

How to assess vineyard soil health

what is soil health and why is it important?

Soil health reflects the ability of a soil to function properly to support plant growth. It comprises the physical, chemical and biological properties of the soil. Soil microbes are vital to the:

- break-down of organic matter and release of nutrients into plant available forms
- suppression of soil borne diseases
- maintenance and improvement of soil structure
- degradation of chemical compounds

SOIL MICROBES ARE ESSENTIAL TO SOIL AND PLANT HEALTH BY MAINTAINING SOIL STRUCTURAL STABILITY AND NUTRIENT AVAILABILITY

how is soil health measured?

A number of commercial service providers offer soil health tests for a fee. Basic soil health tests can cost anywhere from \$90 to \$450 per soil sample, and can include analytical methods such as respiration, microbial counts and molecular technology. The main biological indicators examined in current soil health tests include:

- **Total active microbial biomass**, which is the total population of microbes in the soil involved in mineralisation (decomposition of organic matter into nutrients).
- **Bacteria**, which are involved in nutrient cycling and which degrade quickly and act as a food source for other organisms.
- **Fungi**, which are associated with decomposition of plant material and bind soil particles together for soil structural stability.
- **Protozoa**, which feed on bacteria and play an important role in mineralising nutrients and making them available for use by plants and other soil organisms.
- **Beneficial nematodes**, which are abundant in vineyard soils and are not harmful to the vine. They feed on bacteria or fungi to release nutrients and hence influence decomposition and nutrient turnover in soils.

- **Mycorrhizal fungi**, which form beneficial associations with plant roots by enhancing uptake of essential nutrients in grapevines.

how do I collect vineyard soil samples?

- Greatest microbial activity occurs in the actively growing vine root zone. Take core samples to 20 cm depth, 40 cm from the vine trunk along the row, and 20 cm into the mid-row. Avoid areas of compaction.
- Collect a minimum of 20 cores with a soil auger (>50mm diameter auger is ideal) ensuring roots are included in the sample, and mix all cores thoroughly to provide one representative vineyard sample of 500g in a sealed plastic bag.
- Store samples away from direct sunlight and heat, and send to the service provider as quickly as possible for testing. Check with the service provider regarding any bio-security requirements when sending soil samples.
- Soil analysis can be conducted at anytime during the year, however soil microbial activity in vineyards will generally be at its peak post-flowering time when vine roots are actively growing.

- Sample annually to provide comparative results between years. Collect soil samples at the same time each year from the same vineyard block. Avoid sampling following the application of any soil additives such as fertilisers, composts or biological treatments which may cause a sudden rise in microbial activity.



what do soil health tests tell us?

Soil health tests measure living organisms in the soil. Desirable levels may be suggested by the service provider, although soil biology levels can change quickly over time. Biological soil properties reflect changes in soil management practices and environmental conditions. Soil microorganisms (fungi bacteria) and microfauna (protozoa, nematodes) are sensitive to changes in organic matter. Soil organic matter is essential for nutrient cycling and soil structural stability, but is difficult to measure directly as it changes slowly over time.

Key factors to consider when assessing soil health tests are:

- **Total active microbial biomass.**

This is measured by the amount of carbon produced per soil volume. It responds much more rapidly to changes in soil management and gives an early indication of changes in organic matter before they can be detected by chemical analysis. Total active microbial biomass increases with increasing organic matter content of the soil.

- **Fungi:Bacteria ratio.**

This ratio compares the levels of these microorganisms and reflects decomposition of organic matter and the rate of nutrient cycling. Fungi can breakdown woody organic matter and degrade cellulose and lignin from plant material, so are likely to survive long periods. Bacteria are involved in early stages of decomposition and populations respond rapidly to changes in the soil moisture, temperature and carbon.

- **Nematodes.**

These are measured by abundance, diversity and community structure. The nematode type indicates what the nematode feeds on (e.g. bacteria, fungi, plant) and the different ratios reflect the type of soil functions that are occurring.

- **Mycorrhizal fungi.**

These fungi are measured as a percentage of root colonisation, and assist nutrient and water uptake. Therefore the higher the percentage, the better the colonisation and potential uptake of nutrients. The presence of mycorrhizae can also be measured by spores or the production of the compound glomalin in soil.

- **Protozoa and other bacteria.**

Counts of these organisms may be included in some tests. Populations relate to soil conditions such as aeration (e.g. poor drainage encourages undesirable anaerobic bacteria) and soil structure (actinobacteria degrade chitin, cellulose and toxic material).

how do I use soil health test results?

- Select one commercial service provider to obtain consistent data over time. Consult a reputable agronomist to obtain information on the various service providers available in Australia.
- Soil characteristics (e.g. soil type, pH, depth, nutrient status) greatly influence the population and composition of soil microbial communities. Therefore these tests are best used to monitor changes in soil management practices over time in the same vineyard block.
- The interpretation of soil health data is site specific. Often soil health recommendations are generalised, therefore consult a local reputable agronomist to provide recommendations based on a combination of soil physical, chemical and biological tests.



This fact sheet was prepared by Dr Belinda Rawnsley of the South Australian Research and Development Institute (SARDI), recipient of the 2009 Geoff Knights Viticulture Innovation Award, as part of a Barossa project on soil biological testing in vineyards. The Geoff Knights Viticulture Innovation Award is an initiative of the Barossa Viticultural Technical Group, and is proudly sponsored by Elders Ltd, Barossa Grapegrowers' Vine Selection Society and Grape Barossa.



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