



Cattle Producer's Handbook

Nutrition Section

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Nitrates in Cattle Feed and Water

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Nitrate poisoning is a noninfectious disease that occurs when cattle consume forages or water containing large amounts of nitrate. Each year in range cattle producing areas conditions occur which cause plants and water to accumulate nitrate that increases the likelihood of nitrate poisoning.

Nitrate itself is not particularly toxic to animals. Nitrates consumed by ruminants are normally reduced to ammonia and then absorbed and excreted, thus converted by bacteria into bacterial protein.

Nitrite, one intermediate product, is the actual cause of "nitrate poisoning." Some of the nitrate is absorbed into the blood, where it changes the hemoglobin to methemoglobin. Hemoglobin carries oxygen from the lungs to other tissues, but methemoglobin cannot carry oxygen.

Nitrate becomes toxic when methemoglobin production is high enough that the oxygen-carrying capacity of the blood is reduced to a critical level. If enough methemoglobin is produced, the animal with that condition will die. The toxic level depends both upon how much and how fast nitrate was consumed. Immature ruminants are more susceptible to nitrate toxicity than more mature animals.

Symptoms of Nitrate Toxicity

Nitrate levels from 15 to 45 grams per 100 pounds of body weight are considered toxic in feed and water sources. Nitrate in water sources is more rapidly available than in feed sources. Nitrite is 10 times more toxic than nitrate and should be watched more carefully.

Nitrate poisoning can be rapidly fatal. When nitrate poisoning is suspected, a veterinarian should be called immediately to confirm the diagnosis and start treatment. Since death comes from oxygen insufficiency, cattle should be handled as little and as quietly as possible to minimize their oxygen needs.

Symptoms appear when 30 to 40 percent of the hemoglobin has been converted to methemoglobin, with death occurring at 70 to 80 percent methemoglobin levels. Symptoms may not develop until 3 to 4 days after daily feeding of moderate nitrate feedstuffs. Respiratory distress, incoordination, weakness, muscle tremors, and collapse occur. Forced movement may trigger the onset of symptoms.

Terminal convulsions due to suffocation occur in untreated animals in 12 to 25 hours. In the non-acclimated cow, acute poisoning can occur as soon as 1/2 to 4 hours after abrupt feeding of high-nitrate feed and/or water. If pregnant animals recover abortion usually follows.

Postmortem Lesions

Mucous membranes appear gray (cyanotic) or dark brown. Blood obtained within a couple of hours after death is chocolate brown in color. This blood changes back to dark red within a few hours. Hemorrhages may be in the lungs and on the heart.

Common toxicants that may be confused with nitrates and nitrites are silo gases (slight brown-colored blood), cyanide (cherry red), carbon dioxide (dark blue), and carbon monoxide (bright red). Acute poisonings in cattle most commonly occur with nitrate concentration exceeding 1 percent NO_3 (approximately equivalent to 1.5 percent KNO_3) in forage dry matter or 1,500 mg NO_3/ml (ppm) in water. Irritation may be found in the stomach and intestines (if the source of nitrate is from eating fertilizer).

Chronic Toxicity

Subacute or chronic nitrate poisoning causes poor growth, abortion, repeat breeding, Vitamin A deficiency, goiter, and increased susceptibility to infection. Such problems may occur when high-nitrate forages or waters are fed to animals in poor condition, but controlled