

Nitrate Poisoning of Cattle in Alabama

Nitrate poisoning in cattle is caused by the consumption of feed or water containing high levels of nitrate nitrogen. Under most circumstances, forage plants do not contain levels of nitrates high enough to be toxic. When this does occur, however, it is a serious problem, often resulting in the death of many animals.

Factors Influencing Nitrate Accumulation

Nitrates accumulate during periods of low soil moisture and high temperature or low humidity. In addition, since nitrate is a nitrogen-containing compound, the accumulation of nitrates within plants is favored by heavy nitrogen fertilization—particularly if the fertilization is timed so that it coincides with the beginning of a drought period.

Hay produced in Alabama during periods of adequate moisture availability should pose no threat of nitrate poisoning. Hay cut during or just after drought periods, however, is always suspect. This is particularly true in cases in which applications of nitrogen were made to forage crops, but little growth was made prior to hay harvest because of lack of moisture. *It is important to note that nitrates degrade little with drying or ensiling of forage, and, consequently, may cause toxicity months after harvest.*

Some plants are more likely to accumulate nitrates than others. Some forage crops grown in Alabama that are known to have potential for accumulation of toxic levels of nitrates are as follows:

- Sorghum
- Corn
- Sudangrass
- Sorghum-sudan hybrids
- Soybeans
- Fescue
- Pearl millet
- Bermudagrass

Judging from experience, in Alabama we are most likely to encounter toxic levels of nitrates in bermudagrass or a summer annual grass such as forage sorghum, sorghum-sudan, or sudangrass. This is primarily because these species are most likely to receive the high levels of nitrogen fertilization that favor nitrate accumulation within plant tissues.

It is also possible for weeds to accumulate toxic levels of nitrates. Therefore, weedy hay could pose more of a nitrate toxicity threat than weed-free hay. Some weeds that are known to accumulate nitrates are as follows:

- Pigweeds
- Smartweed
- Lambsquarter
- (carelessweeds)
- Bindweed
- Goldenrod
- Canadian thistle
- Ragweeds
- Nightshades
- Stinging nettle

Pigweed is implicated in nitrate poisoning more frequently than any other weed commonly found in Alabama.

Prevention of Toxicity

It is impossible to merely examine a sample of hay or silage and determine whether it contains potentially toxic levels of nitrates. A laboratory analysis for nitrates is required to determine this. *We highly recommend that Alabama cattlemen take note of this warning that drought-stricken hay may contain toxic levels of nitrates, and we suggest that if they have any such hay, they should have a sample analyzed for nitrates.* Doing this could save a cattleman thousands of dollars! Most commercial laboratories will run analyses for nitrates on request. Results are usually given in parts per million (ppm). The level of nitrate nitrogen toxic to cattle is not sharply defined, but the following table provides general information on the use of feed and forage containing various levels of nitrate nitrogen.

Other Factors Influencing Toxicity

Nitrate poisoning results from methemoglobin formation due to the absorption of nitrates. Nitrate in the feed is reduced to nitrite by the bacteria of the digestive tract, and if the bacteria do not further reduce the nitrite to ammonia, the nitrite oxidizes the iron in the hemoglobin and prevents adequate oxygen transportation.

Indications are that feeding a balanced ration with a high nitrate nitrogen feed enables the bacterial population to become adapted to the higher

Level of Nitrate Nitrogen in Feed and Forage With Response

Nitrate Nitrogen ppm (dry basis)	Response
0 to 1,500	Generally safe to feed. In upper part of range, use caution when feeding pregnant or young animals, and prevent over-consumption frequently observed in feeding large round bales and large square hay stacks.
1,500 to 5,000	Limit the feed source to one half of the dry matter intake. Feed a balanced ration with adequate energy. Provide supplemental vitamin A at 1,500 I.U. if nitrate-containing forage is fed for one month or more. Do not feed with liquid feed or other non-protein nitrogen supplements.
5,000 +	Toxic. Do not use in a free-choice feeding program. Feed containing such levels of nitrates may be ground and mixed if the nitrate-containing feed is no more than 15 percent by weight of the total ration.

level of nitrates. Thus the nitrate nitrogen will be utilized in the same manner as other non-protein nitrogen. It is advisable, therefore, to feed high energy feeds such as corn or other grain with a high-nitrate feed to reduce the likelihood of toxicity. Non-protein nitrogen sources such as liquid feeds or range pellets containing urea should not be fed with feeds containing high nitrate nitrogen levels.

Feeding large stacks and large round bales of hay increases the possibility of nitrate toxicity. Free-choice access to such hay increases consumption (especially the first day) to amounts higher than normal. Nitrate toxicity occurs most often on farms using large round bales or large stacks, apparently due to over-consumption in these situations.

Symptoms and Treatment

Symptoms noted are labored breathing, muscle tremors, and a staggering gait, after which the cow falls down, gasps for breath, and dies quickly with little struggle. The membranes of the eyes and mouth are bluish, indicating a lack of oxygen. If a venous puncture is made, the blood is reddish-brown in color but turns a brighter red when exposed to air.

Nitrate toxicity usually results in death within a short period of time, but if prompt action is taken, death can be prevented. Medication consists of giving a 4% solution of Methylene Blue intravenously using 100 cc per 1,000 pounds of body weight.

Summary

1. Drought in late summer and fall makes it advisable for producers to analyze late-season hay for nitrates.
2. Nitrates in stored forages degrade little with time.
3. Bermudagrass and summer annual grasses are more likely than other forages to contain toxic levels of nitrates.

4. Nitrate levels can be determined through the Alabama Cooperative Extension System Feed and Forage Testing Program.

5. Feeding non-protein nitrogen with hay containing high nitrate levels increases the likelihood of nitrate poisoning.

6. Use of large round bales or hay stack systems increases the danger of nitrate toxicity because in these situations cattle have unlimited access to the hay and over-consumption may result.

7. Danger with potentially toxic hay can be reduced by feeding other nitrate-free feeds along with the potentially toxic material.

8. There is a wide variation in toxicity level and these differences can be attributed in part to rate of ingestion.

9. If administered quickly, it is possible to treat for nitrate poisoning, so in cases of suspected toxicity, contact a veterinarian immediately.



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