Measuring Salinity

understanding the numbers

action Salinity & Water AUSTRALIA

Government of South Australia

The Department of Water, Land and Biodiversity Conservation

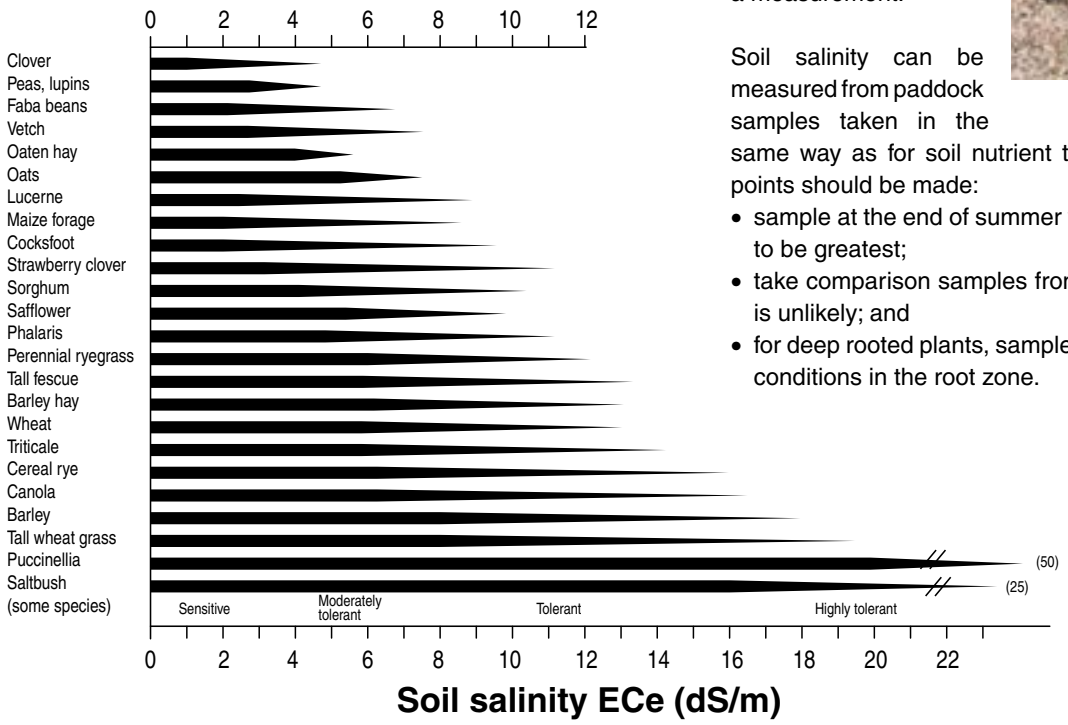
Most plants don't like salt in the soil

Salinity affects crops and pastures by effectively reducing the amount of water available to the plant. This is ironic, given that salinity often occurs in association with waterlogging, but high levels of salt make it increasingly difficult for the plant to extract water from the soil. Further problems may arise from the toxic effects of some salts, poor soil aeration (generally due to waterlogging) or other harmful soil properties such as sodicity.

Some plants are extremely sensitive to salinity, whilst others are moderately tolerant and yet others highly salt tolerant. The following chart gives a broad overview of the relative tolerance of crops and pastures to **soil salinity**. This chart should used only as a guide, as not all salts are the same and in a paddock situation soil salinity can seldom be considered in isolation from factors such as waterlogging and soil type.

The chart indicates when yield might begin to be affected by salinity (narrowing of bar) and when yield might be reduced by 50% (end of bar)

Relative tolerance of crops and pastures to soil salinity



Crops and pastures begin to be affected by soil salinity at narrowing of bar; yield reduced by 50% at end of bar. Salt tolerance is further reduced for seedlings or under waterlogged conditions. (Adapted from T Herrmann, PIRSA, 1995)

How saline is my soil?

The first indication of soil salinity is often the poor performance of crops and pastures, although this can be easily confused with other issues such as nutrient deficiency or imbalance, herbicide damage, soil properties, etc.

Salt tolerant plants such as sea barley grass, samphire, curly rye grass, ice plant and of course bare ground are also tell-tale signs of salinity. What these indicators don't tell us is just 'how' salty the soil is – that is where we need a measurement.

Soil salinity can be measured from paddock samples taken in the same way as for soil nutrient testing. However, a few additional points should be made:

- sample at the end of summer when salt concentrations are likely to be greatest;
- take comparison samples from a similar soil type where salinity is unlikely; and
- for deep rooted plants, sample (separately) the subsoil to assess conditions in the root zone.

What do the numbers mean?

