ALABAMA COOPERATIVE Extension SYSTEM

ALABAMA A&M AND AUBURN UNIVERSITIES

ANR-790-2.6

Drinking Water For Livestock And Poultry

A safe water supply is essential for healthy livestock and poultry. Contaminated water can affect growth, reproduction, and productivity of animals as well as safety of animal products for human consumption. Contaminated water supplies for livestock and poultry can also contaminate human drinking water. For these reasons, farm water supplies should be protected against contamination from bacteria, nitrates, sulfates, and pesticides.

The Environmental Protection Agency has set drinking water standards for human consumption, but no set of standards exists for drinking water for livestock or poultry. The National Academy of Science, however, has recommended maximum levels for some contaminants.

Coliform Bacteria

Coliform bacteria are organisms found in the gastrointestinal tract of livestock, humans, and birds. While these bacteria may not be harmful, their presence often indicates that other disease-causing bacteria may also be present.

Sources. The main source of coliform bacteria is animal waste. Where large numbers of animals are concentrated near shallow or poorly protected wells, bacterial contamination can occur during heavy rainfall. In some cases, old wells have been carelessly used for sewage or waste disposal allowing contaminants to enter directly into the groundwater. Also, bacteria and other organisms can develop rapidly in the waterers used for turkeys and chickens raised under both floor and range production systems.

Limits. There are no legal limits for bacteria in water used for livestock production except where the farm is a dairy operation. In this case, the water must be from a supply which has been microbiologically tested safe by an approved water testing laboratory before milk can be sold from that farm.

Treatments. If water test results indicate the presence of coliform organisms, the water supply system should be checked to determine possible sources of entry. The most common sources for entry of coliform organisms into a water supply are near the immediate area of the well or into the water storage container.

It is not a sound practice to use chlorine to control a continuing supply of pathogens in a contaminated well. Any failure of the chlorination equipment will immediately expose the livestock and poultry to the pathogens. If the source of contamination in a well cannot be eliminated, the only recourse may be to drill a new well.

Troughs should be sited and elevated so that contamination from fecal material is virtually impossible. The nipple-type waterer helps to eliminate a source of water contamination between animals.

Proper cleaning of poultry waterers on a daily basis is an important part of flock management. A recommended procedure is to scrub water pans or troughs thoroughly with a brush, empty, and then rinse with a disinfectant. Poor practice in cleaning waterers can result in subjecting birds to water containing millions of bacteria per milliliter.

Blue-Green Algae

Toxic blue-green algae can contaminate surface drinking water supplies. In livestock, blue-green algae poisoning causes muscle tremors, diarrhea, lack of coordination, collapse, labored breathing, liver damage, and death. Effects can occur within a few minutes to a day, and animals that recover often shed large sections of the unpigmented (white) areas of their hides.

Sources. Algae grow and multiply because of favorable nutrient and temperature conditions. Water with a high level of algal nutrients will experience algal blooms with lower water temperatures than less nutritious water.

Treatments. Algae can be controlled with copper sulfate in concentrations of about 1.0 ppm. This is equivalent to 3 pounds of copper sulfate per acre-foot of water. To keep algae under control during the summer, several applications may be needed. Livestock should not drink directly from the treated water.

If your animal water supply is also a food fish pond, special care should be taken in using copper sulfate. The rate to kill algae is only slightly less than the rate to kill fish. However, the rate for fish disease control is similar to that for excessive algae control. Contact an aquacultural specialist for exact rates in reference to pond alkalinity.

Algal blooms can also occur in stock tanks if nutrients and temperature conditions are favorable. Periodically cleaning the stock tank to remove the nutrient source is the best way of preventing algal blooms there.

Animals must be denied access to the algae-contaminated water and provided with a supply of suitable water.

