Irrigation water quality

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Farm water comes from a number of different sources and so its quality varies. Water sources include dams, bores, wells, rivers, town water, channels and recycled water.

Water from various sources may be of an unsuitable quality for its intended use for irrigation, stock, household or other farm activities.

It is important to identify and correct water quality problems that may affect on-farm use and productivity.

Knowing your water quality

If you have any doubt about the quality of irrigation water get it tested by an accredited laboratory. You should have your water tested before, and sometimes during, use.

Your local NSW Department of Primary Industries advisory officer can advise you how to treat any specific problems in your water supplies.

Knowing your water quality allows you to plan for water treatments to avoid problems such as poor plant growth, or blocked irrigation.

Water quality issues

Problems with water quality may have a chemical basis (for example, acidic or alkaline water or concentrations of certain elements) or be of a physical nature (for example, plant growth such as algae). Some problems may be more obvious than others, and some may require more extensive treatment than others.

Water quality can affect plants, soils, irrigation equipment, domestic use and general farm activities. Some water problems affect a whole range of uses, while others are restricted to more specific uses.

pH

The pH balance of a water supply describes how acidic or alkaline it is. The acidity (or alkalinity) of a water supply can affect plant growth, irrigation equipment, pesticide efficiency and drinking water.

Water with a pH below 7 is acid and water with a pH above 7 is alkaline. Most natural waters are between pH 5 and 8.

The generally accepted pH for irrigation water is between 5.5 and 7.5, but some problems can occur within this range.

Alkaline water may contain high concentrations of bicarbonate (generally in water of pH 8 and above) and carbonates (generally pH 9 and above). This can cause calcium and magnesium to precipitate from the soil, this can affect plant growth. Some trace elements, like copper and zinc, will also be less available to the plant in this situation.

A pH greater than 7.5 is likely to reduce the effectiveness of chlorine disinfection.

Acidic water can also have a detrimental effect on plant growth, particularly causing nutritional problems, while strongly acidic water (below pH 4) can contribute to soil acidification. A pH less than 6 indicates corrosiveness, which can lead to damage to metal pipes, tanks and fittings.

Water lower than pH 6.0 or higher than pH 8.5, when used in spray mixes, can lessen the effectiveness of some pesticides. Check with your pesticide supplier.

Treatment

If you need to adjust your water pH, try to keep it between pH 5.5 and pH 7. Water in this pH range:

- maintains nutrient balance
- prevents scale formation in irrigation equipment
- provides effective chemical disinfection.

Water pH can be adjusted by adding an acid or an alkaline substance to the water supply. The appropriate acid or alkaline may be injected into the pipeline for automated systems or mixed in a tank for manual systems or larger volumes of water. The use of an acid (such as sulfuric acid) will lower the pH, while an alkaline (for example, lime) will increase the pH.

Commercial water test kits are available at most pool stores.

IRON

Soluble iron and iron-loving bacteria can cause blockages in pipes, drippers and sprinklers and can damage equipment such as pressure gauges. If water with high soluble iron is applied by spray, it can discolour leaves and reduce the efficiency of transpiration and photosynthesis.

High levels of soluble iron are usually associated with deep bores and dams where oxygen supply is limited. Aeration oxidises the iron, forming solid particles that can then settle out of solution.

Treatment

Iron is soluble in water where there is little or no oxygen. Oxidising the iron makes it form solid particles that can then settle out of solution or be caught in a filter.

The recommended treatment to remove iron is oxidation, sedimentation and then filtration. Procedures used include aeration and settling chlorination and use of potassium permanganate.

HARDNESS

Water that contains high levels of dissolved calcium or magnesium salts, or both, is described as being 'hard'. Other cations such as iron, manganese, aluminium and zinc can also contribute to hardness.

Water hardness is defined in terms of calcium carbonate ($CaCO_3$, also known as 'lime'). The level of hardness (Table 1) is expressed as the total amount of $CaCO_3$ in milligrams per litre of water (mg/L).

Table 1. Classification of water hardness

Description of water	Hardness expressed as mg/L of $CaCO_3$
Soft	less than 50
Moderately soft	50–75
Slightly hard	75–150
Hard	150–300
Very hard	greater than 300

Hard water can affect soil, stock and domestic water use, and pipes and equipment.

Effect on soils

Hardness does not affect plants directly, but hardness caused by bicarbonates can affect soils, thus having an indirect impact on plant growth. A bicarbonate (HCO_3) is a soluble compound often found in saline–sodic water.

While it is desirable that domestic water supplies contain less than 100 mg/L hardness, there are suggested upper limits for specific farm uses, and these are listed in Table 2.

Table 2. Hardness limits suggested for various farm water purposes

Farm water needs	Hardness (mg/L)
Dairy equipment and hot water systems	up to 150
Domestic uses such as washing and cooking	up to 200
Dips and chemical sprays	up to 300
Septic tanks and hosing down	over 300

Effect on pipelines, irrigation and farm equipment

Calcium salts can form a white encrustation of lime (calcium carbonate). These deposits eventually block irrigation equipment and affect hot water systems. Deposits on heating elements make them overheat and burn out.

Treatment

Reducing hardness is called water softening. Ways to soften water include:

- ion exchange
- water-softening agents
- desalination processes such as reverse osmosis
- use of lime
- pH adjustment
- controlling water temperatures

SALINITY

Salinity is the concentration of all soluble salts in water or in the soil. For most horticultural crops more than 2 dS/m will cause reductions in crop yield.

In water, salinity is usually measured by its electrical conductivity (EC), which is a measure of the concentration of ions in water or in the soil solution. The international standard for measuring

salinity is decisiemens per metre (dS/m), but several other units of measurement are still in use.

How does salinity affect plants?

Plants are adversely affected by salinity in several ways. The most important of these is that it limits the ability of plants to take up water.

If the soil water salt concentration is too high the plant will not be able to absorb water: it will wilt and begin to die. The point at which this happens depends on the type of plant, some crops are more tolerant to salts than others. Tolerance also varies with the stage of growth, especially at germination and at the seedling stage when plants are most susceptible.

EC readings are a general indicator of the salt concentration. They do not tell you the type of salts or their relative concentrations. Plants can also be affected by the toxicity of some elements in saline water, especially chloride, sodium and boron.

Salt scalding on lettuce

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