

# SOIL TESTING FACT SHEET

## Nitrogen soil testing for in-season fertiliser application

Many changes in soil mineral nitrogen occur between the pre-sowing period and once plants are established

### KEY POINTS

- Deep N testing during the crop tillering stage helps to understand N pool available to plant for growth, taking into consideration mineralisation of organic matter.
- Complete deep N testing at or just prior to crop growth stage 31, typically mid to late July depending upon the time of sowing and emergence.
- Fertiliser N application levels depend on the nitrogen demand of the crop (target yield and grain protein) and N supply remaining in the soil.
- Take six deep cores down to approximate rooting depth to get a representative sample of the soil N profile.
- Keep samples cool and dispatch for testing as soon as possible to ensure mineralisation does not occur within the bag.
- By ensuring N is applied during the season, this reduces the reliance on N mining from the soil reserves during spring.

Plant N demand increases at growth stage 31 (GS31), so it is important to understand the N available in the soil at this stage.

N plays an essential role in the production of chlorophyll and deficiency is displayed as yellowing leaves, reduced tillering and ultimately reduced crop yields and protein.

Although most of the N in the soil is in the top layer rich in organic matter, crops can take up significant amounts from

Photo: AgCommunicators



Deep N testing, along with plant tissue testing, at GS30 helps to understand the nitrogen pool available to the crop for growth.

deeper layers, especially if the topsoil dries out during the growing season and there is moisture at depth. Testing N to depth provides a detailed profile of mineral N throughout the subsoil layers and can help diagnose any potential crop production constraints.

Sampling to depth provides a good picture of the N pool available to a plant for uptake during the growing season and aids in efficient N fertiliser use and management.

### Soil nitrogen supply

Plants only take up N in organic or mineral forms. About 95 to 98 per cent of N present in the soil is in an organic form

which is mineralised by microbes into ammonium and nitrate for use by plants during the growing season.

On average, an wheat crop must take up 20 to 25kg-N/ha to produce 1t/ha yield at 11 per cent protein. This means about 40kg/ha of N as fertiliser needs to be applied to crop assuming a 50 per cent uptake efficiency.

**Sampling to depth provides a good picture of the soil mineral nitrogen pool available to a plant for uptake during the growing season and aids in efficient nitrogen fertiliser use and management.**

## Why should deep N testing be completed?

**Fertiliser N application = N demand of the crop – N supply in the soil.**

The N demand of a crop depends on the target yield and grain protein percentage.

Estimating the amount of available soil N can be done by soil testing. After dry conditions, long fallow, pulse crop or pasture, soil tests are the most reliable method.

Soil tests conducted prior to sowing will not account for late fallow mineralisation and in-crop mineralisation.

The plant's access to N at depth depends on many variables including seasonal rainfall distribution, soil type and location.

## How to collect a deep N sample

Using a ute-mounted hydraulic ram probe is ideal for sampling however, is not often easily available for growers. An auger can also work well unless the ground is very rocky.

Photo: AgCommunicators



A ute-mounted hydrolic ram probe is ideal for deep N sampling in-season.

Photo: AgCommunicators



Deep N core soil sample taken using hydraulic ram probe.



Mix samples in a bucket to get a representative sample of the soil nitrogen profile.

Photo: AgCommunicators



Place the deep N soil sample in a plastic bag and keep cool to reduce any risk of mineralisation.

Take in-season deep N samples at the same time each year (usually around mid-late July) for comparison, as N levels can be highly variable throughout the year.

Aim to sample at least a week prior to growth stage 31 to allow for transport of sample and lab analysis.

### Tips for deep N sampling

- In each production zone, normally determined when sampling in summer or autumn, take six deep cores
- Sample in-row where the plants are growing to access the N bucket which is available to the growing plants
- Record GPS location of the sample area (this should be the same area as the sampling area used for pre-season sampling)
- Ideally, take core samples to approximate rooting depth to get a representative sample of the soil N profile, if there is enough moisture through the profile. Segmenting core

samples into 0-30cm and 30cm-rooting depth would be encouraged if budget allows and if there is no subsoil moisture.

