AEN-176

Cooperative Extension Service

Providing and Improving Drinking Water for Livestock

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Water is a fundamental requirement for livestock. Depending on the species, livestock will consume two to six times more water than forages or feed. Nevertheless, drinking water quality for livestock is commonly overlooked, which can result in huge implications to animal health, well-being, and optimal productivity. To that end, providing adequate water sources for livestock is crucial.

Assessing and Improving Water Quality

Ideally, water quality for livestock should include the following drinking water attributes:

- free from disease-producing organisms,
- colorless and clear,
- palatable,
- free from odors, and
- ranging in temperature between 40°F and 65°F.

If an available water source is inadequate, the quality of drinking water for livestock often can be enhanced in several ways.

Clean and Fresh Sources

The availability of water sources that could be used to meet the drinking water requirement for livestock can vary from field to field across the same farm. Source water may be obtained from municipal services, rainwater, wells, springs, ponds, or streams. However, all water is not the same. Quality can vary based on the potential pollutants in the water.

Municipal water should be the cleanest water source in theory, but it still may have objectionable contaminants. For example, chlorinated water has a taste that requires an acclimation period for animals and may prevent livestock from drinking their full requirement. In rural areas, municipal water sources may not be available. When they are, the recurring usage fees may burden the producer economically.

Rainwater is one of the purest forms of water. However, this purity is not absolute, because the water can become contaminated with various pollutants from the air or the surfaces it lands on. Impurities that may contaminate rainwater will vary based on location. The most common impurity is pollen. However, the level of contamination is negligible compared to volume of water that can be harvested. A first-flush diverter is sometimes used to discard the dust and larger particles and prevent them from collecting in the source. See the publication Rainwater Harvesting for Livestock Production Systems (AEN-135) for more information.

Groundwater from wells and springs can be another reliable water source. Cleanliness of groundwater is attributed to the filtration that occurs as precipitation moves through the soil profile. To prevent groundwater contamination, producers must manage potential sources of surface water pollution (e.g., erosion, manure, fertilizers, and septic systems). Contaminated surface waters can interact with groundwater and potentially contaminate the water found in nearby wells and springs. Deeper wells may also be polluted with inorganic salts or by the presence of soluble chlorides, nitrates, sulphates, and other substances. See the publication Alternative Water Source: Developing Springs for Livestock (AEN-98) for more information.

Surface water flows across the surface of the landscape and is conveyed in streams, creeks, and drainages, and it may be detained in ponds, lakes, and impoundments. Surface water will encounter a variety of contaminants deposited on the landscape. Surface waters are a common water supply source for livestock. Nevertheless, surface water sources are commonly polluted by fecal contamination, especially when livestock have access to them, and they are often instrumental in the propagation of microbial and parasitic diseases. Therefore, surface water sources should not be considered to meet livestock drinking water requirements, or at the very least, they should be regarded with caution. However, surface impoundments can be used with best management practices, such as fencing off the source to exclude animals and distributing the stored water to waterers using gravity or pumping. Additionally, the water may need to be filtered to remove pollutants.

Regardless of the source, water used for livestock consumption should be regularly inspected and tested for quality to identify any potential issues. Moreover, the waterer should be cleaned and inspected, both before animals arrive and on a weekly basis while they remain.

Water Examination

A livestock producer's goal should be to acquire the best water obtainable for livestock. However, once acquired, the quality of the water may change due to contamination, seasonal influence, or other factors. The placement of a winter-feeding area above a watershed of a pond or lake, for example, could negatively affect the water quality. Runoff from municipal areas, flooding, and failing septic systems are other possible causes of degraded water quality. Livestock producers can alter and improve water sources. Producers interested in determining the adequacy of a water source should follow multiple steps to test it.

Figure 1. An open trough allows a producer to easily inspect the visual condition of livestock drinking water.

Step 1: Inspection

A visual inspection of a water source is a cursory evaluation that may reveal questionable physical properties, such as turbidity, clarity, odor, taste, and color (Figure 1). However, this is a cursory examination. (Note: Turbidity describes the amount of suspended matter in a column of water, which may be described as opaque, cloudy, or thick. Clarity refers to the degree of transparency or clearness of a liquid. It describes how easily light can pass through the liquid and how well objects can be seen through it.) Many chemicals and microorganisms that will affect the health and well-being of livestock cannot be seen, tasted, or smelled. In addition, humans do not have the same abilities of taste and smell as livestock. This is attributed to the livestock's long muzzle and greater number of olfactory receptors.

A visual observation of water may reveal a green color associated with a host of microorganisms of plant and animal origin. Aside from their ability to contribute to an objectionable taste and odor, they may not be harmful. Conversely, harmful pathogens may exist in the form of eggs and larvae of parasitic worms (e.g., helminths).

