Seasonal soil moisture and nitrogen availability

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Key points

- Soils in the Rutherglen region of Victoria are highly variable.
- Most soils across the region increase in clay content in the subsoil, which has a limited capacity to supply water to plant roots.
- The distribution of plant-available nitrogen (nitrate-nitrogen) throughout these soils is variable, with some soils having a high concentration of nitrogen (N) near the soil surface, while others store nitrogen at depth.
- Sampling for deep soil nitrogen (DSN) by combining all soil from 0–60cm depth does not give a clear picture of where nitrogen is located throughout the profile.

Background

During June 2015 the North East Catchment Management Authority (NECMA) with funding from the Australian Government's National Landcare Programme, enabled Riverine Plains Inc to install and monitor soil moisture probes in cropping paddocks at 11 sites across the Rutherglen region of Victoria through the *Soil Moisture Probe Network Project*.

The objective of this project was for growers to understand how knowledge of stored soil moisture can inform their decisions about applying fertiliser. For example, if the soil profile has sufficient moisture, growers might decide to apply enough nitrogen during spring to satisfy the full crop requirement. However, if there is limited stored soil moisture, growers might only apply a smaller amount of fertiliser, as the crop would be entirely dependent on opportune rainfall events to take it through to harvest.

In addition, measurements of DSN post-harvest and pre-sowing means the amount of nitrogen mineralised during summer can be accounted for when planning the nitrogen strategy for the following season.

The Sustainable Agriculture Victoria: Fast-Tracking Innovation initiative made possible with the support of the Foundation for Rural and Regional Renewal (FRRR) together with the William Buckland Foundation allowed the sampling of DSN (broken into incremental depth samples) at each of these sites. By connecting the results from soil nitrogen sampling to soil moisture status, growers can predict if the stored nitrogen will be available to the crop through the year, or if it will be lost through leaching (due to accumulation of nitrogen at depth under high soil moisture conditions).

Aim

The aim of this project was to increase our understanding of nitrogen availability and movement across, and between, seasons and to appreciate how nitrogen availability is intimately related to soil moisture status.

Method

Soil moisture probes were installed at 11 sites across the Rutherglen region during June 2015. Probes were removed during harvest (November 2015) and in preparation for sowing (late March 2016).

Each probe measured up to four depth intervals (10, 30, 50 and 90cm below the soil surface), with values logged every two hours. The data was manually downloaded from each probe on a regular basis. Gaps in the dataset occurred if the probe was damaged.

Deep soil nitrogen sampling was carried out at each of the soil moisture probe locations during June and December 2015, and April 2016 (Figure 1). The June sampling was carried out at a time when many growers across the region undertake DSN sampling to identify how much nitrogen they need to apply to meet crop demand through spring. The December sampling, post-harvest, provided a measure of post-crop residual nitrogen, and the April sampling provided information on the amount of nitrogen lost or mineralised (becoming more plant-available) during the summer months; ready for sowing.

Sampling at each of the 11 soil moisture probe sites consisted of one core sample, which was split into increments (0–10, 10–20, 20–30, 30–60 and 60–100cm) before being submitted to the laboratory for analysis of mineral nitrogen (nitrate + ammonium) and total nitrogen (includes organic and inorganic forms — i.e. the total nitrogen soil bank).

FIGURE 1 Locations of the 11 soil moisture probes installed across the Rutherglen area

By measuring both mineral nitrogen and total nitrogen growers can appreciate the role of organic forms of nitrogen in cycling and mineralisation processes.

As the nitrogen samples collected were not replicated, they cannot be statistically analysed. As such, the results presented provide an indication of nitrogen availability, however as they are sampled from one point in the paddock, there is the possibility the results are not representative of the rest of the paddock.

Results

Soil moisture and available nitrogen

Please note the graphs included in this section have not been plotted on a common axis, so take care when comparing the values between sites.

The laboratory results for the ammonium fraction were highly variable and potentially unreliable. As such, they have been excluded from the analysis, with just the nitrate-nitrogen fraction of mineral nitrogen being presented.

The monthly rainfall data for Rutherglen is presented in Figure 2 to provide context to the soil moisture results presented. While there was plentiful rainfall during winter, spring was dry. The rainfall during December and January contributed to replenishing stored soil moisture, however there was little follow-on rainfall during February and March.

