Department of Agriculture
Farmnote
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Water quality for farm domestic and livestock use

By Officers of the Chemistry Centre of Western Australia

The total amount of minerals in solution in the water — the total soluble salts — mainly determines the suitability of water for domestic or garden use, unless water is polluted. Other criteria are generally of secondary importance.

The types of salts in water are mainly common salt (sodium chloride) and calcium and magnesium bicarbonates, chlorides and sulfates. In the agricultural areas of the state, about three-quarters of the total soluble salt is common salt — a ratio similar to sea water. This ratio may vary in some coastal and pastoral areas.

Usually the only practical method for using water with total salts above the recommended limits is to mix it with fresher water. Calculate the proportion for mixing from the total soluble salt contents of the two waters.

Results of analysis

Total soluble salts are usually measured by the electrical conductivity of the water and are quoted as millisiemens per metre (mS/m). It is sometimes expressed as milligrams of salt per litre (mg/L) or parts per million (ppm). For water, milligrams per litre (mg/L) are the same as parts per million (ppm) for most practical purposes.

Multiply the conductivity (in mS/m) by 5.5 to convert approximately to milligrams per litre (mg/L) or parts per million (ppm). Multiply the conductivity by 0.385 to convert approximately to the old unit, grains per gallon.

Reaction — acidity or alkalinity

Neutral or slightly alkaline water is satisfactory for all uses.

Water that is naturally acid is not harmful to humans, livestock or plants but can corrode pumps, metallic pipes and tanks. Acidity can be reduced by aeration or by adding alkaline substances, such as lime, to change the pH to a more neutral value.

Appearance

Water that is cloudy with suspended clay is suitable for agricultural uses but should be treated before human consumption. Such water can generally be cleared by the addition of filter alum (aluminium sulfate) at about 40 grams per 1000 litres. Information on clearing cloudy water is available in Farmnote No. 42/04 *Clearing cloudy or coloured water*.

Iron or organic matter, such as algae, can also cause water to be cloudy (see below).

Coloured water

Colour may remain after water has been cleared by filtering or standing. Water coloured yellow to brown by organic matter in solution is satisfactory for irrigation and septic tanks but should not be used for human consumption.

Colour can be removed from water in some cases in the same way as cloudiness.

Odour in water

The objectionable odour similar to rotten eggs in water from some bores and dams is due to the presence of the dissolved gas, hydrogen sulfide. This can be removed by aeration (see Treatment).

Any other odours in water indicate some form of pollution or contamination and the water should not be used for human consumption. Discard stored water and remove the source of contamination before any more is used. Emergency chlorination may be used in some cases — see Farmnote No. 44/04 *Emergency chlorination of farm water*.

Iron

Groundwater often contains iron. Water containing iron in solution may be clear and colourless when first drawn, but becomes cloudy and eventually deposits reddish-brown hydrated iron oxide after standing in contact with the air.

Iron in water imparts a metallic taste but is not harmful to drink but it stains clothes, buildings and paths when used in sprinklers on nearby gardens.

There is no simple method of removing iron, so garden irrigation sprinklers should be sited to prevent spraying buildings and places where the stain might be conspicuous.

For domestic use, remove iron by aeration and settling (see Treatment).

Corrosion of pumps, metallic pipes and tanks

Metallic corrosion increases with the total salt content and the acidity of the water.

To assess the corrosiveness of water, particularly underground water, special techniques are required to make sure that the sample is obtained without loss of dissolved gases.

Before taking samples, always seek advice on these techniques and on the timing of the submission of samples for analysis from the Chemistry Centre of Western Australia (telephone [08] 92223177).

The only successful way to reduce corrosion by underground water is to use resistant materials, such as plastic piping, protective coatings on tanks, and bronze or stainless steel for pumps.

Water for the home

Drinking water

The maximum permissible level of soluble salts for human consumption by World Health Organisation standards is 1500 mg/L or about 270 mS/m. The maximum desirable is 500 mg/L or about 90 mS/m.

The water must also be clear, colourless, odourless and not polluted.

The source of the water must be protected from animals, and not contaminated by drainage from livestock sheds and yards, or septic tank outlets.

If there is any doubt about a water source, seek the advice of the Environmental Health Officer of your local shire council and obtain information on bacteriological testing.

Nevertheless, a single satisfactory result from a bacteriological test does not necessarily prove that the water supply is safe. The correct siting and protection of the source is vital.

In some areas of the state or in particular circumstances, minerals such as heavy metals or nitrate in the water may affect the quality of the supply for human consumption.

Hot water systems

The safe upper limit for total salts in water for use in a hot water system is about 160 mS/m (900 mg/L).

Above this level, copper systems can be excessively corroded. If the system has a thermostat control, dropping the operating temperature to about 50˚C will reduce the problem.

Where scaling is excessive, a water softener can be used (see Treatment) or temperature control will help.

Laundry use and hardness

Hardness is a measure of the difficulty of obtaining a lather with soap. Hardness generally increases with the total salt content and, except for waters obtained from limestone areas, a quarter of the total salts gives a rough measure of the total hardness.

Water with less than 50 mg/L of total hardness is regarded as soft; water with up to 200 mg/L of hardness is not regarded as excessively hard.

Water up to 360 mS/m or 2000 mg/L total salts is suitable for laundry use, but if the total hardness exceeds 100 mg/L, use detergents instead of soap.

Showers and baths

Water containing up to 635 mS/m or 3500 mg/L of total salts is satisfactory for cold water showers or baths, particularly if a liquid detergent is used.

