

Assessing Potential Sulfur Intake Excess

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Sulfur is an essential component of certain amino acids, vitamins, hormones and sulfated polysaccharides. Sulfur is therefore a component of virtually all forages and concentrates. Cruciferous forages, such as turnip, rape, and oilseed meals are also rich in sulfur. The sulfur-containing amino acid content of the protein is probably the reason that protein rich forage such as alfalfa can contribute significant amounts of sulfur to the diet. Grasses tend to be low in sulfur, although under some circumstances grasses can accumulate high concentrations of sulfate. Certain weeds seem to be able to accumulate large amounts of sulfate if large amounts of sulfur are available in the soil. These weeds include Canada thistle, kochia and lambsquarter. Various combinations of these forages commonly explain some of the range cattle problems we have seen. Corn, molasses and sugar beet processing byproducts can be high in sulfur because sulfur-containing acidifying agents may be used in the process. Dairy cattle rations often include some of these high sulfur feeds.

One of the most important sources of dietary sulfur in our region is water. The sulfur occurs as sulfate salts. High water sulfate content is common in this region, but cannot be predicted solely on a geographic basis, requiring water analysis for proper identification. A recent national survey of water sources for beef cattle found 21% of samples exceeded the levels considered safe for all livestock. The accepted maximal safe water sulfate concentration is estimated at 300ppm. Water consumption by cattle is temperature dependent and increases greatly at high temperatures. In hot weather sulfur intake from water can be elevated due to increases in water consumption. Additionally, hot weather conditions also can result in evaporation which increases sulfate concentration.

As dairy rations increasingly include salts to modify the dietary anion/cation balance (DCAD), it is important to account for the amount of sulfate that some of these salts contain. Sulfate salts have been used in feedlot rations as intake limiting agents to minimize the risk of overfeeding. Since one of the effects of high sulfate intake is limited feed intake, this may explain some of the reduced performance seen in animals on high sulfur diets.

This assessment requires estimation of total sulfur concentration (TSC) of dry matter consumed from all sources, including the contribution made by water. Many nutrient elements are assessed for total quantity of intake, such as grams/day or lbs/day. The minimal and maximal limits for sulfur intake are rather expressed as percent of intake, because the utilization and availability of sulfur are closely related to rumen microbial metabolism, and thus are related to total feed intake.

Many dairy ration formulations emphasize the use of legume forages and commodity feeds that are typically high in sulfur, and the ability to substantially reduce sulfur intake by feed modifications can be limited. Since some ground water has high concentrations of sulfate, water purification may be very beneficial for affected dairies. Although this

article has focused on sulfur intake, other water impurities such as nitrate and nitrite can also affect dairy production. Water purification can be beneficial by removing multiple mineral contaminants.

Some Colorado dairies have indeed found production benefits from water purification. As an example on one dairy, water tested high for sulfate and a reverse osmosis purification system was installed. Estimated increased milk production per cow over the following year exceeded 3 lbs per day, and was sufficient to rapidly pay off the purification system. Whether this benefit was due entirely to reduced sulfate intake or the removal of several impurities was not specifically evaluated.

For cattle in general the maximum tolerable sulfur concentration has been estimated at 0.4% on a dry matter basis, and this estimate seems fairly accurate for tolerances in beef cattle in our research. Some researchers have suggested a lower maximum tolerable sulfur concentration of 0.26% for lactating dairy cattle. This is a question that needs to be studied more thoroughly. By estimating the TSC for your herd, based on measured sulfur content of all consumed nutrients, it is possible to evaluate potential hazards. Compared with all other farm animals, lactating dairy cows require the greatest amount of water in proportion to their size. Therefore high sulfate water can represent a substantial amount of sulfur intake in these animals. TSC is estimated by adding the % sulfur contributed by the water to the % sulfur contributed by the feed and all additives, all on a DM basis.