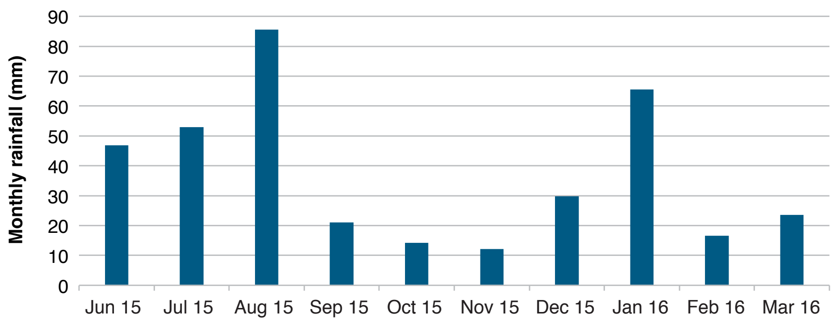

FIGURE 2 Monthy rainfall recorded at Rutherglen, June 2015–March 2016

Location: Springhurst/Lilliput

2014 crop and stubble practice: Wheat, stubble burnt

2015 crop and yield: Wheat, 3.9t/ha

2015 nitrogen applied: 9kg N/ha MAP, 37kg N/ha urea

Timing of 2015 in-crop nitrogen application: Mid-June

2015 stubble management (post-harvest): Stubble burnt

Soil moisture was non-limiting throughout most of the 2015 cropping season at Springhurst/Lilliput, Victoria, until the season dried off during September, at which point soil moisture started to withdraw down to 50cm. Rainfall during November wet the profile somewhat, to a depth of 30cm, however the soil had dried out in the top 10cm layer by sowing (Figure 3).

The June 2015 nitrogen sampling showed a large bulge of nitrate (plant-available nitrogen) at 30–100cm depth, which is likely due to accumulation of nitrogen over time, (Figure 4). This bulge largely disappeared by the post-harvest sampling, with limited nitrogen remaining by the pre-sowing sampling. While the crop may have used some of this DSN, it is likely at least some of the nitrogen in the 60–100cm layer was lost through leaching while soil moisture levels were high throughout the season.

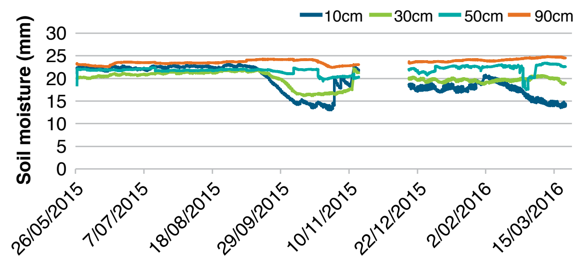

FIGURE 3 Soil moisture levels at Springhurst/Lilliput, Victoria June 2015–March 2016

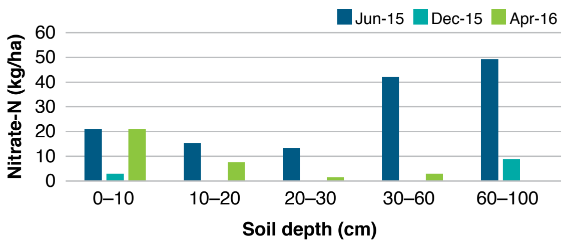

FIGURE 4 Plant-available (nitrate) soil nitrogen levels, at Springhurst /Lilliput, Victoria June 2015–April 2016

Location: East Rutherglen

2014 crop and stubble practice: Canola, stubble burnt

2015 crop and yield: Wheat, 5t/ha

2015 nitrogen applied: 8kg N/ha MAP, 101kg N/ha urea

Timing of 2015 in-crop nitrogen application: Late July, early August

2015 stubble management (post-harvest): Stubble burnt

The East Rutherglen site maintained high soil moisture levels through the season, until mid-September 2015 when the season turned dry (Figure 5). While the 10cm soil layer showed strong extraction of stored soil moisture, only a small change is seen at 30cm, due to the high subsoil clay content at this site. However, the large decrease in plant available soil nitrogen (nitrate-nitrogen) from June to December 2015 (post-harvest) indicates plants were extracting nutrients (and therefore water) to a depth of at least 60cm.

