



BY RACHEL ENDECOTT, BEEF CATTLE SPECIALIST

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WATER QUALITY CONCERNS DURING DROUGHT

Water quality often decreases during drought. This special issue focuses on water quality concerns, testing, and interpretation. Many county Extension offices have a portable meter to measure total dissolved solids (TDS) which can be a first step in investigating water quality. If TDS measures in the 2500-3000 ppm range or higher, a sample should be sent in to a lab for further analysis to identify what salts make up the TDS. While each testing lab is a bit different, most water quality analyses will measure for sodium, calcium, magnesium, pH, nitrate, sulfate, and total dissolved solids.

Total dissolved solids (TDS) consist of the dissolved salts in the water, including sodium, chloride, carbonates, nitrates, sulfates, calcium, magnesium and potassium. It is generally expressed in parts per million (ppm). A guide to livestock and poultry response to saline water is summarized in the table below. Corresponding electrical conductivity values are listed in parentheses below TDS values.

Total Dissolved Solids, ppm or mg/L	Animal Response
Less than 1000 (EC < 1.5 mmhos/cm)	Relatively low in salinity. Excellent for all classes of livestock and poultry.
1000-2999 (EC = 1.5-5 mmhos/cm)	Very satisfactory for all classes of livestock and poultry. May cause temporary and mild diarrhea in livestock not accustomed to the water.
3000-4999 (EC=5-8 mmhos/cm)	Satisfactory for livestock, but may cause temporary diarrhea or be refused at first by animals not accustomed to the water. Poor water for poultry.
5000-6999 (8-11 mmhos/cm)	Can be used with reasonable safety for cattle, sheep, swine, and horses. Avoid use for pregnant or lactating animals. Not acceptable for poultry.
7000-10000 (EC = 11-16 mmhos/cm)	Considerable risk for pregnant or lactating cows, cattle in confinement, horses, or sheep or young of these species. In general, should avoid use. Unfit for poultry and probably for swine.
Over 10000 (EC > 16 mmhos/cm)	Extremely high risk. Not recommended for use under any conditions.

High-sulfate water is not uncommon in many areas of Montana, and can lead to poor animal performance, and even polioencephalomalacia (a brain disorder) and death. High-sulfate water has a laxative effect and usually tastes bitter. Producers should be especially aware of water sulfate concentrations when they are feeding sulfur-containing feeds such as distiller's grains or corn gluten feed. Furthermore, sulfur can negatively impact the absorption of copper. Producers with water sulfate concentrations of 1500-3500 ppm who choose to use that water may wish to address these copper availability issues. Two ideas include increasing the concentration of inorganic copper in mineral supplements and(or) adding or increasing the amount of chelated copper in mineral supplements in an attempt to counteract the sulfur-copper complex. A guide to the use of water containing sulfates is detailed below.

Sulfate (SO ₄) content, ppm or mg/L	Recommendations
Less than 1500	No harmful effects. Perhaps some temporary, mild diarrhea and discrimination against taste near upper limit.
1500-2500	No harmful effects except some temporary diarrhea, although may contribute significantly to total dietary sulfur intake. May cause a reduction in copper availability.
2500-3500	Very laxative, diarrhea usually disappears after a few weeks. Sporadic cases of sulfur-associated polio are possible. May cause substantial reduction in copper availability.
3500-4500	Very laxative. Not recommended for use for pregnant or lactating ruminants or horses, or for ruminants fed in confinement. Sporadic cases of polio likely. May cause substantial reduction in copper availability.
Over 4500	Not recommended for use under any conditions.

Excessive levels of sodium have a diuretic effect. By themselves, sodium and magnesium normally pose little risk to livestock, but their association with sulfate is a major concern. Water over 800 ppm sodium in the presence of high sulfates would be of concern. Also, the laxative effects of high sulfate water will be more dramatic as water pH increases.

High nitrate concentrations in water can be poisonous. Just as with nitrate toxicity from forages, nitrate from water is converted to nitrite in the rumen. Nitrate interferes with oxygen transport by hemoglobin, and animals can die as a result of lack of oxygen. A guide to nitrate concentrations in water is listed below.

Nitrate-nitrogen (NO ₃ N), ppm or mg/L	Recommendation
Less than 100	Should not harm livestock.
100-300	Water alone should not harm livestock. If hays, forages, or silages contain high levels of nitrate, water may contribute significantly to a nitrate problem in cattle, sheep, or horses.
Over 300	Water could cause typical nitrate poisoning in cattle, sheep, or horses, and it's use for these animals is not recommended.

Blue-green algae, or cyanobacteria, are photosynthetic bacteria that live and grow in aquatic environments. Many species exist: some are harmless, some produce neurotoxins that affect the nervous system, and others produce hepatotoxins that affect liver function. These toxins are known as cyanotoxins. Large blooms of cyanobacteria can occur when conditions are favorable, leading to elevated concentrations in water sources. When livestock or other animals ingest high concentrations of blue-green algae, death can occur within minutes or hours.

Poisoning usually does not occur unless there is a heavy bloom that forms a dense surface scum. Colonies may look like a skin or paint on or just below the water surface. Contributing factors to heavy blooms include nutrient-rich water (nitrogen and phosphorus, for example) and warm, sunny weather. Even a light wind can lead to very high (scum) concentrations of blue-green algae, especially downwind shoreline locations where livestock drink. Ruminants and birds are more sensitive to the toxins than monogastrics. Among domestic animals, dogs are most susceptible. Ranchers have reported dead birds and other wildlife along shorelines of affected water sources.

Signs of blue-green algae poisoning would include tremors and difficult breathing if affected by the neurotoxin. At high doses, the neurotoxic effects can take place within minutes. Often, ranchers report sudden collapse and death immediately after consumption of the affected water. The hepatotoxic effects would take longer (hours rather than minutes) after toxic water consumption to be observed. Water samples can be evaluated at a lab for the presence of toxic cyanobacteria and for analysis of cyanotoxin level. You can read more about human health concerns regarding cyanobacteria from the CDC at <http://www.cdc.gov/hab/cyanobacteria/pdfs/activities.pdf>

Water quality is a critical nutritional factor that influences animal health, performance, and well-being. Please don't hesitate to contact me if you have questions about water sampling, testing, or interpretation of analyses.

References:

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