Techniques to Salvage High-Nitrate Forages

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It has been a challenging year. Many farmers have chosen summer annuals, like sorghum-sudan hybrids, as an alternative to winterkilled fields or to get by the summer slump of cool-season forages. While sorghums or sorghum-sudans are excellent summer forages with high yield and nutritive value, conditions limiting growth, such as cloudy weather or drought, may cause high nitrate levels in forages. The question is how to salvage them.

Sorghum-sudan hybrid in October stockpile. (*Dan Waletzco, UWRF*).

Nitrates in forages are normal – they are a primary form of plant-available nitrogen (N). Negative effects occur when animals consume large amounts of nitrates in forages, causing rumen microbes to become overwhelmed in their capacity to convert nitrates to ammonia. This leads to toxic intermediary 'nitrites' which need to be fully converted to ammonia to be safe. Normally, nitrates convert to nitrite, then ammonia, and then protein. If rumen microbes have too much nitrate, they cannot keep up with the rate of conversion, resulting in toxicity.

Summer annual grasses, especially sorghums under growth stress following high N fertilization, tend to accumulate nitrates. Nitrate poisoning can also take place when excess manure or fertilizer is applied. If you suspect your forages have high nitrates, here are some guidelines.

Table 1. Recommended feeding management of forages with varying levels of nitrates.

Nitrate Concentration		Recommendation
----%----	----ppm----	
0-0.44	<4,400	Safe to feed
0.44-0.88	4,400-8,800	Safe for non-pregnant cattle
0.88-1.5	8,800-15,000	Not more than 25% of the ration
>-1.5	>15,000	Do not feed

Adapted from Collins et al., 2018.

Table 2. Plants known to accumulate nitrate.

Forage	Forage Weeds
Barley, Oats, Rye, Wheat	Canada Thistle, Dock, Jimsonweed, Johnsongrass, Kochia, Lambsquarter, Nightshade, Pigweed, Russian Thistle, Smartweed, Wild Sunflower
Summer Annuals (Corn, Millet, Sorghums, Sorghum-Sudan Hybrids, Sudangrass)	
Radishes, Rape, Turnips	
Sugar Beets	
Sweetclover	

Adapted from Collins et al. 2018.

Check for nitrates. Small amounts are not dangerous. High-nitrate forage management guidelines show ≤0.44% (<4,400 ppm) nitrate in dry matter (DM) is considered safe to feed all livestock. Plants containing >1.5% nitrate (15,000 ppm) would be highly toxic to many classes of livestock.

Keep high grazing stubble. Nitrate levels are highest in the lower third of the stems, leaves contain less than stems, and grain/seed/flower contain little or no nitrate. Thus, grazing or mowing to a tall stubble (>6") will keep high concentrations in the stubble. Grazing, compared to haying, will have a slower release of nitrates into the rumen.

Do not overstock; do not overgraze. Allow plenty of daily pasture allocation or herbage allowance (high lbs DM/animal/day). Overgrazing forces animals to consume lower portions of stems that have highest nitrate levels. Do not turn animals into pastures where high nitrates are suspected. Do not graze high nitrates until one week after a killing frost.

Let forage mature. Highest levels of nitrate are found in young plants or on young tillers of old plants. Plant growth reduces accumulated N levels. If testing of young plants reveals low nitrates, mature plants are likely to have low levels.

Feed dry roughage before grazing. To reduce the amount of high-nitrate forage when grazed, feed hay or dry roughage (of plants known to not accumulate nitrate) to dilute toxic effects. Feeding corn or a blended TMR diet also helps dilute high nitrates in forage.

Ensile forage. If high nitrates are suspected, do not feed greenchop. Ensile the forage instead. The fermentation process occurring during ensiling cuts nitrate levels by 30-50%, about half the original concentration.