Harmful algae blooms (HABs), which can be caused by cyanobacteria (also known as blue-green algae), are of particular concern. Algae blooms normally occur in late summer, because of increased evaporation and warmer temperatures, and they take place in standing water that also has high concentrations of nitrogen, phosphorus, and other nutrients from animal waste. Runoff containing fertilizers or human sewage inflows can also result in harmful algae blooms. Further, disease-carrying mosquitos may thrive in stagnant pools.

Step 2: Chemical Analysis

A water test to analyze the quality and composition of the water is necessary to determine constituents that cannot be seen. This helps identify any contaminants or excessive minerals present in the water. Water sampling for livestock should include analyses of total dissolved solids (TDS), sulfates, nitrates, and nitrites. Other physical properties such as oxygen content, temperature, pH, and total suspended solids (TSS) are also useful.

Both TDS and TSS are indicators of water quality. TDS analysis measures the dissolved compounds in water, whereas TSS analysis only measures particles. Refer to Drinking Water Quality Guidelines for Cattle (ID-170) for more information.

Step 3: Bacteriologic Analysis

Water sources may be contaminated with microorganisms such as protozoa, bacteria, and viruses. A count of the total fecal coliform colonies will determine the extent of manure and feces contamination. A qualified laboratory can determine concentrations of fecal bacteria.

Water Treatment

Typically, a water source is not altered once it is obtained for a pasture, lot, or confinement area. However, depending on inspection and water test results, the water source may be deemed unacceptable. In such cases, an alternative water source may be needed, or an appropriate water treatment method may be implemented to improve water quality. Common treatments to improve water quality include aeration, filtration, chlorination, ultraviolet (UV) sterilization, and chemical treatments such as water conditioners or water softeners. These treatments help remove or neutralize contaminants, pathogens, and excess minerals.

Some sources recommend adding chlorine, in the form of sodium hypochlorite, at a rate of one tablespoon per gallon of water. Although this level of chlorine would fall within an acceptable range for drinking water, with a target of two parts per million (ppm), the amount of chlorine needed to achieve this target concentration is a function of the level of contamination, sunlight exposure, surface area exposed to air, and other factors. Livestock producers might assume they can improve drinking water quality by adding chlorine (liquid or pool tablets) to livestock drinking water. The practice of adding chlorine should be strongly discouraged because too much chlorine could be added, making it harmful to livestock. In addition, adding chlorine to an algae-infested trough will cause their cells to explode, releasing malodorous compounds, which will further lower the drinking water quality. Chlorine can be used to clean and disinfect water troughs, but the trough should be thoroughly rinsed to remove any residue.

Improving Water Distribution and Access

There are additional ways to enhance livestock water by improving drinking water distribution.

Adequate Supply

On most farms, water is supplied free choice—available all the time. If access to water is limited, production declines. Conversely, livestock with uninterrupted access to fresh water drink more than livestock that have access only at certain times of the day. Along with increased water consumption, livestock with unlimited access to water consume more dry matter and produce more milk. Therefore, producers should provide a sufficient water supply for livestock, especially during hot weather or periods of high activity.

Water consumption increases rapidly when the ambient temperature rises above 83 degrees Fahrenheit. Therefore, the supply of water should be sufficient to meet the combined consumption rate of all the animals drinking during these times. Otherwise, herd performance problems may arise due to insufficient water consumption.

A storage tank can provide adequate water supply while the animals are drinking and can be refilled after the animals leave. The simplest and most effective approach to satisfying livestock water needs is to provide easy, non-competitive, free-choice access to clean, fresh water all the time.

Adequate Space

Livestock grazing on pasture may drink two to five times per day if they have easy access to water. Ideally, livestock should not have to travel long distances to obtain water; general guidelines recommend no more than 600 to 800 feet. If livestock must travel long distances to water, they drink less often and consume less dry matter.

Producers can space water troughs appropriately to improve distances traveled by cattle. In addition, when the livestock arrive at the waterer, there should be plenty of access points and space to prevent overcrowding, competition, and displacement among animals. For example, cattle require a width of approximately two linear feet at the perimeter of the water source to access the water (Figure 2). Gregarious animals like to eat and drink simultaneously. Therefore, a minimum of 10 to 20 percent of the herd should be able to drink at the same time. For example, a producer with a cattle herd size of 20 should provide, *at a minimum*, four feet of perimeter at a water trough to allow two animals, or 10 percent of the herd, to drink simultaneously.

Figure 2. A tire waterer is an example of a trough that allows multiple animals to drink simultaneously. A trough of this size is ideal for splitting between two pastures or for making a watering hub for multiple pastures.

