VIGORTONE®

A Leader In
Animal Nutrition Since 1912

WATER QUALITY FOR LIVESTOCK AND POULTRY

Water is the most essential of all nutrients in the animal's diet. Approximately 60 to 85 percent of the daily nutrition (water and feed) of farm livestock is represented by water. The fat-free adult body's water content is relatively constant for many species averaging 71 to 73 percent of body weight.

Water quality depends on proper construction, protection, and maintenance of the entire water system, including the source.

Water quality directly affects water consumption. The first effect of water restriction, whether voluntary or involuntary, is reduced feed consumption with resulting lowered animal productivity.

Palatability And Toxic Substances

Low quality water may cause problems in two ways: poor palatability may reduce consumption or toxic substances may be present. Some toxic substances do not reduce palatability; thus, they are potentially more harmful than those that do. Substances that may prove toxic in drinking water include pesticides, fluorine, molybdenum, nitrates, selenium, and high concentrations of other specific trace elements.

In addition to toxic substances, water may contain other compounds that render it unpalatable. An example is alkali water containing high concentrations of K, Na, and Ca carbonates. Water high in saline is less palatable than nonmineral water. Saline salts are Na, Ca, Mg, and K in the bicarbonate, chloride, or sulfate form.

Water may also be contaminated with disease-producing organisms such as bacteria, viruses, protozoa, or worm eggs.

Water Temperature

There is little evidence to show that livestock production is affected by water temperature in the range from above freezing to summer ambient temperatures. Water in open storage tanks may be subject to more bacterial growth as the temperature increases. Poultry tend to consume less warm water, which may be detrimental to egg production in hot weather.

Water Consumption

Animal	Live Weight Lbs	Water Consumption Gallons/Day
Cattle	350	1-5
	750	10-15
	1000	20
Sheep	20	¼
	40-60	⅓
	100-200	½
Swine	20-40	¼-½
	100	¾-1
	200	1¼-1¾
Dairy Cow		15-25
Chickens (mature)	100 birds	3-5½
Turkeys (mature)	100 birds	17

A partial listing of some of the more common water contaminants:

1. **Total Dissolved Solids (Hardness)**
   This term includes all the minerals that have been dissolved as the water percolates downward through the soil and rock formations.

   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. Salts in amounts of 5,000 ppm affect palatability for animals and, if consumed, will produce weight loss and diarrhea.

   Sulfates, which are usually magnesium sulfate (Epsom salt), sodium sulfate (Glaubers salt), or calcium sulfate, cause a

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laxative effect in animals. Laxative effects are more pronounced in young than mature animals. The U.S. Public Health Services recommends that water containing more than 250 ppm of chlorides or sulfates and 500 ppm of dissolved solids not be used for human consumption. Sulfates over 500 ppm in water can cause scours in young animals.

Iron in concentrations as low as 0.3 ppm in water will cause brown staining. It is not unusual to find up to 30 ppm of iron in rural wells. There is no evidence to show that iron in the drinking water will cause any problems with livestock or poultry. One exception may be in the production of ''white veal.''

Manganese often accompanies iron and acts similarly by leaving a black stain.

2. **Nitrates**
Nitrates are widely dispersed in the environment and are particularly beneficial to plants. Health hazards can develop when significant amounts of nitrates (NO_3) enter drinking water.

The three sources of nitrates and nitrites in drinking water are: 1) the percolating action of water passing through the soil; 2) surface water or septic tank contamination of the well; 3) bacterial breakdown of nitrates to nitrites in waterers.

Nitrates (NO_3) are reduced to a much more toxic product, nitrites (NO_2), by bacteria in the rumen, intestinal tract, and livestock waterers. Nitrites are readily absorbed and reduce the oxygen-carrying capacity of the blood by converting hemoglobin to methemoglobin.

Nitrates and nitrites have an additive effect. When evaluating the levels to which animals are exposed, forages, bacterial action in waterers, as well as water levels, should be considered.

In ruminants, nitrate toxicity may appear as vitamin A deficiency. Supplementing the ration with vitamin A, iodine, phosphorus, and energy will help restore the nutritional balance.

Nitrate levels in farm wells fluctuate widely; usually wet spells in the spring result in the highest levels. Removal of nitrates from water is difficult and expensive, as they are dissolved in the water. Basic anion exchangers will remove nitrates.

Levels of nitrates considered unsafe in water have been arbitrarily set between 50 and 100 ppm. The apparent interference with normal nutrition, gestation, growth, and health begins at about 100 ppm of nitrates (NO_3). The U.S. Public Health Services sets 45 ppm of nitrates as the upper limit for a safe water supply for humans.

