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Drought Considerations

Be cautious when turning livestock into pastures with certain warm season grasses as toxic nitrate and prussic acid can accumulate in drought situations. Any plant with the ability to grow quickly can develop buildup of nitrate and prussic acid, but some forages present a bigger threat than others. The sorghum family – including sorghum-Sudan hybrids, forage sorghum, Sudan grass and Johnson grass; and corn – can develop the most buildup of nitrates and prussic acid. “When there’s a drought, warm-season annuals quit growing but still take up nitrogen from the soil and accumulate nitrates and prussic acid,” Craig Roberts, state forage specialist with University of Missouri Extension said. “Once the drought ends those plants start to grow again and look green and lush, but they’ll be full of toxins.”

NITRATE

Nitrates tend to accumulate in the lower portion of the stem of warm season grasses such as, Johnson grass, sorghum, Sudan and corn. Other small grains, millet, soybean, oats, alfalfa, Bermudagrass and tall fescue have potential to develop harmful nitrate levels in their tissue.

When livestock eat tainted forages, nitrates convert to nitrites, which absorb into the bloodstream and stop the blood’s ability to carry oxygen. Nitrate levels tend to be higher in stems, stalks and young leaves.

A simple nitrate presence test can be performed at your local University of Missouri Extension office. Cut the lower 8-12” of several randomly selected samples. Make sure the samples are fresh; a false nitrate reading can occur if the sample begins to dry out. If the samples test positive for nitrate presence, send samples to a lab for a quantitative analysis.

HARVESTING/GRAZING FORAGES WITH NITRATE

Often, a sufficient rain can decrease nitrate levels. Do not turn livestock in immediately, as nitrates temporarily spike following a rain; wait three to five days of active growth to allow nitrate levels to decrease. Dry baling preserves the nitrate level. If forage must be baled, leave ten to twelve inches of stubble to avoid baling the most toxic part of the plant. Ensiled forages can reduce nitrate levels twenty to fifty percent. Use caution when entering silo pits, as gases from forages with high levels of nitrate are toxic. If nitrate levels are higher 1.5% concentration, do not use for livestock feed or bedding. See Figure 1 for feeding recommendations for certain nitrate concentrations.

Fig. 1

NO ₃ -N ppm	NO ₃ ppm	Category	Recommendation
0 – 550	0 - 2,500	Safe	Forage generally safe to feed to all classes of livestock.
550 - 1,100	2,500 – 5,000	Caution	Forage with this nitrate (NO ₃) content can cause a problem in pregnant and young animals. Do not feed forage with nitrate levels this high in combination with non-protein nitrogen supplements; limit forage with NO ₃ levels this high to one-half of total ration.
1,100 - 3,400	5,000 – 15,000	Danger	Limit forage with NO ₃ level to one-fourth of total ration. Supplement forage with energy, minerals and vitamin A.
More than 3,400	More than 15,000	Toxic	Forage with this NO ₃ level or higher is toxic and should not be fed under any circumstances.

NO₃ = nitrate
N = nitrogen
ppm = parts per million

Credit: Rob Kallenbach, University of Missouri State Forage Specialist
Tim Evans, University of Missouri Associate Professor of Toxicology

PRUSSIC ACID

Prussic acid accumulates more in leaves than stems. Plants that accumulate prussic acid include millets, Sudan and Sudan hybrids, sorghum, Johnson grass and cherry trees. Millets do not tend to accumulate high levels of prussic acid. Prussic acid can develop in new growth after a prolonged drought or when plants are injured due to frost, hail and herbicide applications.

Chewing cud creates prussic acid when molecules containing sugar and cyanide in the leaf react with a plant enzyme, freeing up highly poisonous cyanide.

Samples need to be sent to a lab for prussic acid analysis.

HARVESTING/GRAZING FORAGES WITH PRUSSIC ACID

Wait two weeks or for two feet of growth before allowing livestock to graze. Prussic acid will break down and eliminate itself as a problem in harvested forages. Dry baling or ensiling forages is an effective way to reduce prussic acid. If dry baling, sample forage before feeding until prussic acid is no longer detected.