

## **Cattle Business in Mississippi – August 2009** **“Beef Production Strategies” article**

### **Quality Water for Beef Cattle**

*Jane Parish – Extension Beef Cattle Specialist, Mississippi State University*

#### **Water Quality and Contamination Issues**

Water sources can become contaminated to the point that water intake and animal performance or health is impacted. Maintaining clean water supplies for cattle is imperative for avoiding production losses. In addition, to physical cleaning of cattle water troughs, a dilute bleach solution can be useful for disinfecting troughs. Apply bleach to cattle water sources at a rate of eight ounces of household bleach per 1,000 gallons of water. This will supply three to five ppm of chlorine to the water, which should be acceptable for cattle to drink and help control bacterial growth in the water. Alternatively, apply one part bleach to 32 parts water and let this disinfectant solution stand in the water tank for 15 minutes. Then drain the tank, and refill it with water.

Cattle are sensitive to water taste and odor and may not drink as much less palatable water. This lowered water intake could then lead to reduced feed intake and depressed weight gain. Newly arrived calves may refuse water supplies at first due to differences in palatability or water quality. Decrease in water consumption and animal weight gain from cattle drinking from a water source contaminated by feces and urine is possible. This circumstance is common with unrestricted access of cattle to ponds. In addition to cattle effects on water quality, cattle can cause physical damage (such as soil erosion) to stream banks and riparian areas.

#### ***Water Source Effects on Water Quality***

Water source can have a significant impact on the quality of water for livestock use. Possible water quality problems may include high concentrations of minerals or salt, high nitrogen, contamination with fertilizers or other chemicals, bacterial contamination, or algae growth. Steps to avoid pesticide and herbicide contamination of cattle water supplies should be undertaken. Watch for any potential disease problems where water serves as a carrier. The environmental implications of livestock use of water sources where there is potential for runoff and groundwater contamination is another concern.

Researchers have documented a nine percent higher weight gain in nursing calves where the drinking water of the cow-calf pairs came from a trough compared to cattle drinking directly from a pond. Steers in the same study with access to water troughs instead of ponds demonstrated a 16 to 19 percent increase in weight. Another study found that consumption of pond water treated by aeration or coagulation (addition of aluminum sulfate and chlorine) and pumped to a trough improved cattle weight gain by 1/3 pound per day compared to untreated water consumed directly from a pond. The aeration and coagulation treatments removed many contaminants, thus improving taste and odor and increasing intake. Simply pumping water from the pond without further treatment produced no difference in weight gains. Improved cattle weight gains associated with water treatment appeared to be related to improved water palatability

and potentially increased water and feed consumption as a result. Cattle drinking directly from the pond spent less time grazing and more time resting than those drinking from all other water treatments suggesting that feed intake fell when direct pond access was the water source.

### ***Water pH***

The pH is a measure of acidity or alkalinity. Water with a pH below 7 is acidic, and above 7 is alkaline or basic. An acceptable pH range for water consumed by cattle is from 6.5 to 8.0. Water pH influences palatability, corrosiveness, and chlorination efficiency. Water with a pH less than 5.5 may cause acidosis in cattle and lead to lowered feed intake and performance. Excessively alkaline water can cause digestive upset in cattle and increase the laxative effect of high sulfate consumption.

### ***Total Dissolved Solids (TDS) and Salinity***

Total Dissolved Solids is a measure of all constituents dissolved in water. It serves as a useful index for whether or not water is suitable for livestock to drink. Water containing high levels, 4,000 parts per million (ppm) or more, of dissolved solids such as salt can lower beef cattle feed intake and daily gains. Levels surpassing 10,000 ppm should never be used as water sources for cattle. A recommended TDS level of 3,000 ppm or less should be targeted for cattle water supplies.

Wells in the coastal region of the Southeast USA are where high TDS levels in water supplies are normally found. In addition, hurricanes and tropical storms can alter the TDS levels of inland cattle water supplies. Be diligent about testing water supplies for acceptability as drinking water for livestock in the aftermath of these storms, and carefully observe cattle for any signs resembling dehydration. Recommended water sample analysis should include tests for total coliform bacteria, pH, total dissolved solids, total soluble salt, salinity, nitrates, sulfate, and other factors as appropriate such as toxicity problems with specific minerals, pesticides, or blue-green algae growth. Sample bottles and sampling instructions should be obtained from a certified laboratory.

Under specific conditions, water may contain levels of minerals that are potentially toxic to livestock. Elements toxic to cattle more commonly found in water supplies are lead, cadmium, and mercury. High iron and sulfate levels in water can contribute to copper and zinc deficiencies in cattle. Sulfur, iron, and manganese can decrease cattle intake of water by causing foul flavors and odors. Salt is a common TDS component in cattle water sources and can contribute to the total dietary salt intake. High salt content of drinking water (as indicated in TDS levels) can lead to reduced intake of salt-limited protein and mineral supplements.

The tolerance level for beef cattle consuming salt (sodium chloride) in drinking water is between one and two percent salt. However, cattle were found to be more sensitive to salt water in the summer compared to the winter. Water with two percent salinity has been shown to be toxic to cattle. The signs of salt toxicity are similar to those of dehydration or lack of water with severe anorexia, diarrhea, and weight loss being apparent. Signs of dehydration also include skin tightening and drying of mucous membranes and eyes. The eyes of a water-deprived animal may appear sunken and dull.

