

## Watch Out For Nitrate Toxicity in Small Grain Hay!

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Droughty conditions across Montana for the past three years have impacted forage availability. While fall pasture conditions have improved in some areas, many ranchers are scrambling to put together an adequate hay supply for the winter. During 2000 and 2001, the acreage of small grains cut for hay increased dramatically. Much of this increase was due to the planting of hay barley or other emergency forage crops, plus many acres of drought-stricken wheat. As ranchers begin to feed hay this winter, they should be aware of potential nitrate toxicity in much of the hay supply.

Nitrate poisoning of livestock has been noted for over 100 years. Nitrate is a normal plant nutrient, and under most conditions is converted into plant proteins. However, under stress conditions such as drought, frost, prolonged hot or cool conditions, herbicide injury, elevated nitrate levels are accumulated in plants. High nitrate concentrations are frequently found in oats, barley, wheat, sorghum, sudangrass, millet and corn, and many weeds like kochia, Russian thistle, pigweed and quackgrass. On rare occasions, even alfalfa can have high nitrate levels.

Early symptoms of nitrate poisoning include watery eyes, reduced appetite, signs of Vitamin A deficiency, reduced milk production, weight loss, rough hair coats and abortion. With acute nitrate toxicity, animals have labored breathing, shortness of breath, fast pulse rate, muscle tremors, staggering gait, cyanosis (blood, eyes, etc. turn blue), and even death. Normally, forage nitrate ( $\text{NO}_3$ ) is broken down to nitrite ( $\text{NO}_2$ ) and then ammonia ( $\text{NH}_3$ ) by ruminal microbes, and then converted into protein. When a high-nitrate forage is consumed, nitrite is rapidly formed, and nitrite competes oxygen ( $\text{O}_2$ ) molecules. In the blood, nitrite combines with hemoglobin to form methemoglobin, resulting in the blue color and reduced oxygen flow. Nitrate toxicity can occur at low levels of nitrate concentration – 0.25%, and in humans and all classes of livestock. Therefore, all sources of feed and drinking water must be considered.

**All small grain hay grown since 1999 in Montana should be tested for nitrate concentration before feeding.** Nitrate levels of small grain hay are usually safe, however present conditions suggest that we err on the side of caution. Several factors pre-dispose us for problems for winter feeding in 2001 – 2002: 1) drought stress of dryland crops grown during the past three years, 2) many of the small grain hays already tested have toxic nitrate levels, 3) nitrate concentrations in many dwindling water sources has risen, 4) large supplies of various mixed and weedy hays of unknown condition have been shipped in to Montana, and 5) the large quantity of “suspect” hay that will be fed to pregnant livestock. Aside from barley or oat hay, other crops such as millet and sudangrass should be tested, including crops cut immediately after a frost, weedy or over-fertilized forages.

The MSU Extension Service agents in Montana counties use a nitrate “QuikTest” for a fast evaluation for potentially toxic levels of nitrate in forage samples. Since 1999, agents have tested over 3000 forage samples at harvest time to assist with management decisions. About one third of these samples were judged to be potentially high in nitrate, and a laboratory analysis was recommended before feeding. The “QuikTest” is useful at this point to identify different lots of hay for potentially toxic levels of nitrate, however an accurate laboratory analysis is required to determine the actual nitrate concentrations.

Sampling hay for nitrate analysis follows the same procedure as sampling for forage quality. In fact, producers are encouraged to submit cereal forage samples to a testing laboratory for simultaneous testing of crude protein, acid detergent fiber (for estimation of energy and digestibility), neutral detergent fiber (to estimate intake), and nitrate. A random and representative sample should be taken from every individual “lot” of hay to be fed, as well as water or other potential feeds.

Producers should contact their local Extension Service county agents for assistance with sampling, a list of forage testing laboratories, and interpretation of nitrate tests.