

Under certain environmental conditions, wheat, corn, soybeans, Johnsongrass and other plants accumulate toxic levels of nitrate.

Nitrate content generally is highest in young plant growth and decreases with maturity. Sorghums and Sudan grass are exceptions because concentrations can remain high in mature plants.

Nitrate will accumulate due to excessive nitrogen fertilization or if the plants are stressed due to drought, frost, hail or disease. Nitrates accumulate at night, on cloudy days and when environmental temperatures are cool. Rain following a drought will also cause a rapid buildup of nitrate levels. After a drought-ending rain, one to two weeks are required for nitrate concentrations to be reduced to safe levels. Nitrate levels are highest in the roots and stems, levels are lower in the leaves, and almost no nitrate accumulates in the flower and seed.

Ensiling will reduce nitrate levels by 40%-60%; however, forages with extremely high nitrate concentrations at harvest may still be dangerous and should be analyzed before feeding. Nitrate concentrations do not decrease over time in forage harvested as hay.

If forages contain more than 6,000 ppm (parts per million) nitrate, they should be considered potentially toxic. A simple test is to gather several plants from around the field and make a cut in the lower 6 in. of the stem and place a drop of a sulfuric acid solution on the cut surface (most veterinary clinics will have this solution). The cut surface of plants with high levels of nitrate will turn purple in color. A more accurate determination of nitrate levels can be obtained by sending a sample of the suspected forage to a reliable laboratory. Nitrate levels of hay will not change once the hay is cut, but grazed forages will change concentrations on a daily basis. (See Table 2 for nitrate levels and their effect on cattle.)

Nitrate toxicity reduces the ability of blood to carry oxygen. Signs of toxicity include depression, muscle tremors, staggering, weakness and a blue tint to the gums and vulva; exercise makes the signs worse. Similar to cyanide toxicity, treatment for nitrate toxicity is available, but often

**Table 1: Prussic acid and its effect on cattle**

Prussic acid, ppm	Effect on cattle
0-500	Generally safe
600-1,000	Potentially toxic; should not be the only source of feed
1,000 and above	Dangerous to cattle and usually will cause death

**Table 2: Nitrate levels and their effect on cattle**

Nitrate, ppm	Effect on Cattle
0-3,000	Considered safe
3,000-6,000	Moderately safe in most situations; limit to 50% of the total ration for stressed animals
6,000-9,000	Potentially toxic depending on situation; should not be the only source of feed
9,000 and above	Dangerous and will often cause death

## ▣ VET CALL

not helpful unless the problem is identified rapidly. Some guidelines to follow to reduce the risk of nitrate toxicity include:

- 1) Avoid excessive application of manure or nitrogen fertilizer.
- 2) Do not graze or harvest potentially dangerous forage on cool, cloudy days.
- 3) When harvesting forage sorghum and Sudan grass, raise the cutter bar 6 to 12 in. to exclude the base of the stalk. This will also minimize harvesting many weed species that accumulate nitrate when shaded.
- 4) Delay harvesting any stressed forages.

If the plant's leaves have been damaged but the roots and stems are still healthy, nitrates can accumulate because nitrates are being taken up from the soil but not dissipated by the leaves. A week of favorable weather and plant growth is required for plants to reduce accumulated nitrate.

### **Forage benefits**

Despite the potential problems with these forages, cattle producers who take adequate precautions can utilize Sorghum/Sudan crops to fill in seasonal gaps or emergency

deficiencies in perennial forage production. If you are not familiar with these crops, working with your veterinarian, Extension specialist or other local experts can help you avoid serious problems while gaining the benefits of these cultivated warm-season forages.



**E-MAIL:** [rlarson@vet.ksu.edu](mailto:rlarson@vet.ksu.edu)