



## SERVICES OFFERED

# ASSESSING SOIL QUALITY

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## Introduction

What is soil quality?

For agricultural and horticultural production systems, soil quality is a combination of *physical properties* such as soil texture, *chemical properties* such as pH and mineral nutrient content, and *biological properties* including living biomass and mineralisable N. All of these properties are profoundly influenced by the soil organic matter and soil type.

The **Basic Soil Profile (BS)** reports *chemical properties* related to soil quality:

- pH
- cation exchange capacity (CEC) and extractable nutrients.

The **Organic Soil Profile (OrgSP)** includes some additional tests that allow an assessment of the *biological properties*.

Along with the more sensitive **Hot Water Extractable Carbon (HWEC)** test, a dataset for estimating and monitoring soil quality or health is obtained. The OrgSP suite focuses on the soil organic matter fraction and comprises the following tests:

- organic matter (total carbon)
- anaerobically mineralisable nitrogen (potentially available nitrogen)
- total nitrogen
- carbon:nitrogen ratio
- anaerobically mineralisable nitrogen:total nitrogen ratio

The quantity and nature of organic matter is highly dependent upon farming practices and climatic conditions. Factors known to affect the build up or depletion of soil organic matter are listed below:

### Organic Matter Accumulation

Grass/clover pasture  
Moist summer growing conditions  
Direct drill/no tillage  
Incorporation of crop residues  
Controlled Grazing  
Friable soil structure, good root density  
Moderate N fertiliser application  
Green manure/cover crops

### Organic Matter Depletion

Bare soil/fallow  
Summer drought  
Intensive cultivation  
Removal or burning crop residues  
Overgrazing  
Compacted soil, shallow root zone  
Excessive N fertiliser applications  
Erosion

## Hot Water Extractable Carbon (HWEC)

While the total organic matter and the C:N ratio (determined from total carbon and total nitrogen) are useful as a guide to soil quality and the likely rate of organic matter mineralisation, they are fairly imprecise indicators. Small changes in the quantity and nature of the soil organic matter can substantially affect soil quality and fertility, but are not always apparent from the total N and C tests.

A better determinant of soil quality would be soil microbial biomass Carbon, but analysis of soil microbial biomass is time-consuming and expensive.

Trials have shown that Hot Water Extractable Carbon (HWEC), the labile fraction of the soil Organic Carbon pool, correlates strongly with soil microbial biomass C. HWEC is now offered by Hill Laboratories.

The HWEC test provides a robust measure of the more labile soil carbon fraction and has been shown to be sensitive to subtle changes in soil quality that occur due to farm management practices and climactic effects.

Researchers have shown the HWEC test to be an indicator that is sensitive to changes due to fertilisation and grazing as well as physical modification to soils e.g. humping/hollowing and flipping. Differences between ecosystems have also been described, whereby HWEC is generally higher in low intensity soil-plant systems than those under intensive usage, following a decreasing pattern for soils: native>drystock>dairy>cropping>market gardens (for the same soil type).

## Soil Texture

A sub-contracting service is available for the soil texture test (%sand,%silt,%clay) as a key soil *physical property*. Otherwise, qualitative measures such as the “feel test” for soil texture described by Plant & Food Research or Landcare Research (Visual Soil Assessment scorecard) will be indicative. A range of visual characteristics of soils and plants will be useful adjuncts to the soil chemistry and biological indicator tests as measured in the lab soil test.

## Conclusion

A profile of related tests is offered, to better assess the overall quality of a soil. Most of the tests have been offered for many years, but the Hot Water Extractable Carbon is a new service as from 2017. Refer also to a related Technical Note – Laboratory Tests for Soil Carbon and also Technical Note – Organic Soil Profile for more detail and the references supporting these test methods.

The test codes to request are shown in the following table.

Profile or Test Name	Test Code	Includes
Basic Soil + SO4	BS, SO4	pH, Olsen P, Exchangeable Cations (Ca, Mg, K, Na), Cation Exchange Capacity, %Base Saturation, Volume Weight and Sulphate-Sulphur
Organic Soil profile	OrgSP	Organic Matter (from Total Carbon), Total Nitrogen, Potentially Available N (AMN) and CN ratio
Hot Water Extractable Carbon	HWEC	Hot Water Extractable Carbon

## Contact

Please contact an Agriculture Client Services Manager for further information or visit our website to order sampling kits.