NebGuide

University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources

Know how. Know now.

G2060

Water Requirements for Beef Cattle

Rick J. Rasby, Beef Specialist and Troy M. Walz, Extension Educator

Water is as important as other nutrients to a well-balanced diet that will help beef cattle achieve a desired level of performance.

Many times the importance of water to beef cattle is overlooked. Diets are balanced for carbohydrate (energy), protein, vitamins, and minerals so cattle can achieve a desired level of performance, but cattle have a requirement for water too, and animal performance can be affected by water intake. In fact, of these nutrients, water is most critical. The minimum requirement of cattle for water reflects the amount needed for body growth and fetal growth or lactation, to replace what is lost by excretion in urine, feces or sweat, or by evaporation from the lungs or skin. Anything influencing these needs or losses will influence the water needs of livestock.

Under conditions of restricted water intake, an animal may concentrate its urine by reabsorbing a greater amount of water than usual. While this capacity for urine concentration is limited, it can reduce the water requirement. When an animal consumes a diet high in protein or in salt, or containing substances having a diuretic effect, the excretion of urine increases and there is an increased water requirement.

The amount of water lost through evaporation from the skin or lungs is important and in some cases may even exceed what is lost in the urine. If the environmental temperature and/or physical activity increases, water losses through evaporation and sweating increases.

What Impacts Water Requirements?

A number of factors interplay and make water requirements and needs difficult to assess. Because feeds themselves contain some water and the oxidation of certain nutrients in feeds produces water, not all the water needs must be provided as drinking water. Feeds such as silages, green chop, or pasture are usually high in moisture, while grains and hays are low. When cattle consume feeds high in water content, water intake is reduced. High-energy feeds produce more metabolic water compared to low-energy feeds. To learn more about

Table I. Approximate total daily water intake of beef cattle[1].

Temperature in °F[2]						
Weight	40°	50°	60°	70°	80°	90°
Lb.	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons
Growing Heifers, Steers, Bulls						
400	4.0	4.3	5.0	5.8	6.7	9.5
600	5.3	5.8	6.6	7.8	8.9	12.7
600	6.3	6.8	7.9	9.2	10.6	15.0
Finishing Cattle						
600	6.0	6.5	7.4	8.7	10.0	14.3
800	7.3	7.9	9.1	10.7	12.3	17.4
1,000	8.7	9.4	10.8	12.6	14.5	20.6
Wintering Beef Cows[3]						
900	6.7	7.2	8.3	9.7		
1,100	6.0	6.5	7.4	8.7		
Lactating Cows[4]						
900	11.4	12.6	14.5	16.9	17.9	18.2
Mature Bulls						
1,400	8.0	8.6	9.9	11.7	13.4	19.0
1,600+	8.7	9.4	10.8	12.6	14.5	20.6

[1]1996 National Research Council Nutrient requirements of Beef Cattle, Seventh Revised Edition, 1996. Table derived from an article by C. F. Winchester and M. J. Morris, Vol 15, No 3, Journal of Animal Science, August 1956.

[2]Water intake is a function of dry matter intake and ambient temperature. Water intake is constant up to 40°F.

[3]Dry matter intake influences water intake. Heavier cows are assumed to be in greater body condition and require less dry matter and, therefore, less water.

[4]Cows larger than 900 pounds are included in this recommendation.

Table II. A guide to the use of waters containing nitrates for Cattle (National Academy of Science, 1974)

Acceptability	*Nitrate Nitrogen (NO_3-N) ppm*	*Nitrate Ion (NO_3) ppm*	*Sodium Nitrate ($NaNO_3$) ppm*
Safe	Less than 100	Less than 443	Less than 607
Questionable[1]	100-300	443-1329	607-1821
Unsafe[2]	Over 300	Over 1329	Over 1821

[1]Use with caution. High nitrate in forages, or high temperatures (high water intake), could result in toxicity.
[2]Avoid use for cattle.

the water needs of cattle in a feedlot on finishing diets, see *2010 Nebraska Beef Cattle Report* (MP93), Pages 67 to 70. Fasting animals or those on a low-protein diet may generate water from the destruction of body protein or fat, but this is of minor significance.

As illustrated in *Table I*, water needs are influenced by environmental temperature, class of livestock, and weight. Water needs increase as temperature increases. Lactating cows have greater needs than nonlactating cows. Bulls have a greater daily water requirement than nonlactating cows. This is a function of weight. As cattle get heavier, daily water intake increases.

A University of Georgia publication lists the estimated water requirements for cattle in different production stages when the daily high temperature is 90°F. The data suggest for cattle in this environmental condition, a growing animal or a lactating cow needs two gallons of water per 100 pounds of body weight. A nonlactating cow or bull needs one gallon of water per 100 pounds of body weight. As an example, spring calving cows will need close to 20 to 24 gallons of water per day for themselves and another 5 to 10 gallons for their calf in these high temperature environmental conditions. Remember, some of the water will come from the feed they eat, and vegetative grass is high in water content. Also, for the nursing calf, a portion of the daily water needs will come from the dam's milk.

Water Quality

Providing clean, fresh water is always a goal for the livestock producer. There are a number of items that affect water quality. Producers need to adopt management practices that do not negatively impact water quality.

Salinity. Water that contains high amounts of total dissolved salts (TDS) can result in reduced performance. Cows will adapt to some salt in their water. Care must be taken if salt is used to limit intake of a feed in a free-choice supplementation management strategy. Cattle actually prefer water that contains very small amounts of salt. Research suggests that water containing a TDS of 5,000 ppm results in about a 10 percent reduction in performance. Guidelines suggest that water containing 3,000 ppm TDS or less is usually satisfactory for most livestock. Water that contains 5,000 to 7,000 ppm TDS should not be used for pregnant or lactating females. Water with salinity at this level may have a laxative effect.

