

## Nitrate Toxicity Fact Sheet

Dr. Twig Marston, Field Beef Nutritionist, Hubbard Feeds

### Toxicity

Nitrate ( $\text{NO}_3$ ) in forages is converted by the digestion process to nitrite ( $\text{NO}_2$ ), and in turn the nitrite is converted to ammonia ( $\text{NH}_3$ ) and used by rumen microorganisms as a nitrogen source. But, if nitrite intake is faster than its breakdown to ammonia, nitrites will begin to accumulate in the rumen. Nitrite is rapidly absorbed into the blood system where it converts hemoglobin to methemoglobin. Nitrate toxicity may be chronic or acute. In chronic cases, a sublethal dose may result in abortion, weight loss, reduced milk production and other animal performance issues. In acute cases, nitrite is absorbed into red blood cells and combines with hemoglobin (oxygen-carrying molecule) to form methemoglobin, ultimately causing the animal to suffocate and die.

### Symptoms

Clinical signs of nitrate poisoning are related to the lack of oxygen in the blood. Acute poisoning usually occurs from a half hour to four hours after consuming toxic levels of nitrate. Symptoms are immediate and include:

- bluish/chocolate brown mucous membranes
- rapid/difficult breathing
- noisy breathing
- rapid pulse (150+/minute)
- salivation, bloat, tremors, staggering
- weakness, coma, death
- dark "chocolate-colored" blood
- Pregnant females that survive nitrate poisoning may abort due to a lack of oxygen to the fetus. Abortions generally occur approximately 10 to 14 days following exposure to nitrates.

Not to be confused with Mycotoxin, Prussic Acid Poisoning and Lactic Acidosis:

<b>Mycotoxin Symptoms</b>	<b>Prussic Acid Symptoms</b>	<b>Lactic Acidosis</b>
General thriftiness	Excitement/muscle tremors	Feces soft to liquid, yellow or tan colored
Weakness	Rapid, difficult breathing	Feces has obvious sweet-sour odor
Anorexia	Animal goes down	Feces can contain undigested grain kernels
Reduced immunity	Gasp for air/may convulse	Reduced feed intake
Weight loss	Pupils are pink	Lower feed efficiency
Reduced feed efficiency	Bright, cherry red blood	Weight loss or reduced gain
Diarrhea		Lameness (laminitis/founder)
Hemorrhaging		Dehydration
Abortion		Liver abscesses
Death		Increased temperature

### Interpreting of Laboratory Results of Forages

ppm Nitrate ( $\text{NO}_3$ )	Effect on Animal
0 - 3,000	Virtually safe
3,000 - 6,000	Moderately safe, limit to 50% of stressed or pregnant animals' diets
6,000 - 9,000	Toxic to cattle, limit to 25-30% of diets
9,000 and above	Dangerous to cattle and often causes death

### Conversion Factors to Nitrate Content

Potassium Nitrate ( $\text{KNO}_3$ ) ppm  $\times$  0.61 = Nitrate ( $\text{NO}_3$ ) ppm

Nitrate Nitrogen ( $\text{NO}_3\text{-N}$ ) ppm  $\times$  4.42 = Nitrate ( $\text{NO}_3$ ) ppm

% Nitrate  $\times$  10,000 = Nitrate ( $\text{NO}_3$ ) ppm

### Guidelines to Reduce Nitrite Toxicity

- Suspect forages commonly known to have elevated nitrate levels. Sorghum, sudangrass, corn, oats, summer annuals, small-grains, weeds, and stressed plants often have high nitrate levels.

- Increasing nitrogen fertilizer applications will increase plant nitrate levels.
- Lower one-third of plant stalks have the greatest concentration of nitrates as compared to other plant parts.  
Raise cutter bars to avoid harvesting lower stalks.
- Plants under stress have increased nitrate levels.
- Ensilage forages of suspected high nitrate levels instead of haying them.
- Intravenous administration of Methylene blue
- Grain feeding is an effective management decision to dilute nitrate levels.
- **Test all suspicious forages for nitrate concentrations before feeding. Take corrective actions.**