The June 2015 nitrate-nitrogen sampling showed a large amount of nitrogen (170kg N/ha) at the 0–10cm depth before 101kg N/ha was applied as urea during late July/ early August (Figure 6). This indicates plants potentially had access to 271kg N/ha during late winter. As it was quite wet at this time, it is likely some of this nitrogen was lost as gaseous-nitrogen due to denitrification (gaseous-nitrogen loss), while the rest was taken up by the crop. Conversely, the lack of change in DSN (60–100cm) indicates that while the crop may not have used this nitrogen, it is unlikely to have leached deeper due to the high clay content at this site. Summer mineralisation resulted in almost 40kg N/ha available to the following crop.

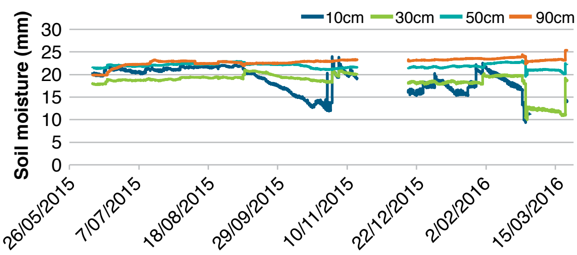

FIGURE 5 Soil moisture levels at East Rutherglen, Victoria June 2015–March 2016

* The sharp drop in soil moisture in late February is due to a damaged probe.

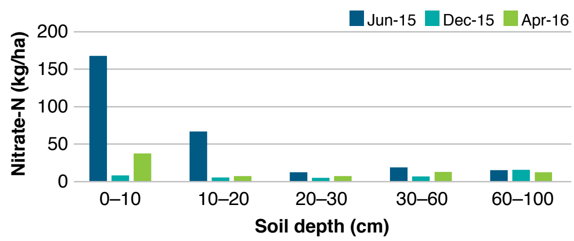

FIGURE 6 Plant-available soil nitrogen levels, at East Rutherglen, Victoria June 2015–April 2016



Location: Wahgunyah

2014 crop and stubble practice: Canola, stubble burnt

2015 crop and yield: Wheat, 4.25t/ha

2015 nitrogen applied: 46kg N/ha urea, 27L N/ha Sulsa (liquid urea — 100L/ha of product applied)

Timing of 2015 in-crop nitrogen application: Granular urea during June, liquid during August

2015 stubble management (post-harvest): Stubble burnt

The Wahgunyah site maintained high soil moisture through the season until mid-September, at which point the crop started to run the soil moisture levels down (Figure 7). Although a soil pit was not available at this site, it appears to be free draining and lighter textured down to at least 50cm, with plants accessing moisture down to 50cm with ease. The fact the 50cm layer had a large range between the upper and lower limits (field capacity and permanent wilting point) indicates a lighter texture, compared with the previous site at East Rutherglen, which is known to have a high clay content.

The June nitrate-nitrogen samples show an accumulation in the 0–10cm soil layer, with little nitrogen at depth (Figure 8). As plants can freely extract water down to at least 50cm, it is likely the crop extracted nutrients from that layer also, which is supported by the absence of detectable nitrate-nitrogen in the 30–60cm soil layer. The lack of change in nitrate-nitrogen levels at the 60–100cm layer indicates plants are not extracting from that layer, which is supported by Figure 6, indicating the deep soil layer may be high in clay, with little penetration extraction of water or nutrients by plant roots.

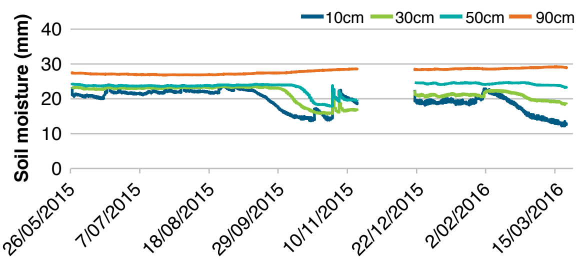

FIGURE 7 Soil moisture levels at Wahgunyah, Victoria June 2015–March 2016

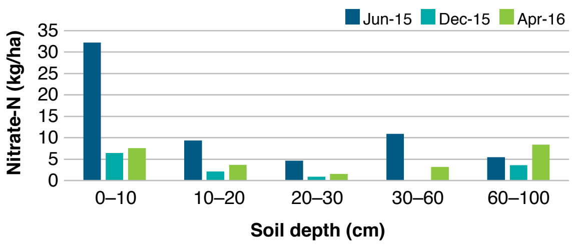

FIGURE 8 Plant-available soil nitrogen levels, at Wahgunyah, Victoria June 2015–April 2016

Location: Browns Plains

2014 crop and stubble practice: Canola, stubble burnt in windrows

2015 crop and yield: Wheat, 5t/ha

2015 nitrogen applied: 87kg N/ha urea

Timing of 2015 in-crop nitrogen application: June, September

2015 stubble management (post-harvest): Stubble burnt

The 10cm soil moisture sensor at Browns Plains was faulty, so is not shown in Figure 9. The remaining data shows plants were extracting moisture down to a depth of at least 50cm and likely a bit deeper, while the 90cm layer shows a heavy clay layer with minimal potential to extract water (Figure 9).