- Remove the sample from the tube and push the core onto a collection tray (see picture below)
- Cut the core lengthways to reduce the amount of soil sampled for ease of mixing
- Thoroughly mix the core samples in a bucket, breaking up any clods
- Place a sub-sample of the well-mixed samples into clean plastic bags

Keep samples cool in an esky or fridge and dispatch samples for testing as soon as possible via Express Post as mineralisation can occur in warm moist soils which will change the mineral N values.

Also record any symptoms of disease, weather conditions, crop rotation, fertiliser history and any recent fertiliser applications.

## Things to avoid when sampling

- Avoid areas which may have abnormal soil nutrient levels and are not representative of the zone, including headlands, watering troughs, old fertiliser dumps, beneath trees, fence lines, roads, tracks and stock camps
- Do not place samples in metal containers as this will contaminate the sample's micronutrient levels. Use plastic bags provided by the lab.
- Do not sample in very wet conditions and avoid contaminating the sample, sampling equipment and sample storage bag

## Using the results from deep N testing

The results from deep N testing can help create an in-season fertiliser nitrogen budget depending on target yield and grain protein percentage.

By ensuring N is applied to the crop in-season, this reduces the reliance on N mining from the soil for crop production, reducing the degradation of the organic N pool and soil organic carbon which is used by soil microbes.

N use efficiency can be improved by delaying fertiliser application until the crop's roots system is adequately developed.

Later N applications during stem elongation can also have yield benefits through increased tiller survival, leaf duration and photosynthetic area. An advantage of late applications is that

growers have a better idea of yield potential before applying the N.

The efficiency of a N regime can be assessed through the grain protein percentage following harvest.

If soil acidity is an emerging problem, deep N samples can also be used to monitor soil pH and aluminium levels at depth.

Use this factsheet in conjunction with the GRDC 'Plant tissue testing as part of a soil testing strategy' fact sheet.

## GRDC RESEARCH CODE

ASO1805-001RTX

## USEFUL RESOURCES & REFERENCES

### GRDC update paper: Dig deep for nitrogen picture

[www.grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-103-mar-april-2013/dig-deep-for-nitrogen-picture](http://www.grdc.com.au/resources-and-publications/groundcover/ground-cover-issue-103-mar-april-2013/dig-deep-for-nitrogen-picture)

### GRDC communities: Dig deeper to know nutrient levels

<https://communities.grdc.com.au/crop-nutrition/dig-deeper-know-nutrient-levels/>

### Soil Quality: Soil Nitrogen Supply

<http://soilquality.org.au/factsheets/soil-nitrogen-supply>

## MORE INFORMATION

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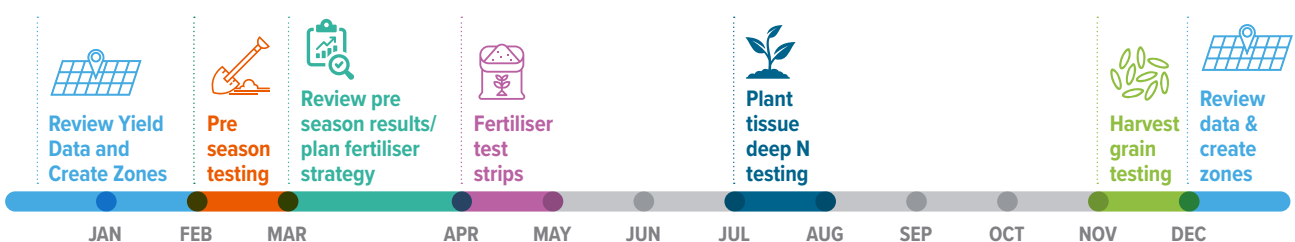
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## SOIL AND PLANT TESTING STRATEGY



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