Temperature Control

Hot Climates

During summer months, consider shading the water or installing other practices to cool drinking water while reducing algae growth. Cooling water also reduces fecal coliform colonies, as they do not thrive or create new colony formations in cool water.

Shade balls and covers are examples of management practices for reducing the heat load on water sources (Figure 3). Shade structures placed over a water trough can also reduce heat load and algae formations (Figure 4).

Figure 3. Shade can be used to keep the water cooler and reduce algae blooms, and it may increase water consumption. In this image, shade balls have been installed to reduce temperature, algae production, and evaporation.

Figure 4. A shade structure has been placed over this water trough to reduce sunlight and algae production.

Figure 5. The probability of freezing in winter can be lowered by reducing the surface area of troughs. This cover can also be positioned on a trough to change air flows and lower the probability of the water freezing.

Figure 6. Calves in this lot are transitioning from their mother's teat to drinking water. Due to the height of the waterer, the calves cannot reach the water easily.

Cold Climates

In winter, take measures to prevent water sources from freezing. This can be accomplished by implementing insulating techniques to reduce heat loss. Insulating the sides of the trough and reducing the surface area of the trough with covers are effective practices (Figure 5). Heating elements or heating devices are practices that will actively warm water when a power source is available.

Management practices like lowering the water level in the trough, which allows winds to pass over the trough and not the water surface, can also be effective, reducing evaporation and cooling and thereby reducing freezing potential. Windbreaks placed upwind of water fountains will reduce wind speed and the cooling effects of wind and evaporation.

Water troughs created using construction tires require temperatures in the lower 20s (Fahrenheit) for several days to create surface ice formations. The lack of ice is attributed to the insulative properties of rubber, which can be 10 times more insulative than concrete.

The large volume of water held in a tire trough also reduces freezing potential. Increasing the volume of stored water reduces the potential for freezing because water has a high specific heat, which means a lot of energy is required to change its temperature. The high specific heat of water is demonstrated by the negligible change in water temperature over a day, even though the air temperature may change 40 degrees (Fahrenheit) from the early morning to the heat of the afternoon.

Combining multiple passive practices creates an additive effect, thereby reducing the amount of heat loss.

Water Accessibility

Ensure easy access to water for all livestock. Consider the height, width, and depth of water troughs relative to the group to be watered (Figure 6). For example, drinking-water trough standards for mature cows include the following:

- Two linear feet of space at the trough
- A *minimum* of 100 square inches of trough area
- Optimum height of 36 inches for cows (from 20 to 24 inches for calves, if also present)
- Capability to water 10 percent of the herd at a time

Design and implement accommodations to meet the needs of different animal sizes and breeds. Also, inspect the area surrounding a watering site. Excessive mud, manure, and algae in a water trough will negatively affect taste and thereby water consumption and livestock production. Correcting these issues will increase livestock production and health. Fencing or barriers should be installed to prevent animals from contaminating their water supply with dirty hooves, soil, manure, or urine.

Regular Cleaning

Water troughs, tanks, and water lines accumulate debris, algae, or mineral deposits that may affect water quality. Foul-smelling water is not consumed as readily as clean water. Animals that drink fouled water eat less and spend more time resting than animals that drink clean water. Cleaning troughs before animals are moved to a new area and inspecting the troughs daily are good management practices. Doing this may provide the greatest benefit to herd production and health.

Troughs should be scoured and cleaned weekly when animals are present. A drainage system should be installed to prevent dumped water from weakening and eroding the traffic pad around a watering site. Drainage water should be plumbed at least 20 feet away from the site to reduce the creation of mud.

Monitoring the Behavior of Livestock

Observe livestock behavior regularly while they are drinking to ensure they are drinking enough water and animals are not being displaced. Unusual water consumption patterns or changes in animal behavior may indicate water quality or quantity issues, which may negatively affect livestock production. Animals with access to clean water will spend more time grazing and less time resting than animals on an inadequate water supply.

Summary

Quality of drinking water can have huge implications for animal health, well-being, and optimal productivity. Therefore, providing adequate water sources for livestock is crucial to enhance livestock production and reduce labor requirements. One of the most important pieces of infrastructure for a livestock operation is the water supply. Adequate water quality is essential for the health and productivity of livestock. Water supply infrastructure should be evaluated every day for cleanliness and abundance, and troughs should be cleaned at least every seven days.

The ability to provide abundant, clean water across all seasons and situations is critical. In addition, producers need a distribution system to provide water to the size, breed, and species that they raise. This is to ensure that all animals, regardless of their size, have access to water.

Failure to evaluate the functionality and water quality of a watering system may result in a system that does not adequately provide water to livestock, leading to physiological, production, or health issues. Livestock producers can implement water improvement practices outlined in this guidance document to ensure livestock have access to clean, fresh, and abundant drinking water.

References

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