



DAIRY NEWS

DRINKING WATER GUIDELINES FOR DAIRY ANIMALS

Alejandro R. Castillo & John H. Kirk
University of California, Davis. Cooperative Extension

In our last newsletter (Jan., 2004) we include some preliminary information on the Merced County survey about the importance of the drinking water chemical composition on the total mineral requirements in lactating dairy cows. Some producers have requested additional information about minerals in water and the possible effects on livestock. According to the National Research Council (NRC, 2001) water quality for both humans and livestock can be defined on five criteria: **organoleptic properties** (odor and taste), **physiochemical properties** (pH, total dissolved solids, total dissolved oxygen, and hardness), **presence of toxic compounds** (heavy metals, toxic minerals, organophosphates and hydrocarbons), **presence of excess minerals or compounds** (nitrates, sodium, sulfate, iron, etc), and **presence of microorganism** (bacteria, viruses, protozoa or parasites). It is important to mention that research information on water contaminants and their effects on cattle performance is sparse (NRC, 2001).

Salinity, Total Dissolved Solids (TDS) and Total Soluble Salts (TSS) are measures of soluble components in water. The salt, sodium chloride is the primary consideration in this category, but other components associated with salinity are bicarbonate, sulfate, calcium, magnesium, silica, iron, nitrate, strontium, potassium, carbonate, phosphorus, boron, and fluoride. The following table (Table 1) is a guideline for Total Soluble Salts in water for dairy cattle

Table 1. Guideline for Total Soluble Salts (TSS) in water for dairy cattle (NRC, 2001)

TSS (mg/L)	Comments
< 1000	Safe and should pose no health problems
1000-2999	Generally safe but may cause a mild temporary diarrhea in animals not accustomed to the water
3000-4999	Water may be refused when first offered to animals or cause temporary diarrhea. Animal performance may be less than optimum because water intake is not maximized
5000-6999	Avoid this water for pregnant or lactating animals. May be offered with reasonable safety to animals where maximum performance is not required
> 7000	These waters should not be fed for cattle. Health problems and /or poor production will result

Nitrate and sulfate are also common components in Total Soluble Salts. Nitrate recommendations in drinking water are shown in Table 2. Most likely the water nitrate concentration recommended limits (>440 mg/L) will not result in visible disease condition. A general recommendation for sulfates is less than 500 mg/L for calves and 1000 mg/L for adult cattle. When sulfates exceed 500 mg/L, the specific salt should be identified. Hydrogen sulfide is the most toxic form and concentrations as low as 0.1 mg/L can reduce water intake. Common forms of sulfate in water are calcium, iron, magnesium, and sodium. All are laxative, but sodium sulfate is the most potent. Excessive levels of sulfates may also reduce the absorption of other minerals like copper and selenium, and creating a need for adjustments in dietary supplemental levels.

Table 2. Nitrates in water (NRC 2001)

Nitrates (NO₃) mg/L	Guidelines for ruminants
0-44	Safe for consumption
45-132	Generally safe in balance diets with low nitrate feeds
133-220	Could be harmful if consume over long periods
221-660	Cattle at risk, upper limits may affect rate of gain, fertility, and possible death
> 660	Unsafe, may cause suffocation, incoordination or staggering, and possible death, should not be used as a source of water

Minerals that have to be considered for analysis and the guidelines for assessing them in the drinking water for cattle are described in Table 3. As mentioned in our previous newsletter, these minerals have to be included in the total mineral balance in diets of all animal categories. The mineral mix supplements have to be formulated according to the deficits and/or the animal's requirements. Based on the normal composition of feeds and drinking water, tailor made minerals mixes have to be developed for each dairy farm.

Table 3. Minerals in the drinking water (Zinpro Water Analysis Program, Version 2.0, 2002)

Mineral (mg/L)	Desired levels*	Maximum upper levels**
Calcium	< 100	200
Chloride	< 100	300
Copper	< 0.2	0.5
Iron	< 0.2	0.4
Magnesium	< 50	100
Manganese	< 0.05	0.5
Phosphorus	< 0.7	0.7
Potassium	< 20	20
Selenium	< 0.05	0.1
Sodium	< 50	300
Sulfur	< 50	300
Zinc	< 5	25

* **Animals consuming water exceeding these limits may reduce performance**

** **The consumption of this water poses a potential animal health risk**

As pointed out, the effects of some water characteristics on livestock are not definitely known. However, it is felt that hardness and pH (physiochemical properties) do not affect water consumption. Water troughs are also an important source of exposure of cattle to bacteria including the human foodborne pathogens. Coliforms, salmonella, and E. coli 0157 have been isolated from livestock water. For this reason, it is important to clean and sanitize the water trough regularly.

Remember, water is the most important nutrient for dairy animals. Water should be always available to your animals in a clean, fresh abundant supply. Cows producing 100 pounds of milk per day need nearly 40 gallons of water each cow. If it is the first time that you are going to analyze the water in your farm, you should also include microorganism and possible toxic nutrients. An improperly balanced and/or overfeeding mineral is just wasting your money. It also may be affecting animal performance (health and productivity), and the quality of your soils. All the minerals in excess of dietary requirements will be excreted in feces and urine. Whether in dry manure or in lagoon water some of these minerals will be apply to the soil. It is a good idea to check the water quality for the animals at least twice a year (winter and summer) and consult your nutritionist to include the contribution of your water to the total diet mineral balance.