Nitrates

Nitrates by themselves are not very toxic. However, in the rumen of cows or sheep, microorganisms change nitrates to nitrites, which are quite toxic. Nitrites are further acted upon by microorganisms and converted into protein. In cows or sheep that consume large amounts of nitrates in short periods of time, however, nitrites accumulate faster than they can be built into protein. These excess nitrites are absorbed into the bloodstream. There the nitrites react with the hemoglobin (the red oxygen-carrying pigment of the blood) to form methemoglobin, which prevents the blood from carrying oxygen. If a large portion of the hemoglobin has been converted to methemoglobin, the animal shows symptoms of asphyxiation including labored breathing, a blue muzzle, a bluish tint to the whites of the eyes, trembling, a lack of coordination, inability to stand, and often death.

In the simple-stomached animals such as swine and poultry, there is no fermentation vat similar to the rumen to aid in the digestion of roughage and to change nitrate to nitrite. Most of the nitrates or nitrites pass unchanged from the intestines into the blood and then are eliminated by the kidneys.

Horses are also simple-stomached, but they have a large cecum (appendix) and this acts much like the rumen in digesting roughage. Since nitrite formation can take place in the cecum, horses are susceptible to nitrate poisoning.

Sources. Some sources of nitrates in groundwaters include nitrogen fertilizers, animal manure or wastes, crop residues, human wastes, and industrial wastes. Since nitrates are soluble and move with percolating water, groundwater pumped from a well may contain nitrates even if their source is a considerable distance from the well.

Water from shallow wells normally contains more nitrates than water from deeper wells because the shallow groundwater table is easily polluted with leached nitrates. While deep wells are usually nitrate free in Alabama, an improperly located or improperly constructed deep well can be polluted with surface water or groundwater.

Limits. The National Academy of Science has found that livestock and poultry studied under controlled experimental conditions can tolerate the continued ingestion of waters containing up to 300 ppm of nitrates or 100 ppm of nitrites. However, they recommend that "in order to provide a reasonable margin of safety to allow for unusual situations . . . nitrates should be limited to 100 ppm or less and nitrite content also be limited to 10 ppm or less."

Treatments. Water unsuitable for farm animals because of its high nitrate content should be replaced by an uncontaminated source. A deeper well may provide water which is low in nitrates. Well drilling techniques have been improved considerably since many of the older and shallower wells were constructed.

Small ponds can be used for a farm water supply where a controlled watershed is available. If protective measures are taken and the watershed is controlled, a farm pond can deliver low nitrate water for livestock.

Nitrates can be removed or reduced in concentration by some ion exchange resins, reverse osmosis, or distillation. The cost of these practices may make them impractical for treating the volume of water required for livestock.

Nitrates are not removed by filters, water softeners, or additive softening compounds, and they are not destroyed by chlorination, standing, or boiling.

Total Dissolved Solids And Sulfates

The term Total Dissolved Solids (TDS) includes all the minerals which have been dissolved as recharge water percolates downward through soil and rock formations. Sulfates are among the common dissolved solids found in Alabama water but not usually in an excessive amount.

Excessive concentrations of sulfates cause a laxative effect in animals, which is more pronounced in young than in mature animals. In young animals, sulfate concentrations in excess of 350 to 600 ppm may be associated with severe chronic diarrhea and electrolyte imbalance.

Sources. Sulfates appear in water when they are dissolved as water moves down through soil and rock formations. Human activities have little effect on the concentration of sulfates or other dissolved minerals in groundwater supplies.

Limits. Most domestic animals can tolerate a total dissolved solid concentration in the range of 15,000 to 17,000 ppm. However, these concentrations will

likely affect production. The National Academy of Science recommends a limit of 3,000 ppm.

Treatments. Animals tend to become acclimated to the sulfates in water. If newly purchased animals are affected, consider diluting the high sulfate water with water containing no sulfate. A dilution of 3 or 4 to 1 may be necessary. Gradually increase the amount of high sulfate water in the mixture. This same procedure may be effective with young pigs at weaning time.

