

Vineyard activities 3: Measuring soil salinity

Current titles in this Vineyard activity guides Vitinote series include:

1. Taking soil samples
2. Measuring soil pH
3. Measuring soil salinity
4. Measuring organic carbon in soil
5. Assessing soil structure
6. Measuring soil porosity
7. Measuring soil strength
8. Measuring the infiltration rate of water into soil
9. Examining grapevine root systems
10. Monitoring soil moisture

Salinity is a measure of the concentration of soluble salts in the soil. Sodium chloride is the most common salt, others include bicarbonates, sulphates and carbonates of calcium, potassium and magnesium.

Some salts are useful (many fertilisers are in salt form), but too much salt of any kind is detrimental to plants and other organisms.

Vitis vinifera varieties are moderately tolerant of salinity (i.e. high total salts). However, a concentration of salts in the root zone that is too high can damage plant health and reduce crop yields.

A very high concentration of soluble salts can kill vines. Measurement of soil salinity is generally used to determine the salt status of a soil, particularly if vines are showing salt toxicity symptoms.

It is also used to gauge the impact on soils irrigated with saline water, particularly in combination with deficit irrigation.

Soil salinity is measured as electrical conductivity (EC) in units of decisemens (dS/m). Salt is extracted from the soil using one of two methods, the most accurate and reliable of which is the saturation extract, although this method must be completed in a soil testing laboratory.

Alternatively, measurement can be made in the vineyard using an inexpensive EC meter and a (1:5) soil and water suspension.

EQUIPMENT

- Portable handheld EC meter
- Plastic jars with screw-on lids
- Distilled or rain water
- Thermometer
- Recording sheet and pen

TIMING

Salinity testing is best undertaken when soil sampling is conducted. Make sure any surface soil samples are taken within the irrigation wetting pattern, although it may also be a good idea to take some mid-row samples as well.

Salinity in the root zone often comes from a saline water table, therefore the subsoil, and possibly a deeper level soil sample, should also be measured.

METHOD

1. Take three surface and three subsoil samples from each site (as described in points 1–5 in *Vineyard activities 1 - Taking soil samples*).

Make sure surface and subsoil are not combined so that they can be analysed separately.

2. Crush large aggregates and remove any gravel so you have a fine mix to test.
 3. Refer to instrument instructions and periodically calibrate the EC meter.
 4. Take jar lid and fill it level with soil. DO NOT COMPRESS THE SOIL. Pour into jar*.
 5. Add five jar lids of distilled water and screw lid on tight. Shake periodically over one hour.
 6. Let the mixture stand undisturbed for half an hour or a little longer if the suspension is not clear. If the suspension cannot be clarified, the measurement can still be taken in the knowledge that EC will be slightly overestimated (0.01–0.03 dS/m).
This error is acceptable for a field estimate that can be used to decide whether to submit samples for saturation extract analysis.
 7. Rinse the EC meter electrodes in rain or distilled water and dry gently with a tissue.
 8. Take a reading by immersing the electrode in the water above the settled soil as per manufacturer instructions. Make sure the electrodes are fully covered. Take care to minimise electrode contact with soil at the bottom of the jar.
 9. Allow reading to stabilise.
 10. Record EC value.
 11. Using thermometer record water temperature.
 12. Rinse electrode on the EC meter between each reading.
- *If you have scales and volumetric flask then the accuracy of the 1:5 soil to distilled water ratio can be improved by using 20g of air-dried soil and 100ml of distilled water. Jar lids are used in the field when scales are not available.

INTERPRETING RESULTS

If the soil water solution was not at 25°C at the time of measurement then an approximate correction has to be applied (unless the meter has an automatic correction, check the manufacturers instructions):

- Increase the EC value by 2% for each degree above 25°C.
- Decrease the EC value by 2% for each degree below 25°C.

The tables below indicate the salinity hazard for grapevines measured as described above ($EC_{1:5}$) and also as recorded by laboratory soil-water saturation extract tests (EC_{se}).

Salinity hazard	Measured as $EC_{1:5}$ (dS/m)			Effect on vines
	Sandy Loam	Loam	Clay	
Non-saline	<0.15	<0.17	<0.4	None
Slightly saline	0.16–0.3	0.18–0.35	0.41–0.8	Own-rooted affected
Moderately saline	0.31–0.60	0.36–0.75	0.81–1.6	Some rootstocks tolerate
Very saline	0.61–1.2	0.76–1.45	1.6–3.2	No vines grow
Highly saline	>1.2	>1.45	>3.2	Vines die

If $EC_{1:5}$ values exceed 0.15 dS/m (sands), 0.18 dS/m (loams) or 0.3 dS/m (clays), then you should submit soil samples to a commercial laboratory for saturation extract analysis.

USEFUL CONVERSIONS

You may wish to convert your EC measurements to other units. Below are some conversions.

- 1 dS/m = 1 mmho/cm
- 1 dS/m x 640 = 1 ppm salt (approximate)
- = 1 mg/l salt (approximate)
- 1 dS/m x 1000 = 1 μ S/cm
- = 1 EC unit

Salinity hazard	Measured as saturation extract EC _{se}	Effect on vines
Non-saline	<2	None
Slightly saline	2–4	Own-rooted affected
Moderately saline	4–8	Some rootstocks tolerate
Very saline	8–16	No vines grow
Highly saline	>16	Vines die

Both tables modified after Cass.

FURTHER INFORMATION

Product or service information is provided to inform the viticulture industry about available resources, and should not be interpreted as an endorsement.

The information in this Vitinote has been trialed by viticulturalists as part of the Cooperative Research Centre for Viticulture's Viticare On Farm Trials project. For information about On Farm Trials, visit www.crcv.com.au/viticare/

A key reference on these topics is:

- Nicholas P (Ed.) (2004) Soil, irrigation and nutrition, Grape Production Series 2, SARDI, Adelaide.

Another useful reference is:

- Nicholas, P, Magarey PA and Wachtel M (Eds.) (1994) Diseases and pests, Grape Production

Series 1, Hyde Park Press, Adelaide (a glove box edition of this book is also available).

Both of these publications are available from Winetitles, 08 8292 0888, or visit www.winetitles.com.au

See also:

- Cass A, (1998) Measuring and managing chemical impediments to growth. Australian Grapegrower and Winemaker, July 1998, pp13-16.
- Rayment GE and Higginson FR, (Eds.) (1992) Electrical conductivity, in Australian laboratory handbook of soil and water chemical methods, Inkata Press, Melbourne, pp15-16.

Water management for grapevine production: Research to Practice® and *Grapevine nutrition: Research to Practice®* are training programs whose delivery can be fine-tuned to suit each region. They include topics on soil management issues.

Visit the web site at www.crcv.com.au/viticare/vitinotes/ for updates and more Vitinote titles.

ACKNOWLEDGEMENTS

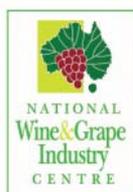
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