Septic tanks

Water of up to 1635 mS/m or 9000 mg/L of total salts is satisfactory for use in a septic tank. Water of higher salinity can be used if there is limited use of the septic tank or if an oversize system is used to allow for the slower action in saltier water.

Other uses

Water used for other purposes, such as for air-conditioning, aquaria, batteries, boilers, concrete mixing, engine cooling, milking machine washing, photographic processing or swimming pools, may need special treatment either before or during use.

Advice on these aspects is available from the Chemistry Centre of Western Australia.

Water for gardens and irrigation

Farmnote No. 71/99 *Tolerance of plants to salty water,* provides a guide to the suitability of water for irrigation and home gardens.

Livestock water

Quality of water for livestock

The quality of water that livestock will drink varies greatly with circumstances and conditions. Usually livestock become accustomed to the variations over the year, and suffer little effect. But livestock suddenly introduced to salty water may either refuse to drink it or suffer ill-effects.

Livestock, thirsty through travelling or under extreme conditions, may, for a short period, drink saline water but if used continuously, the saline water would cause ill-effects.

Limits of total soluble salts in water for livestock are listed in Table 1. These figures should not be rigidly followed. At these maximum levels there should be no harmful effect on health, although production may fall and the animals should be watched carefully.

Table 1. Safe upper limits of total salts in water for livestock

Livestock	mg/L	mS/m
Poultry	3,000	550
Dairy cattle (milk producing)	3,500	650
Pigs	4,500	800
Horses	6,500	1,200
Dairy Cattle (dry)	7,000	1,300
Sheep (lambs, weaners, lactating ewes)	7,000	1 300
Beef cattle	10,000	1,800
Sheep (adult, dry)	10,500 to 14,000	1,900 to 2,550

Water with less than 3000 mg/L total salts (550 mS/m) can be used continuously by all livestock.

Where green feed is available, animals can tolerate more saline water than when bush or scrub is the only feed. Older dry livestock can tolerate water of higher salinity than young livestock or lactating ewes.

In isolated instances, magnesium has been found at levels which affect a recommendation on total salts alone. A test for magnesium may be warranted when livestock are scouring on drinking water with more than 5000 mg/L total salts (900 mS/m).

Cloudiness of water due to clay in suspension is not normally harmful to livestock but bacterial or algal toxins found in water could harm livestock. Salmonella bacteria, introduced by faecal contamination, especially of dams and water holes, can lead to scouring and death of livestock.

Changes in salinity

The salinity of a water source may change over the years, and fluctuate with the seasons. Often, the salinity of dams, soaks and tanks increases during the summer because of evaporation.

Stream salinity fluctuates seasonally because of rainfall. Immediately after the first rains, the flow reaches maximum salinity as salts left on the dry creek banks over summer are flushed downstream. The salinity then drops as the flow increases due to the influx of fresh run-off water. When flow eases as summer approaches, salinity rises again.

Long term increases in water salinity are usually associated with clearing. Salinity often increases in dams, soaks and creeks after clearing because the quantity and salinity of seepage water flowing into them increases. Because of these changes following clearing, streams flowing from bushland areas are usually fresher than nearby streams in cleared land.

Salinity in larger streams and rivers fluctuates seasonally and in response to clearing in a similar way to the small streams. The major rivers decrease in salinity as the distance from the headwaters increases, because of the inflow of fresher streams in the high rainfall coastal areas.

Treatment

Water can be treated to improve its quality. Some treatments that are practical on a small scale are listed below.

Aeration

Aeration of water helps remove odours cause by hydrogen sulfide gas, and dissolved gas that makes water acidic and corrosive. It also helps remove iron by converting it to an insoluble form.

The best aeration method is spraying the water in small droplets from a nozzle such as a shower rose on to a splash board, about a metre above the surface of the water in the holding tank or dam. The addition of lime after aeration may be necessary to further reduce acidity.

Iron removal

Efficient aeration usually removes iron from solution as a fine precipitate that will settle on standing, leaving clear water above it. Hydrolime or good quality builders lime at the rate of 25 grams per 1000 L may be needed to speed settling after aeration.

A convenient method of removing iron is to use a two-tank system. The water is aerated into the first tank and then allowed to stand until clear, usually for 24 to 48 hours. Add lime if the settling time is excessive. Then draw off the clear water into the second tank ready for use. Periodically flush out the accumulated sludge in the first tank.

Water softening

Softening is only necessary for heating or washing. Generally softening is not necessary unless the total hardness exceeds 200 mg/L. It removes the calcium and magnesium responsible for scale produced by heating and the curds formed with soap. The use of detergents can avoid the need for softening.

If softening is needed, use a base-exchange domestic water softener. Such softeners are readily available commercially.

The size and cost of the water softener needed depends on the hardness of the water, the water requirement and how often the softener has to be regenerated.

Desalination

A range of small desalination plants is available. Most use either the reverse osmosis or ion exchange process. Capital costs are high and running costs depend on the required reduction in salinity and the scale of the operation.

Samples for analysis of salt content

Any district office of the Department of Agriculture will analyse water for the total salt content. A fee for this service is charged in most circumstances.

Samples should be at least 500 mL in a clear glass or plastic bottle, previously well rinsed with the water to be sampled. Use a clean screw cap, cork or stopper to seal the bottle, and mark the bottle with the sender's name and address, and the date of sampling.

Further information

Further information is available from the Chemistry Centre of Western Australia, 125 Hay Street, East Perth, (08) 9222 3177, or offices of the Department of Agriculture.

Some related Farmnotes of the Department of Agriculture are listed below:

Farmnote No. 42/2004 *Clearing cloudy or coloured water*

Farmnote No. 44/2004 *Emergency chlorination of farm water*

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