The entire nitrate problem, its effect on production and reproduction, safe limits, complications with other nitrogen sources, and desirable methods of removal or neutralization are all subjects of considerable controversy.

3. **Microorganisms**
Coliform bacteria are nearly everywhere and may be of plant, animal, or soil origin. The term fecal coliform bacteria refers to normal 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 and viruses may also be present.

Harmful microorganisms can readily enter a well having improper protection from surface water contamination. It is possible that microorganisms can contaminate a water supply at the drinking point. A test result level of 0 colony forming units (CFU) for coliform bacteria is desirable.

If coliform bacteria are cultured from a water sample, chlorination, filters, and prevention of surface water contamination help remove the bacteria.

4. **pH**
Acid water corrodes pumps, pipes, tanks, and fixtures. Acid water can be neutralized by adding soda ash or caustic soda to the water.

Alkalinity is found in most water supplies and comes from bicarbonates, carbonates, and hydroxides giving a soda taste to the water. It usually promotes the growth of bacteria, and may cause scale to accumulate in water pipes and heaters.

5. **Chlorides**
Alone, chlorides are not harmful unless in large quantities (over 200 ppm). Chlorides unite with sodium, forming brine wells, and other salts, rendering some well water useless. Levels of 50 to 100 ppm are more palatable to livestock. Human water supplies containing more than 5 ppm of chlorides are objectionable.

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6. **Phosphates**
   When phosphates are found in rural well water in large amounts, it usually indicates pollution. While phosphates themselves are harmless, their presence should alert one to the probability of bacterial contamination.

7. **Hydrogen Sulfide**
   This is the ''rotten egg'' odor of water from deep wells. As little as 1 ppm produces an objectionable smell. This weak acid attacks iron, forming a black, greasy deposit. The most economical method to remove hydrogen sulfide is oxidation by a chemical such as hypochloride, which will change the gas to elemental sulfur that is filterable.

8. **Pesticides And Herbicides**
   Pesticides and herbicides can enter ground water or surface water from run-off, drift, rainfall, or accidental spills. Should a water supply become contaminated, contact the local Environmental Protection Agency (EPA) office for instructions and guidelines.

9. **Other Toxic Elements And Substances**
   Whether from natural or human sources, water occasionally contains elements or substances in toxic amounts. Unfortunately, only limited information is available on experimentally determined toxic levels of various substances in water for livestock and poultry. Too many conditions are involved in determining whether or not certain levels of a toxicant will cause harm that no single concentration can be accepted as dangerous in all situations. Toxic substances in water may be a suspended solid, be in solution, or distributed between the two. Their availability in these phases may differ considerably during the digestion process of animals. Short-term intake of a toxic substance may have no observable effect, while long-term consumption may result in serious harm. Different species of animals may react differently to a toxic substance, and the young and healthy may not respond in the same way as mature or unthrifty animals.

   It should be pointed out that water sources, especially those from shallow wells, are subject to sudden changes in composition from natural or human causes.

   Many elements found in water rarely harm livestock because they occur at low levels in soluble form or are toxic only in excessive concentrations. Examples of these are iron, aluminum, beryllium, boron, chromium, cobalt, copper, iodine, manganese, molybdenum, and zinc. Also, these elements do not seem to accumulate in meat, milk, or eggs to the extent that they would constitute a problem in livestock drinking water except under extraordinary conditions.

   On the other hand, elements such as lead, mercury, and cadmium must be considered actual or potential problems, because they occasionally are found in water at toxic concentrations or may accumulate in meat, milk, or eggs at levels unfit for human consumption.

Water Testing

Contact your county health service, county extension agent, or veterinarian for information on available laboratories and required tests. Obtain instructions for the required quantities, containers, and handling for water testing.

U.S. Public Health Service (USPHS) Drinking Water Standards

Chemical	USPHS Limit Not to Exceed
Nitrates	45 ppm
Nitrites*	0.03 ppm
Iron	0.3 ppm
Hardness*	0-3 GPG (soft) 4 GPG — on up (hard)
Phosphate*	5 ppm (denotes sewage)
Precipitation	N/A
Sulfate	250 ppm
Hydrogen sulfide	0.1 ppm
pH	7 — neutral
Arsenic	0.01 ppm
Chlorine	N/A
Copper	1 ppm
Cyanide	0.01 ppm
Fluorine	0.1-1.2 ppm
Zinc	5 ppm
Silver	0.05 ppm
Selenium	0.01 ppm
Manganese	0.05 ppm
Lead	0.05 ppm
Salinity	5000 ppm

*Accepted by most laboratories

Note: 1 GPG (grain/gallon) = 17.1 ppm
1 ppm = 0.058 GPG