

## Drought Stricken Forages Often Present Nitrate Toxicity

Under normal weather conditions, nitrogen application to soils is taken up as nitrate by plants and metabolized into plant protein. Under drought conditions, this metabolism is decreased and nitrate content of the plant is increased. Forages such as corn, sorghums, pearl millet, soybeans, sudangrass and sorghum-sudan hybrids may accumulate toxic levels of nitrates. Several weeds (e.g., pigweeds, Canadian thistle, ragweed's goldenrod, nightshades) may also accumulate nitrates, so weedy hay may create a problem. Whenever nitrate accumulations are suspected, take extreme precautions in feeding the forage.

- When cattle or other ruminants consume forages with nitrates, the rumen bacteria convert the nitrates to nitrite. Bacteria may utilize nitrite, but the bacteria are overloaded when nitrate concentrations are too high. In this case, nitrite is readily absorbed into the blood system and changes the blood into a form (methemoglobin) that cannot transport oxygen in the body.
- When acute toxicity occurs, cattle have difficulty breathing, have paralysis, go down and may die within an hour unless treated. Accurate diagnosis and prompt treatment of acute cases are essential in the prevention of deaths and abortions.
- The prime diagnostic criterion for nitrate toxicity is chocolate-brown blood. Another symptom is the darkening of normally white membrane (e.g., eyes) to a bluish color.
- Animals are often drowsy, develop a chronic cough, are unthrifty with a reduced appetite and have a drop in production. Abortions and decreased conception may occur.

### Nitrate in forages CANNOT be estimated.

- It is absolutely essential that forages be analyzed. Taking a representative sample prior to grazing the suspected forage is important. Sampling prior to harvest can help determine whether it is worthwhile to harvest the crop.
- Nitrate content of forage MAY decrease by 15 to 20 percent if ensiled, but this cannot be counted upon.
- Nitrate content normally does not decrease in hay. If the nitrate in the forage is excessive, the cost of harvesting and storage should be avoided.
- If preliminary analysis indicates that harvesting is feasible, nitrates may change by the time of harvest, so a second analysis should be made on the forage prior to feeding.
- Nitrate content of drought-stricken forage often increases for two to four days following a rain, so harvesting or grazing should be postponed if rain occurs. Leaf and grain portions of forages are normally lower in nitrate content than lower stalks, so get a representative sample of what will be harvested or grazed.
- The minimum toxic level of nitrates is difficult to define even though there are guidelines. Labs normally list either nitrate (NO<sub>2</sub>) or nitrate nitrogen (NO<sub>2</sub>-N) values (other values occasionally reported) and the numbers are very different.
- Nitrate values can be converted to nitrate nitrogen by multiplying the nitrate value by 0.23; nitrate nitrogen can be converted to nitrate by multiplying the nitrate nitrogen by 4.40.
- The following guidelines for nitrate nitrogen were compiled from several sources and the categories may differ slightly from those you obtain from your laboratory reports.
  - 0-575 PPM: Generally considered safe.
  - 575-1150 PPM: Use caution when feeding young or pregnant animals. Prevent over consumption.
  - 1150-3450 PPM: Potentially fatal.
- Susceptibility of animals to toxicity will depend not only on the concentration of nitrate in the forage but also on the total amount of nitrate consumed, the speed of intake of the toxic forage and the adaptation to the feed.

- If the nitrate content is not excessively high, the danger can be reduced by hand-feeding or mixing the forage with other nitrate-free feeds. For lactating dairy cattle on total mix rations, varying the ingredients can alter the final concentration of nitrates in the total feed mix.
- For beef cattle, dry dairy cattle or heifers, blending nitrate containing forages is difficult. Feeding the animals with nitrate-free forages before grazing may be adequate, but any such grazing management must be done with care.
- Adapting the cows to the feed over time allows the bacteria to adjust to the forage. Introduce such forages into the ration gradually over a period of 7 to 10 days.
- Don't allow hungry animals access to the suspected forages. Under practical conditions, injury is much greater when an animal consumes the forage rapidly than when it is consumed slowly.
- Thus, providing small amounts over a long period of time, even when the cows are accustomed to the feed, is less apt to create problems than if the cows have free access to nitrate-containing hay.
- The inability to control total intake creates problems when cows are allowed free-choice access to grazing (e.g., drought-stricken corn) or hay in large round bale feeders. Providing other nitrate-free feeds before or with grazing or large round bales helps limit "slugging" the cow's system with nitrates.
- Addition of vitamin A (~22,000IU/head/day) is considered beneficial. Access to iodized salt is also considered of value as the iodine metabolism may be compromised with nitrates.
- Animals exhibiting symptoms of nitrate toxicity maybe saved if immediate action is taken. Animals should be removed from the nitrate containing forages and placed on nitrate-free forages.
- Animals should be handled and moved slowly and with a minimum of stress. The oxygen-carrying capacity of the blood is quite low, so stressing the cows or running them with dogs, horses or pickups enhances the problem.
- Methylene blue is the specific treatment for animals exhibiting systems of nitrate toxicity, and survival of affected animals may be improved if a veterinarian administers methylene blue immediately.

In summary, drought-stricken forages may contain toxic amounts of nitrates for cattle, and prevention of problems is essentially the only valid approach to avoiding economic loss. Suspected forages should be tested and results used in the feed management of cattle. Nitrate-containing forages may be used with proper precautions. Limiting forage intake, adapting cows to forages, mixing problem forages and nitrate-free feeds and preventing animals from eating nitrate-containing forages free choice, especially when hungry, are important in avoiding cattle losses.

This information was adapted from a fact sheet written by B. R. (Pete) Moss, Professor in Dairy Science, Don Ball, Alumni Professor in Agronomy, Darrell Rankins, Associate Professor in Animal Nutrition and Gatz Riddell, Professor, Large Animal Surgery and Medicine.