Salinity is measured in parts per million (ppm) or milligrams of salt per litre (mg/L). However, rather than performing an expensive chemical analysis we normally infer the salinity from a relatively simple measurement of electrical conductivity (EC). This is based on the fact that moist salty soil conducts electricity, the saltier the higher the conductivity.

The standard unit for EC is deciSiemens per metre (dS/m), but several other units still in use tend to confuse the situation. The conversions are shown in the following table.

1 dS/m	1 mS/cm
1 dS/m	100 mS/m
1 dS/m	1000 µS/cm
1 dS/m	640 ppm = 640 mg/L*

* This conversion is an average figure that can vary markedly with the type of salts present.

Can I measure soil salinity myself?

A fact sheet (Information Sheet No. 66/00) describing a rapid soil salinity test using a simple conductivity meter is available from regional PIRSA offices or from www.pir.sa.gov.au

What about water salinity?

Salty irrigation water can be detrimental to plants, either reducing productivity or even killing the plant and can also result in a build up of salt in the soil. The actual impact of irrigation with salty water depends on the chemical composition of the water, the irrigation practices and the soil type. The following table should therefore be seen as an approximate guide to the upper limits of tolerance of plants to saline irrigation water.

	mg/L*	dS/m
Subterranean clover	1000	1.6
White clover		
Strawberry clover	2000	3.2
Perennial rye grass		
Fodder crops		
Rhodes grass	3000	4.7
Lucerne		

*A less common unit, but used occasionally, is grains per gallon: 1 grain ~ 14 ppm.

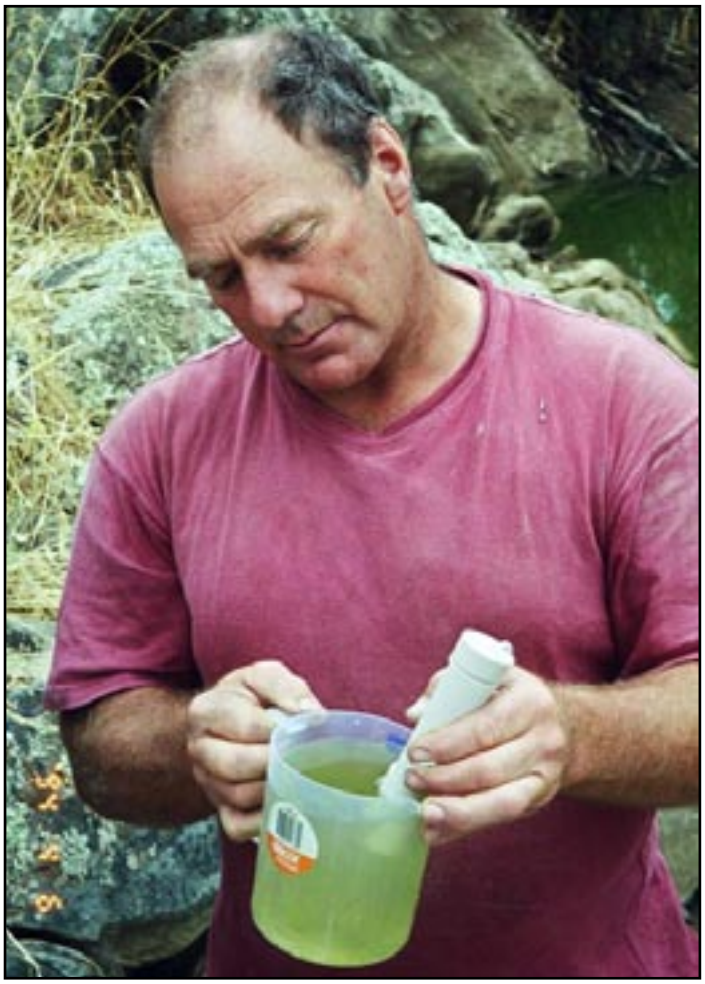
Animals too are affected by salty drinking water, the impact varying considerably between different species. Approximate limits for survival are shown in the table, but these figures must be treated with caution as they can vary considerably with the composition of salts present.

	mg/L	dS/m
Poultry	3500	5.5
Pigs	4000	7
Horses	6000	9.4
Lactating cows	6000	9.4
Lactating ewes	6000	9.4
Dry cows	10 000	15
Dry sheep on dry feed	14 000	22

Maximum allowable salt concentrations in drinking water will also be very dependent on climate, age and condition of animals, pasture composition, conditioning to salt and supplementary feed.

Can I measure water salinity myself?

Salt composition and concentration can be measured by chemical analysis, but as with soil salinity the total dissolved salts can be inferred from a measurement of electrical conductivity (ECw). This is a relatively simple procedure using a hand-held conductivity meter that comes with instructions.



For further information contact Saltland Agronomist for the Combined SE Soil Conservation Boards: Ph 8755 3166.