

Maintaining water purity for agricultural use

By Claudi Nortjé



South Africa is considered a water-scarce country. The ever-increasing demand for water, combined with dry and unfavourable climate conditions, exert pressure on available water resources. However, pollution-driven water scarcity is also a factor to consider.

According to the Food and Agriculture Organization (FAO) of the United Nations, water quality can be degraded to such an extent that it can no longer be used. In order to manage water properly, Grain SA says its quality must be determined, monitored and allocated based on its quality, or by treating it until the quality matches its intended use.

The Department of Water and Sanitation (DWS) is the primary custodian of South Africa's water resources. One of its main objectives is to maintain the usability of water and continually ensure its quality.

The four broad categories of water usage recognised in the *National Water Act, 1998* (Act 36 of 1998) includes domestic, industrial, agricultural and recreational use. This article focuses on water purity for agricultural use in terms of livestock and irrigation.

According to the DWS, water quality requirements are determined by the following:

- Typical water quality problems associated with specific water usage.
- The effects of poor water quality on its use.

- Benchmarks used to measure the impact of water quality on specific water usage.
- The various water quality components that are of concern.

Water purity in irrigation

Irrigated agriculture is considered one of the largest water consumers in South Africa. The Milk Producers' Organisation (MPO) reports that agriculture consumes approximately 75% of South Africa's rainfall. From this, natural vegetation uses 60%, dryland crop production uses 12%, and irrigation uses 3%.

According to the *National Water Quality Guidelines* published by the DWS, water supply for irrigation often originates from several sources, including farm dams, large reservoirs, groundwater, rivers or municipal supply. It is important to note that the quality and quantity of water from rivers vary greatly and is mostly influenced by seasonal drought or floods.

Producers can experience a range of problems due to changes in water quality, including reduced crop yields, poorer crop quality, degradation of soil health, and corrosion or encrustation of irrigation equipment.

Water testing and treatment

In order for producers to ensure that the water they use for irrigation is of sufficiently high quality, they must implement effective measures to ensure

that the water is free of contaminants. This means that water should be tested regularly to assess its microbiological and chemical contents. Every water source should be tested, and reservoirs should be protected from contamination by birds, rodents, insects, and other organic and inorganic matter as far as possible.

Proper effluent disposal is another critical component in preventing contamination of nearby water sources. If effluent is applied to a pasture, it should be left undisturbed for at least 21 days before any further grazing or harvesting takes place. Water sources should also be kept safe from any potential pollutants, such as fertilisers or silage effluent.

According to a recent study by Stellenbosch University, the Water Research Commission and the former Department of Agriculture, Forestry and Fisheries (DAFF), a variety of bacteria, viruses and protozoa isolated from irrigation water subsequently contaminated cultivated produce. The study found that the pathogens in water were predominantly of faecal origin. Producers can help reduce the risk of microbiological contamination by manipulating feed rations or treating manure before using it as fertiliser.

In addition to water quality, the type of irrigation system used may also influence the extent of crop contamination. The study found that flood and spray irrigation represent the most significant contamination risk, since these irrigation techniques transfer water directly onto the edible parts of fresh produce.

Water for animal consumption

According to Grain SA, the norms used to determine water's suitability for animal use, include looking into issues that

Table 1: Disinfection techniques currently used to treat water used for irrigation.

Physical/mechanical	Chemical	Physical/photochemical	Combination treatments
Sand/media filtration Ultrafiltration	Chlorine-based bromine Hydrogen peroxide Peracetic acid Ozone	Ultrasound Ultraviolet light (UV)	Chlorine/UV Hydrogen peroxide/UV Peracetic acid/UV

Table 2: South African water quality guidelines (in mg/L⁻¹) for different water uses where no health effects are expected. (Source: Department of Water Affairs, 1996)

Water quality components	Aquatic water use	Domestic water use	Agricultural water use		
			Livestock	Irrigation	Aquaculture
Cadmium	0,00015	0,005	1	0,1	0,05
Chromium	0,007	0,05	0,01	0,01	0,0002
Copper	0,0003	1	1	0,1	0,002
Lead	0,0002	0,1	0,5	0,2	0,01
Mercury	0,00004	0,001	0,001	–	0,000001
Nickel	–	–	1	0,2	–
Zinc	0,002	3	20	1	0,03

– No guideline is given.

affect health, the environment, product quality and watering equipment. The environmental impact of confined animal feeding operations may affect water resources. This not only includes livestock, but also pertains to game ranching and water provision for wildlife.

In intensive production systems, the taste or aesthetic properties of water can also influence feed and water intake. Although water may meet the necessary water purity specifications for animal use, it may still have poor palatability, which can lead to reduced intake and a negative impact on growth.

As with irrigation operations where water usage is sufficiently allocated and monitored, animals' water intake should also be tracked so that any changes that indicate potential production problems can easily be detected.

Many intensive livestock producers go the extra mile to disinfect their water to reduce its impact on watering equipment. Scaling, corrosion and deposition of sediment in the water distribution system

often have a significant economic impact, which is why it is best to treat the water before distributing it to livestock.

According to Grain SA, the disinfection process depends on the water quality and requires the entire process to be adequately managed and monitored. The mismanagement of water quality for animal use can harm product quality, which can then lead to consumer health hazards.

According to the DWS, the following factors should be considered when establishing water quality guidelines since they can influence the level at which poor water quality will have an adverse effect on livestock production:

- Species tolerances.
- The impact climate has on the animal.
- Feed environment.
- Production system.
- Animal physiology.
- Animals' production phase.
- The length of exposure to a potentially harmful substance.

- The effect of concentrated intake over a short period.
- The physiological and economic impact of exposure to a potentially hazardous element.

Metals consumed via water may accumulate in the animal's tissue, specifically in the muscles, bone, liver, kidneys and brain. However, apart from pesticides and mercury, most metals cannot accumulate to such an extent that they will threaten consumers' health. In chickens, a decrease in egg production and a lower hatchability rate may result from high calcium concentrations and the subsequent interactions with zinc and manganese.

Where to begin

Whether for animal use or irrigation, the standard approach should always be to first determine the water's quality, followed by possible changes to storage, delivery and treatment options to improve water quality.

In addition, producers should determine how best to manage their water allocation so that the water quality is suited to its intended use. In order to ensure that crops and livestock won't be negatively affected by harmful metals, bacteria, fungi or other components that may be present in the water supply, water quality, allocation and the ultimate effect it has on production must continually be monitored. 🌱

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