

# NITRATE TOXICITY IN FORAGES

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In Tennessee, many beef producers rely on tall fescue fields for hay. Some also use summer grasses like bermudagrass or sorghum x sudangrass hybrids. While these grasses can be effective for hay production, there is a risk of nitrate buildup, particularly in these plants, especially during droughts. Knowing what nitrate toxicity is and how to avoid it is important.

## What Is Nitrate Poisoning?

Nitrate poisoning occurs when animals ingest hay with high nitrate levels. During drought conditions, summer grasses can accumulate high levels of nitrates from the soil, particularly if nitrogen fertilizer has been applied. Under these conditions, nitrate that is already present in the plant is not metabolized at normal rates due to stress and lack of plant growth, leading to excess nitrate accumulation. When cattle eat forages with high nitrate levels, the nitrate turns into nitrite in their bodies, disrupting how their blood carries oxygen. Symptoms include difficulty breathing, muscle tremors and a bluish tint to the eyes and mouth. If not addressed quickly, it can lead to death.

## Preventing Nitrate Accumulation in Plants

To prevent high nitrate accumulation in forages, avoid fertilizing summer grasses with nitrogen fertilizers during dry conditions. Also, do not cut or graze these crops during or right after a drought until they have received rain and started to grow again. If you are concerned about nitrate levels, reach out to your local Extension office for advice on testing your forage.

## Detecting High Nitrate Forages

The best way to handle nitrate toxicity is by preventing it. If you think your hay might have high nitrate levels, it's important to test it before feeding it to your livestock. Every local Extension office in Tennessee should have a nitrate screening solution, which is used to check for the presence of nitrates in the field.

Here's how you can do a quick nitrate check:

- 1. Collect samples:** Gather 10 to 15 stalks representing the field or forage you're about to feed.
- 2. Prepare the stalks:** Cut the stalks open lengthwise.
- 3. Apply the solution:** Place a couple of drops of the Nitrate Screening Solution on the nodes of the stalks.
- 4. Check for blue:** If a blue color develops in a few seconds (Figure 1), it means the sample is positive for nitrates. Keep in mind that the shade of blue doesn't indicate nitrate levels, so further testing is needed.

If you get a positive result, you should send a new sample to the lab to find out exactly how much nitrate is present. Do not send in samples that already have the solution on them—take fresh samples for the lab.

For crops still in the field, cut 10 to 15 random stalks and chop them into 1.5-foot sections for easier shipping or transport. For chopped samples or silage, take handfuls from 10 to 15 different spots, mix them well in a bucket and fill a gallon bag with the mixed sample. This ensures you have a representative sample for testing.



Figure 1. Positive sample for nitrates (Photo: Bruno Pedreira)

## Understanding Safe Nitrate Levels in Your Forage (Southern Forages)

- 0 – 2,500 ppm: Safe. You can feed this hay without worrying—it's generally safe.
- 2,500 – 5,000 ppm: Use with caution. This hay is usually safe if it's part of a balanced diet. If you're feeding it to pregnant animals, make sure it does not make up more than half of their total dry feed. Avoid mixing it with liquid feed or other non-protein nitrogen supplements and be extra careful if you're feeding it to young or pregnant animals.
- 5,000 – 15,000 ppm: Risky. Limit this hay to a quarter of the total feed. It's important to supplement with extra energy, minerals and Vitamin A. Be aware that milk production might drop within a few days, and you could see some reproductive problems.
- Over 15,000 ppm: Toxic. Do not feed this hay freely. If you must use it, grind it up and make sure it's no more than 15 percent of the total feed.

**Note:** *The nitrate content won't decrease during storage, so testing is crucial. The University of Tennessee's Soil, Plant, and Pest Center offers testing services. For more details, contact your local Extension office.*

## References:

Ball, D.M., Hoveland, C.S., and Lacefield, G.D. (2015). Southern Forages: Modern Concepts for Forage Crop Management (5th ed.). International Plant Nutrition Institute, Atlanta, GA.



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