### ***Nitrates***

Nitrates in drinking water are one of the most prevalent water quality problems on Southeastern USA beef cattle operations. Nitrates from manure or fertilizers can enter water supplies and create water quality problems for cattle. Water supplies from shallow wells in agricultural areas and surface water sources prone to fertilizer runoff are more likely to contain problematic nitrate levels than other water supplies. Water contamination with nitrates becomes an even more serious concern when feed or forage supplies contain high levels of nitrates and when water levels in surface ponds recede during drought and concentrate nitrate levels. Water may not contain toxic levels of nitrates, but when consumed in combination with feedstuffs containing nitrates, can contribute to nitrate poisoning of cattle.

Nitrates are converted to nitrites in the rumen of cattle and can interfere with oxygen transport in the nitrite form. Chronic cases of nitrate poisoning are most common and can result in reduced feed intake, lowered growth rates, and abortions. Nitrate-nitrogen levels in water of 100 ppm or less are generally considered safe, while levels between 100 and 300 ppm are questionable for livestock consumption. Nitrate-nitrogen levels in cattle drinking water over 300 ppm are generally considered unsafe. Use these recommendations with caution when high nitrate levels are present in feeds or forages or during periods when hot weather induces high water intakes.

### ***Sulfates***

Over periods of greater than one week, high-sulfate water results in reduced feed consumption, lowered weight gains, scours, diuresis, and suboptimal production. High levels of dietary sulfur, which can result from water containing sulfate, have been implicated in reducing net energy values, interference with mineral status, and development of polioencephalomalacia. Adverse effects of high concentrations of sulfate in water may be more extreme for younger cattle and with high environmental temperatures. Sulfate concentrations of 500 mg per liter may negatively affect calves.

Water sulfate sources include sodium, magnesium, calcium, and iron sulfate, all of which act as laxatives. While sodium sulfate is the strongest laxative, cattle may become resistant to laxative effects after a few weeks. Hydrogen sulfide is the most toxic form of sulfate, and hydrogen sulfide amounts as low as 0.1 ppm may reduce water intake. Water intake starts to fall at sulfate concentrations of 2,500 to 3,000 mg of sulfate per liter and continues to drop as sulfate concentrations increase beyond these levels. Cattle reduce their consumption of water containing high (4,000 mg of sulfate per liter) concentrations of magnesium sulfate even after given time to adjust to the high magnesium sulfate levels. Iron sulfate may reduce water intake more than other sulfate forms. Maximum tolerable concentrations of sulfur for cattle are 0.4 percent on a dry matter basis.

### ***Microorganisms***

Bacteria, viruses, and parasites are regularly found in ponds and other surface water supplies that collect runoff from a manure source or that allow direct cattle access. While most microorganisms in cattle water supplies are quite harmless, there are some organisms that can contribute to reduced cattle health and performance. A

contaminated water source can spread a pathogen (disease-causing agent) quickly throughout the herd. Leptospirosis is a disease affecting cattle that can be spread through water supplies.

Coliforms are bacteria that normally inhabit the digestive tracts of humans, cattle, and other animals. Ponds where cattle have free access can reach coliform concentrations exceeding 15,000 counts per milliliters (mL). Maximum levels of coliforms should not exceed from 1 to 500 counts per 10 mL of water, with the lower end of this range for calves and the higher end of this range for mature cattle.

### ***Blue-green Algae***

Blue-green algae are bacteria that, under certain conditions, can produce toxins such as nerve toxins and liver toxins that can kill cattle quickly. Muscle tremors, difficult breathing, and collapse are signs of nervous system toxins, while weakness, pale mucous membranes, and bloody diarrhea are signs of liver toxins. Cattle surviving blue-green algae poisoning may become chronic poor-doers and can develop photosensitization (increased risk of sunburn). Contact a veterinarian for treatment options if blue-green algae poisoning is suspected.

Nutrient enrichment of surface water may lead to blue-green algae (cyanobacteria) growth, which can be a water quality problem. Cattle can contribute to nutrient loads in water supplies when allowed unrestricted access to them. Additionally, warm water is ideal for blue-green algae growth, so summer is the season when these algae are most likely to appear in cattle water supplies. Toxicity problems most often occur when cattle consume large amounts of the algae in the summer or early fall following a rapid bloom of algae. Wind can concentrate blue-green algae along the downwind banks of ponds.

Blue-green algae cannot be picked by hand from the water like green algae. Toxins produced by blue-green algae appear as an oily substance on the water surface. Eliminating sources of nutrients entering the water, aerating the water, pumping water to a trough, or eliminating cattle access to the contaminated water and providing an alternate water source are methods to combat blue-green algae problems. When surface water contaminated with blue-green algae is pumped with the intake pipe at least three feet below the surface, intake of blue green algae toxins is minimal. Keeping water troughs clean from debris and away from sunlight can also help control algae growth.

Copper sulfate (blue stone) is an algacide that can be added to water sources contaminated with blue-green algae in situations where algae growth is dramatic or toxicity problems are occurring. A recommended maximum concentration is one part per million of copper sulfate in the water. Treatment should be applied evenly across the body of water, and usually lasts for two to three weeks. It is important to consult an aquaculture specialist prior to treatment if the body of water to be treated contains fish. Cattle should be held off of treated water supplies for at least five days after last algae bloom. Sheep are very sensitive to high copper levels. The maximum tolerable level of copper sulfate in water is 2.7 and 6.8 pounds of copper sulfate per acre foot of water for sheep and cattle, respectively.

## **Water Quality Summary**

Water is the most important nutrient for cattle. Providing adequate and high quality water supplies to cattle at all times is a must for beef cattle operations. If poor cattle performance or health arises, evaluation of drinking water quality should be considered. Testing water for anti-quality factors can help diagnose suspected problems. For more information on water or beef cattle nutrition or for water sampling instructions and submission information, contact an office of the Mississippi State University Extension Service.