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Water Quality Guidelines for Cattle

Divyanshu Singh Tomar*[1], Gunjan Sharma[2], Tejeshwari Satpute[3] and Shivam Bharadwaj[4]

[1,3]PhD Scholar, Livestock Production Management Division, ICAR-NDRI, Karnal
[2]PhD Scholar, Animal Nutrition Division, ICAR-NDRI, Karnal
[4]PhD Scholar, Animal Genetics and Breeding Division, ICAR-NDRI, Karnal

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Introduction:

For animals, water is an essential nutrient. Water should be adequate to fulfil the nutritional requirements of cattle. Water accounts for around 87% of milk and 60 -70% of livestock's body composition. Water is required for maintaining bodily fluids and ion balance, as well as digesting, absorbing, and metabolising nutrients, removing waste and excess heat from the body, creating a fluid environment for the foetus, and delivering nutrients to and from the body tissues. The production of healthy animals requires a sufficient and clean water supply. Water that has a negative impact on animal growth, reproduction, or productivity cannot be regarded as acceptable.

Water Quality:

To include water quality aspects, 5 quality indicators must be combined.

1. Organoleptic properties (Taste and smell)
2. Physiochemical properties (pH, dissolved solids, total dissolved oxygen, and hardness)
3. Toxic compounds (heavy metals, toxic minerals, organophosphates, and hydrocarbons)
4. Presence of excess minerals (nitrates, sodium, sulphate, and iron)
5. Presence of harmful microorganisms

pH:

It is a measure of acidity or alkalinity. A pH of 7 is neutral, less than 7 is acidic and more than 7 is alkaline. Because it includes dissolved minerals and gases, drinking water and natural water have a pH range, even though the pH of pure water is 7. Surface waters have a pH range of 6.5 to 8.5, whereas groundwater has a pH range of 6 to 8.5. The pH of drinking water should be 6.5 to 8.5.Nonspecific consequences such as digestive distress, diarrhoea, poor feed conversion, and decreased water and feed intake may occur when the pH of the water is outside of the desired range.

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Total dissolved solids (TDS):

Salinity is measured in parts per million (ppm) or milligrams per litre (mg/L) and refers to the amount of salt dissolved in water. The phrase "total dissolved solids" (TDS) is frequently used to describe the salinity of the water.TDS is a non-specific water quality indicator. Water quality should not be determined only by TDS levels.Total dissolved solids (TDS), salinity, and total soluble salts (TSS) are all measurements of soluble components in water. The primary component in this group is sodium chloride. Bicarbonate, sulphate, calcium, magnesium, and silica are other components linked to salinity, TDS, or TSS.Iron, nitrate, strontium, potassium, carbonate, phosphorus, boron, and fluoride are secondary components present in lower amounts than the principal constituents. Species, age, physiological state, the season of the year, and salt content of the whole food, as well as the water, all influence animal tolerance to salts in water. Saline water adaptation is possible for animals. However, sudden transitions from low-salt to high-salt water can be harmful, but gradual transitions are not. Diarrhoea is the most common symptom of high-salinity water. Cattle will be hesitant to drink if the TDS is high, thus they will consume a significant amount at once. This can make the animal extremely sick and perhaps kill it.

Guidelines for TDS content in water:

Total solids (PPM)	Comments
<1000	Satisfactory
1,000 to 2,999	Although it should not harm health or performance, minor diarrhoea could occur.
3,000 to 4,999	Diarrhoea, especially upon first intake.
5,000 to 6,999	Adult ruminants can consume it with some safety, but calves and pregnant animals should not use it.
7,000 to 10,000	Must be prevented if at all feasible. Calves, ruminants that are lactating or pregnant, should not use it.
>10,000	Potentially lethal and may result in brain damage

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Hardness:

The quantity of dissolved calcium and magnesium in water is known as the hardness of the water. The hardness of water has no effect on animal performance or water intake. If the water is already salinized, softening it by replacing calcium and magnesium with sodium may cause problems. When water contains a substantial quantity of calcium, it should be included in the overall mineral intake. Many mineral salts, on the other hand, are generally insoluble and pass through the body unabsorbed.