If the animals do not become acclimated to the high sulfate water, the sulfates will need to be removed from all water used by the livestock. Techniques such as distillation, reverse osmosis, and demineralization are all available but require relatively high levels of management and may not be economically feasible for the livestock producer.

Pesticides

There have been no reported cases of domestic livestock deaths resulting from pesticides contained in livestock drinking water. Many pesticides are readily broken down and eliminated by livestock with no obvious ill effects, but there is a possibility that some could be excreted in milk or accumulate in meat. Fish are more sensitive to pesticides than are livestock or poultry.

Sources. Pesticides can enter a surface water or groundwater supply from runoff, drift, rainfall, direct application, accidental spills, faulty storage facilities, and faulty waste disposal techniques. Of the pesticides currently in use, the organophosphates are the most dangerous for livestock.

Limits. The National Academy of Science recommends that "the maximum levels for public water supplies for individual pesticides should also apply to farm animal water supplies."

Treatments. It is difficult and expensive to test for unknown pesticides or suspected chemicals in water. If the chemical can be identified, a test can be conducted to determine if that chemical is present in the water supply.

The best solution is to prevent the problem from occurring. Locate the well on high ground where surface runoff will not reach it. Be sure that there is adequate drainage around any water supply well.

If a surface water supply such as an excavated pond or impoundment is used, the design should include waterways which prevent uncontrolled surface runoff from entering the water supply.

Saline Water

The damage of high saline water depends more on the total amount of minerals present rather than on any specific one. The ions most commonly involved in high saline waters are calcium, magnesium, sodium, bicarbonate, chloride, and sulfate. Usually chlorides are less harmful than sulfates. Magnesium chloride appears to be more injurious than calcium or sodium salts.

Sources. High saline waters can be located near the coast or other areas where there is saline intrusion in the water.

Limits. Table 1 gives the National Resources Council recommendations on saline waters for horses and other animals.

Table 1. Saline Water For Livestock.

Total Soluble Salts Content Of Waters	Comments
Less than 1,000	These waters have a relatively low level of salinity and should present no serious burden to any class of livestock.
1,000 to 2,999	These waters should be satisfactory for all classes of livestock; they may cause temporary and mild diarrhea in livestock not accustomed to them, but they should not affect their health or performance.
3,000 to 4,999	These waters should be satisfactory for livestock; they may cause temporary diarrhea or be refused at first by livestock not accustomed to them.
5,000 to 6,999	These waters can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses; water approaching the upper levels of these limits should be avoided for pregnant or lactating animals.
7,000 to 10,000	These waters are probably unfit for swine; considerable risk may exist in using them for pregnant or lactating cows, horses, sheep, the young of these species, or for any animal subjected to heavy heat stress or water loss. In general, their use should be avoided, although older ruminants, horses, and even swine may subsist on them for long periods of time under conditions of low stress.
More than 10,000	The risks with these highly saline waters are so great that they cannot be recommended for use under any conditions.

Source: Cunha 1989.

Treatment. Where possible it is best to use water with a low saline content. Alternate sources may be the best treatment. Table 1 can serve as a guide on saline water use for horses and other livestock. Animals prefer water which is low in dissolved salts, but they will adapt to saline water after a short period of time.

Iron

There is no evidence to show that iron will cause any problems with livestock or poultry.

According to Report Number 26 of the Council for Agricultural Science and Technology, "Under usual conditions, water supplies only a small percentage of the iron available to animals. Because iron from natural sources is absorbed with efficiency less that 10 percent, the iron in water should not pose a hazard to animals. Under these circumstances, a 'no limit' recommendation is reasonable. High doses of the more available forms of iron, however, are toxic."

Water Testing

When water is suspected of causing health problems in livestock, an accurate diagnosis is crucial. A laboratory exam of both the animals and the water supply may be necessary to adequately diagnose the problem. A veterinarian may need to determine the actual disease. Since water is often blamed for problems caused by production or disease, temporarily changing to a known safe water supply is a useful test to determine if the water supply is causing the health problems.

