

WATER QUALITY FOR IRRIGATION

SODICITY

The suitability of water for irrigation will be determined by two main criteria, Sodicity hazard and Salinity hazard. This document deals with the sodicity hazard of water.

SODICITY

Sodicity is the effect the irrigation water can have on the physical and chemical properties of the soil due to an accumulation of sodium.

Sodium can affect plants in three ways:

- By destroying soil structure causing clay particles to disperse (resulting in coarse blocky texture and crust formation after rain or irrigation) and reducing water movement (permeability) and aeration in the soil.
- Toxic effects on sodium sensitive plants when absorbed by either their roots or leaves.
- Calcium and/or potassium deficiencies may occur if the soil or irrigation water is high in sodium.

Measures of the sodicity hazard of irrigation water include Sodium Adsorption Ratio SAR and Residual Sodium Carbonate (RSC), also called Residual alkali (RA).

SODIUM ADSORPTION RATIO (SAR)

The sodium adsorption ratio SAR measures the relative proportion of sodium ions to calcium and magnesium ions in the water sample. The sodium adsorption ratio is used to predict the potential for sodium to accumulate in the soil primarily at the expense of calcium, magnesium and potassium as a result of continued use of sodic water.

$$SAR = \frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$$

where Na^+ , Ca^{++} and Mg^{++} are in meq/L.





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<u>SAR</u>	<u>Sodium Hazard</u>
SAR < 3	ideal
SAR 3 – 6	low sodium
SAR 6 – 8	medium sodium
SAR 8 – 14	high sodium
SAR > 14	excessive sodium, unsuitable

RESIDUAL SODIUM CARBONATE (RSC) OR RESIDUAL ALKALINITY (RA)

$RSC = (HCO_3^- + CO_3^{--}) - (Ca^{++} + Mg^{++})$ with concentrations in meq/L.

Residual sodium carbonate represents the amount of sodium carbonate and sodium bicarbonate in the water and is said to be present in a water sample if the concentration of carbonate and bicarbonate ions exceeds the concentrations of calcium and magnesium ions. RSC is usually expressed as milliequivalents per litre (meq/L) of sodium carbonate.

An excess of carbonates and bicarbonates causes precipitation of soil calcium and magnesium, making the sodium present potentially more damaging to soil structure as well as potentially activating soil sodium.

<u>RSC value</u>	<u>Sodium Hazard</u>
<1.25	Low
1.25 – 2.5	Medium
> 2.5	High

SODICITY CLASS

Water is allocated a sodicity class based on its SAR and RSC. The overall sodicity class determines the waters suitability for irrigation.



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Sodicity classes for irrigation water

Sodium absorption ratio SAR	Residual sodium carbonate RSC meq/L	Sodicity class	Comment
Less than 3	Less than 1.25		No sodium problem.
3 to 6	Less than 1.25	1	Low sodium, few problems except with sodium sensitive crops.
6 to 8	Less than 2.5	2	Medium sodium, increasing problems; use gypsum and not sodium sensitive crops.*
8 to 14	Less than 2.5	3	High sodium - not generally recommended.
Greater than 14	Any value	4	Very high sodium - unsuitable.
Less than 6	1.25 – 2.5	5	Medium RSC - Medium sodium, increasing problems; use gypsum and not sodium sensitive crops.*
Less than 14	2.5 – 5	6	High RSC - High sodium - not generally recommended.
Less than 14	Greater than 5	7	Very high RSC - unsuitable.

Source: Interpreting water analysis for crop and pasture QDPI & F Note

<http://www2.dpi.qld.gov.au/fieldcrops/3472.html>

*Sodium sensitive crops include beans, avocado, citrus, deciduous fruits and nut trees. These sensitive crops may show sodium's toxic affect when:

Flood irrigation water has a sodium adsorption ratio (SAR) as low as 4.5

Spray irrigation water that wets the foliage, has a sodium content greater than 70 mg/L or SAR greater than 3.



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