

## Vineyard activities 4: Measuring organic carbon in soil

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

Soil organic matter is material in the soil derived from living species.

This includes the decomposing remains of plants and animals in various stages of breakdown, the cells and tissues of soil organisms, and substances made by plant roots and soil microbes.

Well-decomposed organic matter forms humus: a dark brown, porous, spongy material that has a pleasant, earthy smell.

Soil organic matter is generally measured as the amount of carbon in the soil.

There are many beneficial roles that soil organic matter plays in soil:

- Provides food for soil microbes
- Provides nutrients to plants (particularly nitrogen, phosphorus and sulfur)
- Stabilises soil structure and increases water holding capacity
- Makes it easier for water to enter the soil
- Reduces run-off and erosion
- Improves the soil's ability to hold nutrients thereby reducing pollution potential

- Helps buffer the soil against changes in pH
- May protect plants against disease

Many factors affect soil organic matter levels:

- Soil depth – the organic matter content generally decreases as you dig deeper
- Soil type – sandy soils generally have lower soil organic matter than heavier soils such as loams
- Management practices – excessive cultivation reduces organic matter levels
- Temperature – organic matter breaks down quicker in hot climates compared with cool climates
- Soil water content – organic matter breaks down quicker in moist soil (though not permanently saturated) compared with dry soil

Organic matter can be split into separate types or 'pools'. Each pool has a different function in the soil. The main pools are outlined in the table over the page.

Organic matter pool	What is it?	What does it do?
Microbial biomass	Bacteria and fungi (i.e. the living part)	Decomposes the organic matter
Light fraction	Organic matter that has recently be incorporated	Food for microbes, releases soil nutrients
Soluble organic matter	E.g. root exudates	Moves through the soil profile – Binds soil particles, available for plant uptake
Protected organic matter	Protected chemically or physically	Can't be decomposed by microbes
Inert organic matter	E.g. charcoal	Does not breakdown, but helps soil structure
Humus	Well decomposed organic matter	Supplies nutrients

## EQUIPMENT, TIMING AND METHOD

The same as described in *Vineyard activities 1 - Taking soil samples*.

## ANALYSIS

The analysis of soil organic matter status will have to be carried out in a laboratory. Laboratories determine organic carbon levels in two ways:

1. Loss on ignition – the soil is heated at very high temperatures and the organic matter is essentially 'burnt off'. This results in an estimation only of the organic content.
2. From organic carbon measurements – carbon compounds are determined by laboratory instruments and then converted to soil organic matter levels using a simple calculation. This method is more accurate.

## OPTIMAL VALUES

There is very little information about organic matter levels in vineyards; most of the work in this area has been done in pasture or cropping situations.

The values in the table below are a rough guide to the general organic matter levels (%) considered to be high, medium and low in several different soil types in South Australia.

Rather than comparing the level of organic matter to a set of values such as the one above, it might

	Sand	Sandy loam	Loam	Clay loam/ clay
<b>Low</b>	0.9	1.2	1.6	2.1
<b>Moderate</b>	0.9–1.7	1.2–2.4	1.6–3.1	2.1–3.4
<b>High</b>	>1.7	>2.4	>3.1	>3.4

Adapted from Baldock and Skjemstad

be better to compare results from different sites within the vineyard, remembering that in a very general sense more organic matter usually means a 'healthier' soil. It is also worthwhile noting that:

- most Australian soils are low in organic matter by world standards — a reflection of our geological/biophysical history and our climate.
- it can be difficult to increase the (stable) fraction of organic matter in a soil. Organic materials like mulch or straw usually have to be applied at high levels (several tonnes per hectare) for many years to increase organic carbon levels appreciably.
- when looking at options to maintain or raise organic matter levels, consider growing grasses and other plants with fibrous root systems in the vineyard. The roots of such plants and their attendant soil micro-organisms are significant contributors to organic matter levels within the soil.

## ACKNOWLEDGEMENTS

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## 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/](http://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](http://www.winetitles.com.au).

- Baldock JA and Skjemstad JO, (1999) Soil Organic Carbon/Soil Organic Matter, in Soil Analysis: an Interpretation Manual, Eds. Peverill, KI, Sparrow, LA and Reuter, DJ, CSIRO Publishing, Melbourne, pp 159-70.

*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.

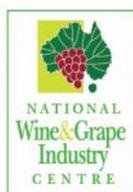
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