Tests should be made by laboratories that have been certified by the Alabama Department of Public Health or the Alabama Department of Environmental Management.

Contact your community or county health service, county Extension agent, or veterinarian for information about where water samples can be examined and what tests may be required.

Obtaining A New Water Source

If testing shows that an existing water supply is contaminated, a new well may have to be drilled. The well should be drilled by a professional water well contractor, preferably one licensed by the Alabama Department of Environmental Management.

Water Quality Guidelines For Beef And Dairy Cattle

Water is the nutrient required in the largest quantity for beef and dairy cattle. A beef cow can drink up to 5 percent of its body weight in water per day; a high-producing dairy cow, up to 20 percent. A lack of water will have a rapid and dramatic effect on animal health and productivity.

The guidelines given in Table 2 are based on limited research and field observations and are not standards. They are presented as an aid in evaluating water quality tests and troubleshooting water intake problems on farms.

Water quality recommendations in this article pertain only to livestock and poultry, not to human drinking water.

Table 2. Water Quality Guidlines For Cattle.

Water Quality Element	Acceptable Level
Bacteria (coliform)	50 to 100/ml
Bacteria (total)	1,000/ml
Hardness	Generally no problem
Metals:[a]	
Arsenic	0.20 mg/L[b]
Cadmium	0.05 mg/L
Chromium	1.00 mg/L
Cobalt	1.00 mg/L
Copper	0.50 mg/L
Lead	0.10 mg/L
Mercury	0.01 mg/L
Nickel	1.00 mg/L
Vanadium	0.10 mg/L
Zinc	25.00 mg/L
Non-metals:	
Fluoride	2.00 mg/L
Nitrate nitrogen	100.00 mg/L
Nitrite nitrogen	10.00 mg/L
pH	6.0 to 8.0
Sulphate	500.00 mg/L
Total dissolved solids	3,000 mg/L

[a]The National Resources Council has published a list of the recommended upper limits for these potentially toxic substances in the drinking water of livestock and poultry.
[b]Mg/L = milligrams per liter = parts per million.

Sources: Bergsrud and Linn 1990, and National Resources Council 1989.

References

Bergsrud, Fred, and James Linn. 1990. Water Quality For Livestock And Poultry. AG-FO-1864-D. Minnesota Cooperative Extension Service. University of Minnesota. St. Paul, MN.

Cunha, Tony J. 1989. Animal Feeding Nutrition: A Series Of Monographs. Academic Press, Inc. New York, NY.

National Resources Council. 1989. Nutrient Requirements For Horses. 5th ed. National Academic Press. Washington, DC.

Quality Of Water For Livestock. 1974. Report No. 26. Council for Agricultural Science and Technology. Ames, IA.

Additional Sources Of Information

The following faculty* at Auburn University may be contacted through your county Extension office for additional information:

VETERINARY MEDICINE:
Dr. James Floyd, **jfloyd,** 844-1501

DAIRY CATTLE:
Dr. B. R. (Pete) Moss, **bmoss,** 844-1513

BEEF CATTLE:
Dr. B. G. Ruffin, **bruffin,** 844-1559

POULTRY:
Dr. Joseph Hess, **jhess,** 844-2611

SWINE:
Dr. Norwood J. VanDyke, **jvandyke,** 844-1564
Dr. Frank Owsley, **wowsley,** 844-1505
Auburn Swine Unit 844-1574

HORSES:
Dr. Cynthia McCall, **cmccall,** 844-1556

*Bold letters are ACENET user I.D.s.

ALABAMA COOPERATIVE Extension SYSTEM

ANR-790-2.6

This publication, supported in part by a grant from the Alabama Department of Environmental Management and the Tennessee Valley Authority, was prepared by James E. Hairston, *Extension Water Quality Scientist,* assisted by Leigh Stribling, *Technical Writer.*

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

UPS, **New June 1995,** Water Quality 2.6