Figure 10 shows nitrogen distributed to depth during June, with the highest concentration in the 10–20cm soil layer. It appears plants were extracting nutrients through the profile, based on the low levels of nitrate-nitrogen present during December, and may have almost depleted all nutrient reserves by harvest. Mineralisation during the summer months has provided some nitrate-nitrogen prior to sowing, although this is primarily only in the 0–10cm layer, as would be expected.

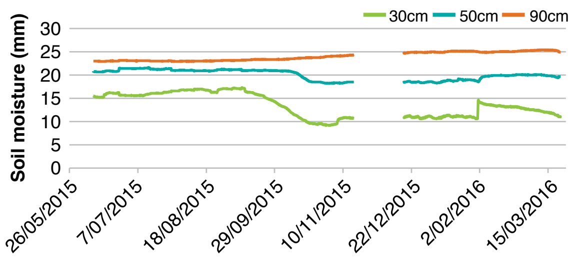

FIGURE 9 Soil moisture levels at Browns Plains, Victoria June 2015–March 2016

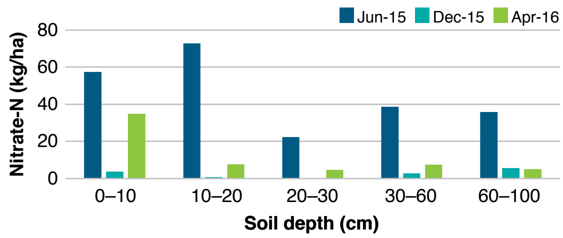

FIGURE 10 Plant-available soil nitrogen levels, at Browns Plains, Victoria June 2015–April 2016

Location: Cornishtown

2014 crop and stubble practice: Wheat, stubble burnt

2015 crop and yield: Wheat, 5t/ha

2015 nitrogen applied: 58kg N/ha urea

Timing of 2015 in-crop nitrogen application: Late June

2015 stubble management (post-harvest): Stubble burnt

The soil moisture graph from the Cornishtown site (Figure 11) indicates a soil profile that gradually increases in clay content with depth, based on the staged decrease in soil moisture at each depth from late September to the start of November, with the November rain event only impacting on the 10cm layer.

This correlates well with the nitrate-nitrogen values (Figure 12). While there was measurable nitrate-nitrogen to depth during June, although probably less than optimum in the 0–10cm layer, the crop depleted the nutrient stores to depth by harvest. However, the stores of nitrogen in the topsoil were replenished with summer mineralisation of nitrogen.

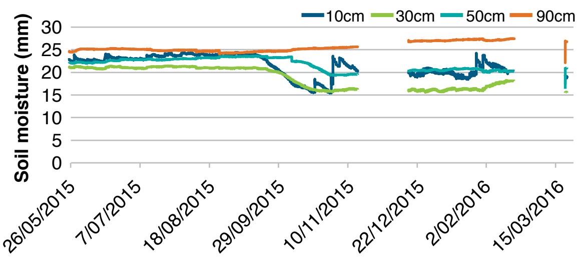

FIGURE 11 Soil moisture levels at Cornishtown, Victoria June 2015–March 2016

* Soil moisture sensor not working during early March 2016.

