NebGuide

Nebraska Extension

Research-Based Information That You Can Use

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Water Requirements for Beef Cattle

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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 over-looked. Diets are balanced for carbohydrate (energy), protein, vitamins, and minerals so cattle can achieve the 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 water for cattle reflects the amount needed for body growth, 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

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

Temperature in degrees F[2]						
Weight	40°	50°	60°	70°	80°	90°
Lbs.	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons
Growing Heifers, Steers, and 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
800	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						
900	6.0	6.5	7.4			
1,100	6.7	7.2	8.3			
Lactating Cows[3]						
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]2016 National Research Council Nutrient requirements of Beef Cattle, Eigth Revised Edition, 2016. 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]Cows larger than 900 pounds are included in this recommendation.

Table II. A guide to the use of water containing nitrates for Cattle (National Academy of Science, 2001)

Acceptability	*Nitrate (NO_3) ppm*[1]	*Nitrate Nitrogen (NO_3N) ppm*
Safe	0—44	0—10
Generally Safe—balanced with low Nitrate feeds.	45—132	11—20
Questionable[2]	133—220	21—40
Cattle at risk	221—660	41—100
Unsafe[3]	More than 661	More than 101

[1]1 mg/L = 1.001142 ppm, so 1 mg/L is about 1 ppm.

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

[3]Avoid use for cattle.

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?

Several 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 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. As a function of weight, 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 this elevated temperature. 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 several items that affect water quality. Producers must 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 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.

Table III. Generally considered safe concentrations of some potentially toxic nutrients and contaminants in water for Cattle[1].

Substance	*Upper limit guideline, mg/L[2]*
Aluminum	0.5
Arsenic	0.05
Boron	5.0
Cadmium	0.005
Chromium	0.1
Cobalt	1.0
Copper	1.0
Fluorine	2.0
Lead	0.015
Manganese	0.05
Mercury	0.01
Nickel	0.25
Selenium	0.05
Vanadium	0.1
Zinc	5.0

[1]NRC (2016)

[2]1 mg/L = 1.001142 ppm, so 1 mg/L is about 1 ppm.

Sulfates. Animals can become acclimated to 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. Distillers grains can be high in sulfur, and total sulfur intake is the combined amount from the forages, feeds, and water consumed.

Substances in Water. There are other substances (*Table III*) that can impact water intake by cattle. *Table III* lists some of those substances. 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 (no movement) water, warm temperatures, and nutrients (phosphorus and nitrogen) are ideal environments for the growth of blue-green algae. To control blue-green algae, control or eliminate the sources or conditions listed above. Livestock ponds can experience blue-green algae blooms. Blue-green algae can be toxic to cattle and other livestock. When in abundance, blue-green algae give the water the appearance that someone has dumped a bucket of light green or turquoise paint in the water. This phenomenon is known as a "bloom" of algae. Blue-green algae float and will concentrate on the downwind side of the pond. Another common alga 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. Algae toxin levels are highest during or directly after a bloom, often occurring in late summer when cattle have their greatest water consumption.

Toxicity from blue-green algae is difficult to predict. Algae blooms can be controlled 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. *Table IV* includes guidelines for treating blue-green algae infested water with copper sulfate. The best way to control blue-green algae is to eliminate the source of nutrients. 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.

Treatment is focused on preventing 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 have sampling instructions and sampling bottles. Take a representative sample and properly identify and label the bottle. Make sure the bottle is sealed tightly. Packaging, preparing the sample for mailing, and storing until the sample is sent to the laboratory will be included in the instructions.

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