



SALINITY—NEW SOUTH WALES

Key points

- Soil salinity varies across the landscape and within paddocks.
- The severity of soil salinity varies over time, in response to both climate and land management.
- Soil salinity can be managed by on farm actions.

What is soil salinity?

A saline soil is one that contains sufficient soluble salts (most commonly sodium chloride) to adversely affect the growth of most plants. Salinity reduces a plant's ability to extract water from the soil and can cause toxicities from specific ions. The point at which the growth of different plants is adversely affected varies. Some species are very sensitive to salt while others, such as saltbush, are very salt-tolerant.

Soils develop salinity via interactions with groundwater. If groundwater rises to within 2 metres of the soil surface, water can rise by capillary action to the surface. When this happens, the water can bring salt into the root zone and when the water evaporates at the soil surface, concentrated salts are left behind.

A **salinity outbreak** is where symptoms of salinity are present. A **salt scald** is an area completely devoid of vegetation due to high salinity.

Signs of salinity in the paddock

Any of these signs should trigger investigations of potential soil salinity:

- crop symptoms including reduced yield, and burnt leaf tips and/or margins (figure 1)
- salt-tolerant plant species thriving while others show poor growth
- dieback of trees
- waterlogged soil (separate from rain or flood events)
- bare patches of soil
- wet, dark greasy patches
- salt crusts on the soil surface when it is dry
- stock congregating and licking surface salt
- very clear water in dams and waterways.

Measuring salinity

Soil salinity varies across paddocks and farms, and vertically within the soil profile. Soil may be saline at depth but not in the topsoil, indicating that there may be a future problem in the topsoil.

Samples can be taken to assess salinity by measuring the electrical conductivity (EC) of soil and water. EC is usually measured in deci Seimens per metre (dS/m). Distilled water has an EC of 0 dS/m, sea water has an EC of 35–55 dS/m



Figure 1: Salinity damage in dryland chickpeas. Photo: Col Begg © NSW government.

and the desirable limit for human consumption is 0.8 dS/m. EC_e is the electrical conductivity of a soil extract. EC_w is the electrical conductivity of water sample. Sometimes irrigation water EC_{iw} or drainage water EC_{dw} is indicated. Crops vary in their tolerance to salinity (Table 1).

Large scale ground surveys of soil salinity can be carried out using electromagnetic induction (EM) devices. EM

Table 1: Susceptibility of various crops to yield decline with saline soil and irrigation water (Tenison et al. 2014).

CROP	AVERAGE EC CAUSING 5% YIELD REDUCTION (dS/m)			
	EC_e (root zone salinity)	EC_w (irrigation salinity)		
		well drained soils	moderate to slow draining	very slow draining
Barley—forage	6.0	6.0	4.0	2.0
Barley—grain	8.0	8.0	5.3	2.6
Canola	6.5	6.5	4.3	2.1
Faba beans	1.8	1.8	1.2	0.6
Oats	5.0	5.0	3.3	1.7
Wheat	6.0	6.0	4.0	2.0
Durum wheat	5.7	5.7	3.8	1.9
Cotton	2.4	NR	1.6	0.8
Maize	1.7	1.7	1.1	0.6
Soybeans	0.75	0.75	0.5	0.25
Sunflowers	5.5	5.5	3.6	NR
Millet	6.0	6.0	4.0	2.0
Sorghum grain	1.5	1.5	1.0	0.5
Rice	3.0	NR	NR	1.0

NR = no record

devices rapidly estimate soil salinity in the paddock by measuring the ease with which a magnetically-induced current passes through the soil.

Dryland salinity

Dryland salinity occurs when naturally occurring salts in rocks and soil are mobilised and redistributed by water. For example, surface runoff after rainfall, recharge of groundwater, subsurface lateral flows of groundwater, or groundwater discharge.

Dryland salinity occurs throughout NSW (figure 2). Saline outbreaks in upland areas of the NSW Murray-Darling Basin cover around 62 000 hectares (Department of Environment and Climate Change NSW 2009), but individual areas are usually less than 10 hectares. Most salt scalds occur in the 600–700 millimetre rainfall zone.

Irrigation salinity

Irrigation salinity occurs when excess irrigation water leaches past the root zone and mobilises salt in the soil.



Figure 2: Salinity scalding. Photo: Graham Johnson © NSW government.

Further reading and references

Department of Environment and Climate Change NSW (2009) 'Salinity Audit: Upland catchments of the New South Wales Murray-Darling Basin'. ([online](#))

Tenison K, Wild J, Madden E, Draper V & McMahon L (2014) 'Training manual', New South Wales Department of Primary Industries.

The New South Wales Department of Primary Industries has a range of useful information on soil salinity and its management in NSW ([online](#))

The Saltland Genie website helps compare specific management strategies for dryland salinity ([online](#))

Author: Stephanie Alt (New South Wales Department of Primary Industries).

Irrigation salinity in NSW occurs mainly in southern NSW in the Murray and Murrumbidgee irrigation areas.

Areas of land affected by irrigation salinity have dropped sharply in the last 10 years, from 14 000 hectares to less than 500 hectares in the Murray Valley. The mechanisms for this change are not completely understood, but are possibly due to a combination of reduced winter rainfall and improved farm management and infrastructure.

Managing groundwater levels

Salinity management aims to maintain groundwater levels at least 2 metres below the soil surface, mainly by maximising plant water use to reduce groundwater recharge. Useful techniques include:

- monitoring groundwater levels
- growing species tolerant of salt and waterlogging in low lying, non-production areas
- growing perennial pastures as these can use twice as much water as annual pastures
- avoiding long fallows when the profile is >75% of field capacity
- appropriate crop selection and crop rotations
- efficient irrigation management.

Troubleshooting

Recognising and acting on salinity problems early is the best solution as soil salinity can be a more difficult and expensive issue to correct when well advanced. **Dryland salinity** outbreaks can be managed by excluding grazing on saline areas and sowing saline tolerant species. **Irrigation salinity** can be managed by improving irrigation management, specifically application efficiency. Specific management of salt-affected areas could include hill/bed shapes that minimise salt accumulation around seedlings, and pumping and recycling of groundwater (this requires advice from a hydrology consultant).



Department of
Primary Industries



Soil Biology Initiative II
Supported by the GRDC

The National Soil Quality Monitoring Program is being funded by the Grains Research and Development Corporation, as part of the second Soil Biology Initiative.

GRDC Grains Research & Development Corporation
Your GRDC working with you

The participating organisations accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.