Nitrate/Nitrite Poisoning in Livestock

Nitrate poisoning has been recognized in livestock for many years. Ruminant livestock Cattle are the most susceptible to nitrate poisoning. These species consume nitrate contaminated feed or water. Thenitrates are converted to the more toxic nitrite form by the microflora in the rumen. If the ability of microflora to convert the nitrite to ammonia and ultimately protein is exceeded, poisoning will occur. Acute nitrate poisoning is manifested by elevated heart rates and respiration rates. Affected animals exhibit signs of incoordination and collapse. Coma and death soon follow. Acute nitrate poisoning is a medical emergency. With chronic exposure to high nitrates in feed or water, vitamin A deficiency, abortion and reduced performance may occur, but documentation of these problems in controlled studies is limited.

Prairie Diagnostic Services currently utilizes a screening test to check for presence or absence of nitrate in feed. This screening test detects nitrate concentrations from approximately 0.5-1.5%. **Concentrations exceeding 1% are associated with clinical disease and are high risk to ruminants.** Under normal circumstances the plant can convert the nitrate into amino acids and protein. If the plant is stressed by frost, drought, heat, hail, and/or herbicide exposure, among other factors, the plant cannot metabolize the nitrate and concentrations build up in in the plant. In many parts of western Canada, drought stress is often the primary problem. If the weather cools off and rainfall occurs, the plant metabolism may return to normal and the nitrate concentrations will decline to safe levels. Unfortunately, if the drought stress is severe, the plant metabolism is unlikely to return to normal. If the crop is cut during the high nitrate state, the nitrate concentrations are fixed and will not decline.

There are numerous plants that are prone to accumulating nitrates. This includes various annual crops, like barley, oats, canola, wheat, corn, millet, sorghum, and rye. Weeds are often notorious nitrate accumulators; such weeds include kochia, pigweed/amaranth, thistle, lamb's quarter, and dock. As most of the nitrate in the plant tends to accumulate in the stem, stubble grazing of nitrate accumulating plants can be high risk. Harvesting crops for dried bales or as greenfeed can also be high risk.

With limited feed supplies, many producers may be forced to use the high nitrate feeds for livestock. If you receive a positive test on the feed sample, a quantitative test is essential to determine the extent of dilution/mixing of the feed that is needed. At this time, Prairie Diagnostic Services does not do quantitative testing. Submission to other feed test labs is recommended. The feed needs to be diluted to less than 0.5% total mixed ration. Due to variations in the nitrate content of the feed and possible exposure to nitrates in the water, it is recommended that a margin of safety be followed with the dilution. If 1:3 is the estimate, then 1:5 may ensure clinical disease is avoided. Livestock can develop tolerance to the nitrates in the feed. This process will take approximately one week. During this period of time the extent of dilution can gradually be reduced. This process can be high risk if the time period to adapt is too short. It should also be

noted that pregnant cattle are susceptible to abortion. The cow may not exhibit any evidence of poisoning, but the highly susceptible fetus may abort.

In many instances, producers wish to have the animals graze contaminated drought-stressed pastures. Mixing feed is often not practical. Supplemental palatable feed could be placed on the pasture and gradually reduced in content over the adaptation period. Selective grazing by animals consuming only the high nitrate feed may compromise this strategy. If possible, providing grain on pasture as a supplemental feed may reduce the risk. This approach also has concerns if cattle consume excessive grain. Another approach that is more labor intensive is to allow cattle to graze the contaminated field for only one hour and move them to another field. The grazing time can be extended an hour or so every second day until adaption has occurred. Ensiling the feed is another option, but there are mixed opinions whether this has a major impact on the nitrate concentrations. With the lack of feed and extensive nitrate contamination of existing feeds, the options for producers are high risk. It is recommended that feed testing be done to evaluate the extent of the problem. Since affected animals often die before treatment can be attempted, a conservative approach to strategies is essential.
If you have additional questions, you may contact Dr. Vanessa Cowan, Veterinary Toxicologist, by email at vanessa.cowan@usask.ca

More information can be found at:
https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/livestock/animal-health-and-welfare/nitrate-toxicity

https://www.beefresearch.ca/blog/dont-let-high-nitrates-sneak-up-on-your-herd/