

Nitrate Toxicity in Livestock

Megan Van Emon, Extension Beef Cattle Specialist

Although many areas of Montana have received much needed rain this year, nitrates are still an issue that should be considered when harvesting forages. Oats are the number one nitrate accumulating crop, with wheat and barley being close seconds. In addition, weeds can also be nitrate accumulators. Oftentimes when a drought dissipates, stress on the plants is reduced. However, this may not correlate to a reduction in nitrates in the plants.

In general, plants take up nitrogen from the soil in the form of nitrate, which is then converted into nitrite and then into ammonia and finally into amino acids. Amino acids are the building blocks to protein in the plants. Nitrates accumulate during the night when no photosynthesis is occurring and peaking during the early morning. Photosynthesis is active during the day, which converts the nitrate into the protein. Stressful conditions on the plant cause the roots to accumulate nitrate faster than it can be converted into protein.

Stressful conditions not only include drought, but also during times of prolonged cool temperatures, hail, disease, mineral deficiency, and many others. Nitrates mainly accumulate in the bottom one-third of the plant, so one way to aid in reducing nitrates in the harvested forage is to raise the cutter bar on the swather. Another method to reduce nitrate concentrations in crops is to allow those plants to further mature before harvesting. Additionally, plants can be ensiled, which aids in reducing nitrate levels, but is not a reliable method because reduction in nitrates is variable.

Once nitrate containing plants are harvested, nitrates remain at the harvested level, they cannot be reduced by time because all photosynthesis has stopped. Therefore, it is extremely important to test for nitrates, not only in times of stress, but also on “average” years. There are two common tests available at your local Extension offices, the QuikTest and the Strip Test. The QuikTest requires acid to determine if nitrates are present in the sample and can be conducted in a few minutes. However, this only gives a qualitative answer, yes, nitrates are present, or no, nitrates are not present. Therefore, samples should be submitted to a commercial laboratory for further analysis. The Strip Test provides a quantitative answer using a colorimetric strip and takes about 45 minutes to complete. The Strip Test provides an estimated concentration of nitrates in the provided sample. However, we still recommend sending the sample to a commercial laboratory, especially if the concentration is high.

Toxic levels of nitrates in plants can cause nitrate toxicity in livestock. Similar to plants, nitrate is converted to nitrite and then to ammonia and then to microbial protein in the rumen. When excessive concentrations of nitrate are consumed, nitrite accumulates in the rumen faster than it can be converted to ammonia. The nitrite then enters the blood stream from the small intestine and causes the conversion of hemoglobin to methemoglobin, which cannot carry oxygen efficiently. The main symptoms of nitrate toxicity include labored breathing, weakness, staggering gait, abortions and can cause death. In many instances, cattle are found near the nitrate containing feed. One of the main indicators of nitrate toxicity is after death, when the blood appears to be chocolate brown in color due to the lack of oxygen.

The main treatment plan for nitrate toxicity is prevention. However, if noticed quickly enough, a veterinarian may administer methylene blue, which can aid in alleviating symptoms. However, prevention and management are the best factors to reducing the potential for nitrate toxicity.

Montana is conservative in their recommendations when feeding nitrate containing forages. Lower risk forages should contain less than 1,500 ppm nitrate and above this level, forages should be fed with caution or not at all as levels approach 10,000 ppm. In addition, nitrate concentrations in the water should also be considered, as these can add to the potential of nitrate toxicity.

Overall, care should be taken each year when feeding livestock feeds or water sources that contain nitrates. When collecting feed and water samples for all analyses, not just nitrates, it is extremely important to collect a representative sample. The analysis is only as good as the sample collected, so care should be taken when collecting pre- and post-harvested feeds or water.