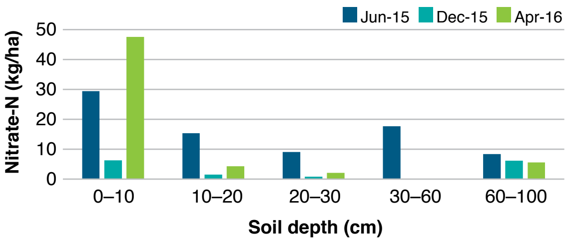

FIGURE 12 Plant-available soil nitrogen levels, at Cornishtown, Victoria June 2015–April 2016

Location: Carlyle

2014 crop and stubble practice: Canola, stubble burnt in windrows

2015 crop and yield: Wheat, cut for hay 5t/ha

2015 nitrogen applied: 74kg N/ha urea

Timing of 2015 in-crop nitrogen application: Late June, August

2015 stubble management (post-harvest): Stubble burnt

The crop at the Carlyle site appears to have had limited access to soil moisture (Figure 13), with the 0–10cm sensor being the only one to show clear change with rainfall or crop water extraction. This indicates the site is located on a heavy clay, and/or has a high amount of run-off — both of which would limit the amount of rainfall infiltrating to depth. This suggestion is supported by the nitrate-nitrogen values shown in Figure 14, which reveal the nitrogen is mostly stored in the 0–10 and 10–30cm layers, with only minimal nitrogen moving down to 60cm. As most of the nitrate-nitrogen is in the topsoil layers, this, with additional in-crop nitrogen, are likely being utilised by the crop. However it is likely that significant denitrification occurred on this site during the wet winter, which may have been subject to prolonged waterlogging due to its inability to drain water. The amount of nitrate-nitrogen mineralised during summer was surprisingly low, suggesting the soil sample may have been taken from an area of bare ground, from which there was limited organic matter (OM) to drive the mineralisation process.

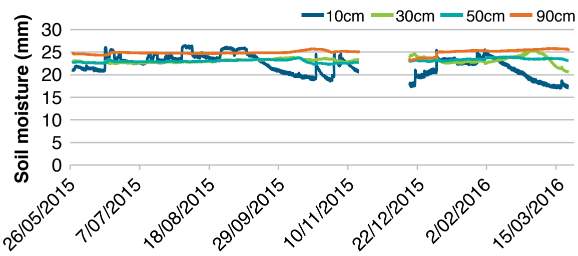

FIGURE 13 Soil moisture levels at Carlyle, Victoria June 2015–March 2016

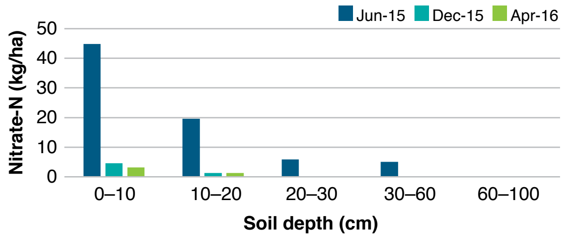

FIGURE 14 Plant-available soil nitrogen levels, at Carlyle, Victoria June 2015–April 2016



Location: Indigo

2014 crop and stubble practice: Wheat, stubble burnt

2015 crop and yield: Feed wheat, 3.5t/ha

2015 nitrogen applied: 10kg N/ha MAP, 46kg N/ha urea

Timing of 2015 in-crop nitrogen application: July

2015 stubble management (post-harvest): Stubble burnt

The Indigo site looks to be quite free draining down to at least 30cm, as shown by the 10cm and 30cm depths in Figure 15, showing similar soil moisture storage. The range in soil moisture storage (difference from wet to dry) in the 10cm and 30cm layers, and the rapidity with which the profile wet and drained, indicates this soil is likely to have a high gravel content. While infiltration decreased down to 50cm, there were still some plant roots at depth, as seen by water extraction by the crop during early October 2015 after the 10cm and 30cm layers were depleted of soil moisture.

The soil nitrate-nitrogen values shown in Figure 16 support this observation. The even distribution of nitrogen through the profile during June indicates easy movement of nutrients down the profile, while the lack of measurable nitrogen post-harvest indicates the crop used this nitrogen within season, with leaching of nutrients below the measured depth also possible. Movement of mineralised nitrogen over summer was also measured, with the 10–20cm depth recording as much nitrate-nitrogen as is in the surface 0–10cm layer.