Nitrates. *Table II* is a guide to evaluate water that contains nitrates. Nitrates themselves are not poisonous to cattle; however, in the rumen, nitrates are converted to nitrites, and nitrites are absorbed into the bloodstream and convert hemoglobin to methemoglobin. Methemoglobin does not bind to oxygen, and the oxygen carrying capacity of the blood is reduced. Cattle can be adapted to nitrates, but it must be done slowly. A safe level of nitrate nitrogen (NO_3N) in the water for cattle is less than 100 ppm. Water over 100 ppm NO_3N needs to be managed when used as a part of cattle's diet. However, it is still advised to avoid high nitrate water as a source for livestock. Remember, total nitrate intake would be the sum of the nitrates contained in both the feed and water consumed.

Sulfates. Animals can become acclimated to the sulfates in water. Consider diluting high-sulfate water with low-sulfate water for newly arrived animals. The sulfate upper limit for calves is less than 500 ppm (167 ppm sulfur as sulfate). For adult cattle, the upper limit is less than 1,000 ppm (333 ppm sulfur as sulfate). Caution is required when evaluating sulfate levels in water because of interactions with copper and molybdenum, and the inhibiting effect compounds such as sodium fluoride have on sulfate absorption for the digestive tract. In addition, high levels of sulfates also may contribute to an increased incidence of polioencephelomalacia (PEM), a brain disorder found in cattle. If copper deficiency problems are suspected, water sources should be analyzed for sulfates to determine if high sulfate levels are contributing to the problem. Remember, distillers grains can be high in sulfur, and total sulfur intake is the combined amount from the feeds and water consumed.

Substances in Water. There are some other substances (*Table III*) that can impact water intake by cattle. *Table III* lists some of those substances. Some of the more common problems are high or low pH, or excessive levels of sulfates, hydrogen sulfide, iron, and magnesium. Many times these substances in water cause an "off flavor" and impact water intake.

Blue-green Algae. Algae is a microscopic plant that grows in water in relation to the conditions and the amount of nutrients available. Stagnant water, lakes, and ponds are ideal environments for the growth of blue-green algae, which can be toxic to cattle. When in abundance, blue-green algae gives the water the appearance that someone has dumped a bucket of light green or turquoise paint in the water. This phenomena is known as a "bloom" of algae. Blue-green algae floats and

Table III. Limits for some potentially toxic substances in drinking water for beef cattle.

Substance	*Safe Upper Limit mg/L (ppm)*
Arsenic	0.2
Cadmium	0.05
Calcium	500
Chloride	1,500
Chromium	1.0
Cobalt	1.0
Cyanide	NE[1]
Fluoride	2.0
Iron	NE
Lead	0.1
Magnesium	250
Manganese	NE
Mercury	0.01
Molybdenum	NE
Nickel	1.0
Nitrate Nitrogen	See *Table II*
Salinity (Total Soluble Salts)	3,000
Sodium	1,000
Sulfate	500
Total Dissolved Solids	3,000
pH	Range 5.5 to 8.5
Vanadium	0.1
Zinc	25

[1]No upper limit established limited experimental data.

will concentrate on the downwind side of the pond. Another common algae found in waters is the nontoxic filamentous algae, best described as a hair-like green material that can grow on the sides of a stock tank or along a pond edge. Livestock ponds commonly experience blue-green algae blooms. Algae toxin levels are highest during or directly after a bloom, often occurring in late summer when cattle have their greatest water consumption. Toxicity as a result of blue-green algae is difficult to predict. Algae blooms can be controlled in a pond by using copper sulfate (blue stone). Be aware that a rapid die-off of algae may result in killing fish. Copper sulfate treatment may be ineffective if alkalinity of the water is less than 300 ppm. The maximum tolerable level of copper sulfate in water is 2.7 (sheep) and 6.8 (cattle) per acre-foot. *Table IV* includes guidelines for treating blue-algae infested water with copper sulfate. The best way to control blue-green algae is to eliminate the source of nutrients entering the pond.

(Total alkalinity in ppm ÷ 100) x 2.04 x acre-foot volume = pounds of copper sulfate needed

Signs of blue-green algae poisoning are diarrhea, vomiting, lack of coordination, labored breathing, seizures, convulsions, and possibly death. During recovery, unpigmented skin may slough off. A suggested treatment for algae afflicted animals is large quantities of medical-grade charcoal and mineral oil, given orally. These are given to try to prevent any further absorption of the toxins by the affected animals. Contact a veterinarian for more information and assistance.

Table IV. Amount of copper sulfate to treat water contaminated with blue-green algae.

Amount of $CuSO_4$ used	*Water volume for 1 ppm*	*Water volume for ½ ppm*
1 oz	7,800 gallons	15,000 gallons
8 oz	62,500 gallons	125,000 gallons
1 lb	125,000 gallons	250,000 gallons
8 lb	1,000,000 gallons	2,000,000 gallons

Sampling Water for Analysis

Contact your extension office to locate a laboratory nearest to you that will test livestock water. The laboratory will likely have sampling instructions and a sampling bottle. Take a representative sample and properly identify and label the bottle. Make sure the bottle is sealed tightly. Any considerations needed until the sample is delivered to the laboratory will be included in the instructions.

This publication has been peer reviewed.

UNL Extension publications are available online at *http://extension.unl.edu/publications*.

Index: Beef
Feeding & Nutrition
Issued March 2011