When discussing nitrate poisoning of cattle in Florida we tend to think of grazing winter annuals like ryegrass or small grains. However, nitrate poisoning can occur with cattle grazing perennial grasses like bermudagrass. One case of nitrate poisoning occurred when cattle were fed bermudagrass hay harvested from a poultry processing plant spray field. Another instance occurred when brood cows grazed bermudagrass pasture heavily fertilized with dairy cow manure. Several instances of nitrate poisoning have occurred when liquid fertilizer, containing nitrate compounds, was broadcasted (sprayed) on bahiagrass pasture instead of banded.

A few basic facts are in order to understand why nitrate poisoning occurs in cattle grazing ryegrass, small grain, or heavily fertilized perennial grass pastures:

1. Nitrate is the elemental form of nitrogen absorbed by plants for protein synthesis and growth.
2. Nitrate uptake by plants is much faster in moist soil than in dry soil.
3. Nitrate concentration is highest in young plants and decreases as the plant matures. Forages harvested or grazed at early stages of maturity will have high protein and TDN levels, and are very palatable to cattle. These forages also can have toxic levels of nitrate.
4. Nitrate concentration is highest in the lower plant (stems) which is the storage tissue. Nitrate is lowest in the leaf because it is being synthesized into protein using energy produced by photosynthesis. Thus nitrate poisoning is more of a problem when cattle are forced to eat stems in either an over-grazed situation or when the forage is cut for hay.
5. Nitrate is particularly toxic to cattle because rumen bacteria immediately reduce nitrate to nitrate, the toxic factor that combines with hemoglobin (produces chocolate colored blood) and suffocates the animal.

Some management practices that should be considered when grazing pastures or haying forages suspected to contain high levels of nitrate:
1. Analyze the forage for nitrate. The nitrate level that causes poisoning is extremely variable, but 1.5% potassium nitrate (dry matter basis) is generally considered the upper limit at which forages can be safely grazed.

2. Suspect forages can be grazed or harvested for hay without problems once the forage reaches a certain stage of maturity. This is very critical for ryegrass grown on organic soil and heavily fertilized bermudagrass on sandy soil.

3. If nitrate toxicity is a concern, place a few test animals on the pastures for several days before grazing the entire herd.

4. If nitrate toxicity is a concern, place cattle on suspected pastures for only 2 to 4 hours each day for the first few weeks to prevent over consumption.

5. Cattle seem to adjust to eating high nitrate forages with time. But, it may be that cattle learn to select only the leaves that have less nitrate, or they eat more quantities of other forages if available.

6. Do not overstock pastures where the suspect forage is the only forage available. Cattle are likely to eat the entire plant including the stem. Provide free-choice hay is possible.

7. Do not place underfed or starving cattle on suspect pastures without filling them up with hay first. If hay is not an option, place cattle on the pasture for only 2 hours per day.

8. Be especially cautious of initiating grazing or haying heavily fertilized grasses when the weather has been overcast and rainy for several days. Moist soil facilitates nitrate absorption, and without sunshine to drive photosynthesis, nitrate accumulates in plant tissue.

9. When using liquid fertilizers, make sure products containing nitrates are banded and not broadcast as a spray. If sprayed, graze only after a good rainfall washes the nitrate of the plant tissue.

The first visual symptom of nitrate poisoning is rapid breathing. This progresses to respiratory distress characterized by mouth breathing and violent respiratory movements. In extreme cases the animal dies in convulsions in an hour. In average cases, death results after a similar clinical course over 3 to 4 hours. Animals that survive often take 10 to 14 days to fully recover. Animals can be saved if immediate treatment is given. Treatment is accomplished by administering a 2% solution of methylene blue intravenously. Consult your veterinarian well before the fact for details.

For questions or comments regarding this publication contact Findlay Pate.