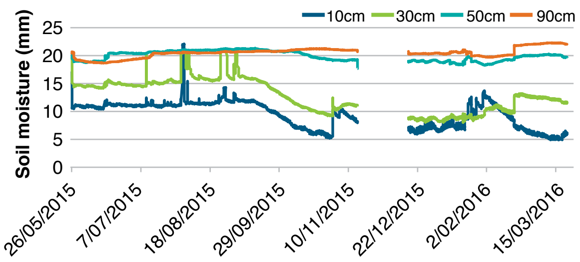

FIGURE 15 Soil moisture levels at Indigo, Victoria June 2015–March 2016

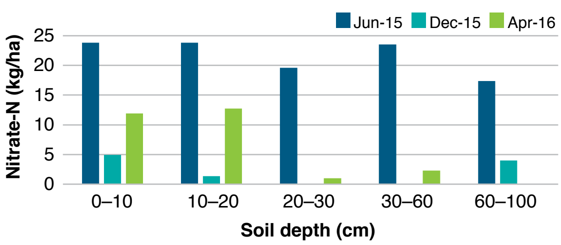

FIGURE 16 Plant-available soil nitrogen levels, at Indigo, Victoria June 2015–April 2016

Location: Norong Central

2014 crop and stubble practice: Wheat, stubble burnt

2015 crop and yield: Wheat, 3t/ha

2015 nitrogen applied: 8kg N/ha MAP, 92kg N/ha urea

Timing of 2015 in-crop nitrogen application: Late July, late August

2015 stubble management (post-harvest): Stubble burnt

The Norong Central site appeared to be waterlogged most of the winter, as shown by the 10cm depth layer having a higher soil moisture content than the deeper layers (Figure 17). This can only occur if the topsoil has a greater clay content than the subsoil, and so can hold more water (which is unlikely), or if the soil is saturated, with free-standing water. Saturation is likely, as the 30cm layer also held more water than it would otherwise.

While the soil moisture results indicate that the plant roots may not have gone much past the 30cm layer, due to the wet conditions, the nitrate-nitrogen at depth was decreased by harvest, by plants or through losses to depth (Figure 18). Moreover, although nitrogen supply at depth was replenished during summer, presumably through mineralisation, the amount measured at depth is surprising given most mineralisation processes occur in the top 0–10cm layer of soil, with limited movement to depth. One possibility may be that the location for the April sampling was a stock camp during the summer months.

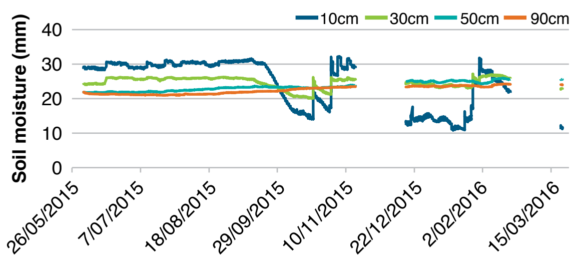

FIGURE 17 Soil moisture levels at Norong Central, Victoria June 2015–March 2016

*Soil moisture sensors not working in early March 2016.

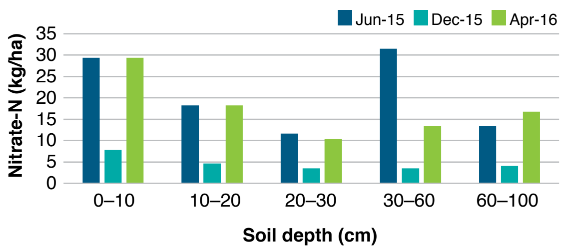

FIGURE 18 Plant-available soil nitrogen levels, at Norong Central, Victoria June 2015–April 2016

Location: Norong

2014 crop and stubble practice: Wheat, stubble burnt

2015 crop and yield: Wheat, 4t/ha

2015 nitrogen applied: 9kg N/ha MAP, 74kg N/ha Urea

Timing of 2015 in-crop nitrogen application: June, August

2015 stubble management (post-harvest): Stubble burnt

The soil moisture profile at Norong showed a high capacity to store and release moisture from the 10cm depth, due to a light-textured topsoil (Figure 19). However, there was likely a large texture change into the subsoil, with a large increase in clay content. This would explain why the moisture release range of the 30cm and 50cm soil layers is similar, and relatively small (small difference between wet and dry moisture levels). The decline in soil moisture in the 30cm and 50cm depth during mid-October indicates plants were accessing to this depth, with the nitrate-nitrogen values supporting the soil moisture results (Figure 20). While some nitrogen may be lost to depth, it is likely plants used most of the nitrogen.