Hardness, milligrams per litre	Category
0 to 60	Soft
61 to 120	Moderately hard
121 to 180	Hard
>180	Very hard

Nitrate:

It can be utilised as a source of nitrogen in the rumen for bacterial protein production, but it can also be reduced to nitrite. Nitrite lowers the oxygen-carrying capacity of blood when taken into the body, which can lead to asphyxiation in extreme cases. Laboured breathing, rapid pulse rate, foaming at the mouth, convulsions, blue muzzle and bluish tinge around eyes, and chocolate-brown blood are all signs of nitrate or nitrite poisoning tissues. Fertilizers, animal manure, and decomposing organic materials can all pollute water with nitrate. Contamination can occur in shallow wells with weak casings. According to EPA, the maximum level of nitrate for human consumption is 10mg/L.

Nitrate-nitrogen NO_3-N (ppm)	Comments
<100	Not harmful to livestock and poultry
100-300	Could be harmful if consumed for a long period of time
>300	Unsafe and possibly fatal

Sulphate:

A level of sulphate over a certain threshold can harm cattle. Ruminants are particularly vulnerable. Sulphate levels in calves should be less than 500 ppm, and in adults, cattle should be less than 1,000 ppm. Sulphate levels in the diet can diminish copper

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availability. Sulphates should be tested in water sources if copper insufficiency is suspected. The most hazardous form of sulphides is hydrogen sulphide, which can limit water intake. Calcium, iron, magnesium, and sodium salts are common types of sulphate in water.

Although all are laxatives, sodium sulphate is the most effective. Cattle are given sulphate-rich water (2,000 to 2,500 ppm) and get diarrhoea at first, but then become resistant to the laxative effect. When compared to other types of sulphate, iron sulphate has been found to be the most powerful depressor of water intake. High-sulphate water and feed have been associated with the development of polioencephalomalacia (PEM) in calves and can cause copper deficiency with or without the help of molybdenum.

Microbiological quality –

To establish hygienic quality, the microbiological study of water for coliform bacteria and other microorganisms is required. Because certain coliform bacteria are soil-borne or nonfecal, a faecal coliform test can be done to see if the total coliform comes from faeces.Fresh samples can be tested for faecal *Streptococci* to see if the contamination is from animal or human sources. Human sources of pollution may be the reason why faecal coliforms surpass faecal streptococci. Faecal coliform levels should be lesser than 1 per 100 ml for young calves' consumption. Coliform counts for adult animals should be less than 15 per 100 ml. For calves and adult cattle, faecal streptococci levels should not exceed 3 or 30 per 100 ml, respectively. The total bacteria count includes practically all pathogenic and nonpathogenic bacteria that live on organic substances. A total bacteria count of more than 500 per 100 ml of water may suggest a concern with the water quality.

Cyanobacteria:

Algae growth in livestock tanks or ponds might be formed by cyanobacteria, a kind of bacterium (sometimes called blue-green algae).During hot, dry weather, it reacts to sunlight and emerges in stagnant water. Diarrhoea, loss of coordination, difficult breathing, and death are among the symptoms of cyanobacteria poisoning in animals.

Safe levels of potentially toxic nutrients and contaminants in water for cattle:

Element	Safe Upper Limit(ppm or mg/L)
Aluminium	5.0
Arsenic	0.2
Boron	5

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Cadmium	0.05
Calcium	1,000
Chromium	1.0
Copper	0.5
Fluoride	2.0
Lead	0.05
Molybdenum	0.5
Nickel	1.0
Nitrate	100
Nitrite	33
Selenium	0.05
Sodium	1,000
Sulfate	500 to 1,000
Vanadium	0.1
Zinc	24.0

Conclusion:

Animal health and production depend on the availability and quality of water. The most frequent water quality problems affecting livestock production are high mineral concentrations (excessive salinity), high nitrogen content (nitrates and nitrites), bacterial contamination, heavy growth of blue-green algae, and accidental contamination by petroleum, pesticides, or fertiliser products. One part of a herd health and productivity assessment should include water quality monitoring during periods of reduced production or nonspecific diseases.