

# Keep an Eye Out for Nitrate Toxicity

As cattle transition from rangelands to croplands or feed yards, be aware of nitrate toxicity. Although nitrate toxicity is nothing new, it is still necessary to keep a diligent eye on forages that are at risk of nitrate accumulation and watch for symptoms of nitrate poisoning in livestock, particularly cattle.

Known as “oat hay poisoning” since the 1930s, nitrate toxicity is the excessive consumption of

nitrate by livestock, which can result in death. Livestock can consume nitrates from forages, water and other supplements. The toxicity can occur by acute or chronic situations. Acute toxicity is consumption of large amounts of high-nitrate forages in a short period, while chronic is the consumption of small amounts of high nitrate forages over long periods of time.

Nitrate poisoning causes a lack of oxygen in the blood. Acute poisoning usually occurs within a half hour to four hours after consuming toxic levels and the onset of symptoms is rapid. Symptoms include:

- Rapid/labored breathing
- Noisy breathing
- Salivation, bloat, tremors, staggering
- Bluish/chocolate brown mucous membranes



- Dark chocolate-colored blood
- Weakness, coma and death

Chronic poisoning, which is created by sublethal doses of nitrates, may still result in abortion of calves, weight loss, reduced milk production and other animal performance issues. If a pregnant female survives nitrate poisoning, abortions generally occur 10 to 14 days following exposure to nitrates.

The typical culprit for nitrate toxicity is baled or grazed cereal grains like oat, Sudan grass, rye, wheat, barley, triticale and spelt. However, toxicity has been reported in other crops such as brome grass, orchardgrass, fescues, sorghum, millet, corn, sweet clover and alfalfa. Specific weed species can also be of concern such as kochia, lambsquarter, pigweed, quackgrass and Russian thistle.

So why do these plants accumulate nitrates? The uptake of nitrates from the soil is a normal

and natural process for plants to obtain the nitrogen needed for growth and development during the growing season. Nitrate accumulation occurs when roots absorb nitrates faster than the plant can convert it into protein. This typically is correlated with the stage of plant growth and/or enhanced by specific conditions, most commonly climatic conditions.

The highest levels of nitrate are found in the lower third of the stem and in vegetative growth stages. Under normal conditions, nitrate levels are consumed as the plant matures further into grain development. Drought is the most common event causing high nitrate levels. However, frost periods, unseasonably cool weather patterns, hail, shade, disease and insect pressures, herbicide damage and grazing during the growing season can also stress the plant into accumulating more nitrates.

Be especially aware of grass pastures and hay crops grown on soils with high manure applications, high nitrogen fertilizer applications, or under stressed conditions like drought. Unfortunately, nitrate toxicity is so unpredictable it can even occur in normal growing conditions. Nitrate accumulation can occur in any crop, however it is more common in cereal grains.

Management guidelines:

- Test cereal grain forages or other suspected forages prior to feeding or grazing.
- Allow cattle time to adapt to increased nitrates in the diet. If levels are not excessively high, animals can adapt to increasing amounts in feed.
- Do not allow hungry cattle to eat high-nitrate forages.
- Overstocked pastures increase grazing of the high-nitrate plant parts.
- Observe cattle frequently for signs of toxicity when you

**Table 1. Recommendations for laboratory results of forages in parts per million.**

Potassium Nitrate (KNO <sub>3</sub> )	Nitrate Nitrogen (NO <sub>3</sub> -N)	Nitrate (NO <sub>3</sub> )	Recommendations for use in livestock
0–7,220 ppm	0–1,000 ppm	0–4,430 ppm	Generally considered safe for livestock
7,220–10,830 ppm	1,000–1,500 ppm	4,430–6,645 ppm	Safe for nonpregnant animals; 50% of dry matter ration for pregnant animals
10,830–14,440 ppm	1,500–2,000 ppm	6,645–8,860 ppm	50% of dry matter ration for all animals
14,440–25,270 ppm	2,000–3,500 ppm	8,860–15,505 ppm	Limit to 35% of dry matter ration, do not feed to pregnant animals
25,270–28,880 ppm	3,500–4,000 ppm	15,505–17,720 ppm	Limit to 25% of dry matter ration for nonpregnant animals
>28,880 ppm	>4,000 ppm	>17,720	DANGER: Do Not Feed

Nitrate Poisoning of Livestock, North Dakota State University Extension, revised by Janna Block, <https://www.ag.ndsu.edu/publications/livestock/nitrate-poisoning-of-livestock>



turn them out in pastures or on suspect feed.

- Don't graze high nitrate pastures after a killing frost, until a week after the frost.
- Cattle in poor health, especially with respiratory diseases, are more susceptible.
- Give livestock access to fresh, nitrate-free water always.
- Dilute high nitrate forages with low nitrate feeds and forages. High-energy feeds, such as grains (corn, wheat, barley), are best because they stimulate the conversion of nitrate into the non-toxic forms.
- Graze cattle on high-nitrate pastures during the day and remove them at night

for the first week of grazing if possible. This helps acclimate cattle to the higher nitrate levels.

What can be done with forages that have high nitrate levels or are suspected? Ensiling forages is the safest and most effective way to manage high nitrate levels. During the fermentation process of silage, the microbial activity consumes the nitrates resulting in 10 to 60 percent lower levels.

Another option would be delaying the harvest of the forages to later maturity stages, for example from flowering to the soft dough stage. One questionable option is raising a cutter bar to only harvest the top two thirds of the hay. For forages that have experienced environmental events, such as cool weather, hail, pest

pressures and drought, always test for nitrate levels prior to grazing or haying.

As hay is purchased this fall and winter, do not be afraid to request a forage analysis for nitrate toxicity especially on cereal grain forages. Also, as plans are being made for next year's forage crops and grazing rotations, keep in mind potential nitrate toxicity and ways to minimize your risk. For more information on nitrate toxicity, please contact your local extension office.

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