

## SOIL NITROGEN TESTS

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### Introduction

Management of Nitrogen (N) in farming systems is of importance in both achieving sustainable production and maintaining our environment. Whether fertiliser Nitrogen is applied or growers are attempting to use a “biological” approach without additions of synthetic N, soil testing may be useful in quantifying nitrogen potentially available for growing plants.

Hill Labs have invested significantly in NIRS instrumentation and the associated calibration to allow fast turnaround-time for several soil tests. The NIRS method will be the default method used, but a “codeswap” to the reference method will be driven by qualification criteria. The *Organic Soil Profile* measuring nitrogen and organic matter, with ratios, has been created to provide additional information on the biological activity in the soil.

### Soil Nitrogen Tests Available

- **Potentially Available Nitrogen (AN) [also known as Anaerobic Mineralisable Nitrogen—AMN]**

This test is a measure of Nitrogen mineralised under specific laboratory conditions (anaerobic incubation at 40°C for 7 days). The actual amounts of nitrogen that will be mineralised in the field will depend on factors such as soil temperature and moisture. *The results are reported as kg/ha assuming a 150mm sample depth for potentially available-N (AN), or ug/g for anaerobic mineralisable-N (AMN).*

**N.B.** This test is measuring any free ammonium-N **and** the readily mineralisable N fraction. Some laboratories subtract the free ammonium-N from the mineralisable fraction but this step is omitted at Hill Labs, as the value is usually very low and would incur a higher test cost. Note this test name was previously reported as “Available N” but the method remains unchanged.

- **Hot Water Extractable Organic Nitrogen (HWEONir/HWEON) & Potentially Mineralisable N (PMN)**

A new test introduced in December 2019, the Hot Water Extractable Organic Nitrogen (HWEON) test has been shown by researchers to be a very good test to derive the potentially mineralisable Nitrogen (PMN) in soils, to aid with Nitrogen fertiliser decisions for crop soils. This new test (HWEON) is thought to be an improvement on the AN/AMN tests described above. Ongoing research will be undertaken to demonstrate this, and may result in replacement of the AN/AMN test in the future. As for AN(AMN), the actual amounts of nitrogen that will be mineralised in the field will depend on factors such as soil temperature and moisture.

*Results are reported as HWEON (mg/kg) and also calculated to PMN (mg/kg). An additional calculated result as PMN kgN/ha is also available, using the client supplied sample depth (assumes 150mm if no depth provided) and the lab volume weight as a proxy for field bulk density. The PMN profile (PMNp) is required for this additional reporting expression.*

- **Total Nitrogen (tNNir/tN)**

This test measures the total Nitrogen in the soil by way of the Dumas combustion method. This measure includes Nitrogen that is unavailable to the plant but is useful in determination of Carbon: Nitrogen ratios. In some cases, tN can be used as an input value in decision support tools where field-calibration for the landuse has been carried out by research.

- **Organic Soil Profile (OrgSP)**

The objective of creating the *Organic Soil Profile* is to quantify some aspects of soil quality that may be influenced by management practices. Ratios are included as these are useful as indicators of the rate of biological activity in the soil at the time of sampling.

The tests in the profile are: **Organic Matter (from Total C), Total Nitrogen (TN), Potentially Available Nitrogen (AN & AMN) and ratios C/N and AMN/TN.**

- **Mineral Nitrogen Profile (MinN)**

Also referred to as “Deep Soil Mineral N”, this profile includes the mineral Nitrogen fractions of nitrate-N and ammonium-N measured on **freshly collected soil**. It represents the Nitrogen available to plants at the time of sampling and does not include any measure of potentially mineralisable Nitrogen. It is frequently used for cropping soils at a range of sampling depths and incorporated into models to estimate Nitrogen fertiliser requirements for the growing crop. Unless samples can be received at the laboratory within 4 hours of collection, they should be kept cold to prevent biological mineralisation occurring in the soil while in transit to the laboratory. This biological effect is generally lower on low Organic Matter soils, where the Mineral N is usually also quite low. The main objective of keeping the samples chilled, is to minimise any warming of the soil to more than the ground temperature at the time the sample was taken. A Dry Matter (soil moisture) test is also measured, as the Mineral N values are reported on a dry-weight basis.

- Hill Labs require a minimum of 150g of soil per sample to work with for the Mineral N profile (NO<sub>3</sub>-N, NH<sub>4</sub>-N and Dry Matter). Where other tests are also requested, a minimum of 500g fresh soil is required.
- Sample bags should be labelled with indelible pen, so the identification will not erase with water.
- Once the samples are collected, they must be sent to the laboratory immediately (if they can be received at the laboratory within 4 hrs)
- Ideally, samples are chilled and then packed into a chilltainer with frozen icepacks and sent by courier to Hill Labs. It is advisable that samples be kept chilled near to 4degC or less, to minimise any mineralisation that may occur. Freezing samples is not highly recommended (can result in a flush of mineralisation on thawing in some soils), but may be necessary if samples are to be in transit overnight.
- North Island samples should be sent to the Hamilton branch of Hill Labs
- South Island samples should be sent to the Christchurch branch of Hill Labs

## Other

NOTE: Hill Labs now uses Near Infra-Red Spectroscopy (*NIRS*) for some soil nitrogen and soil carbon measurements, allowing faster turn-around time. The method text page of the soil test report describes which method has been used for the analysed sample. The conventional test method can be requested via quote.

Further explanatory information is available to help with interpretation of these tests in **Technical Notes “Soil Quality Tests”, “Understanding Soil Nitrogen Tests” and “Analysis of Soils Using Near Infra-Red Spectroscopy (NIRS)”**.

All tests are available as either individual tests or in conjunction with other profiles. Visit the website [www.hill-laboratories.com](http://www.hill-laboratories.com) or contact the laboratory for guidance on how to request these tests or to ask about pricing information