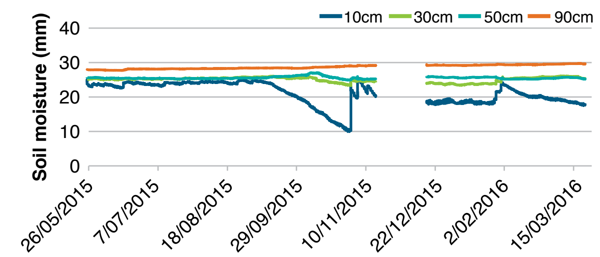

FIGURE 19 Soil moisture levels at Norong, Victoria June 2015–March 2016

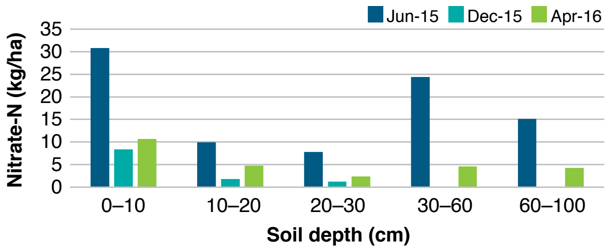

FIGURE 20 Plant-available soil nitrogen levels, at Norong, Victoria June 2015–April 2016

Location: Dugays Bridge

2014 crop and stubble practice: Lucerne, two-way disc before cropping

2015 crop and yield: Wheat, 2.5t/ha

2015 nitrogen applied: 18kg N/ha DAP

Timing of 2015 in-crop nitrogen application: None applied

2015 stubble management (post-harvest): Stubble burnt

The Dugays Bridge soil moisture probe indicates this site is likely to be free draining, which would be expected as it is close to the Murray River (Figure 21). As such, it is unknown if there is any lateral water movement from the river at the 50cm and 90cm deep soil layers. However, when the 10cm and 30cm sensors started drawing moisture during September, the 50cm sensor showed slight drawdown, as did the 90cm sensor. This indicates roots were accessing water at depth.

The nitrate-nitrogen results (Figure 22) show the crop accessed almost all available nitrogen reserves by harvest, with little nitrogen remaining in the profile at the end of the season. The poor mineralisation of nitrate-nitrogen during summer indicates most of the 'potentially mineralisable nitrogen' fraction in the total soil nitrogen bucket was accessed. This means the 2016 crop would require larger nitrogen inputs to meet its yield potential.

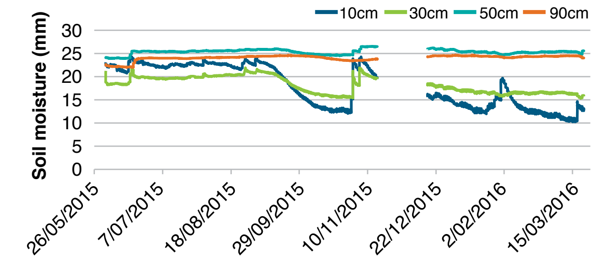

FIGURE 21 Soil moisture levels at Dugays Bridge, Victoria June 2015–March 2016

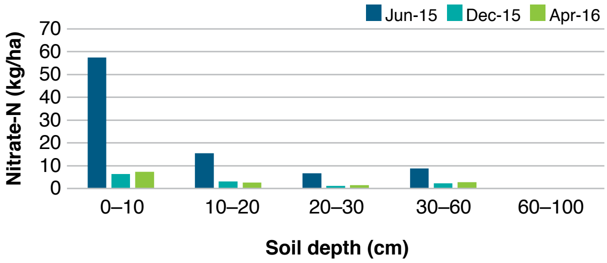

FIGURE 22 Plant-available soil nitrogen levels, at Dugays Bridge, Victoria June 2015–April 2016



Location: South-west Rutherglen

2014 crop and stubble practice: Canola, stubble burnt in windrows

2015 crop and yield: Wheat, 4.9t/ha

2015 nitrogen applied: 10kg N/ha MAP, 46kg N/ha urea

Timing of 2015 in-crop nitrogen application: July

2015 stubble management (post-harvest): Stubble burnt

The soil moisture profile of the South-west (SW) Rutherglen site indicates this soil had plentiful capacity to store and release water for plant growth, with plants accessing moisture down to at least 50cm, if not deeper (Figure 23).

The increase in nitrate-nitrogen down to 60cm indicates nitrogen can be easily leached in this soil (Figure 24). While plants are likely to take up most of this nitrogen, as roots accessed this depth, there is potential for nitrogen to be lost deeper in the soil profile. This is seen from the April sampling, where the nitrate-nitrogen values increased at the 60–100cm soil depth. This demonstrates the ability of this soil to move nutrients to depth.

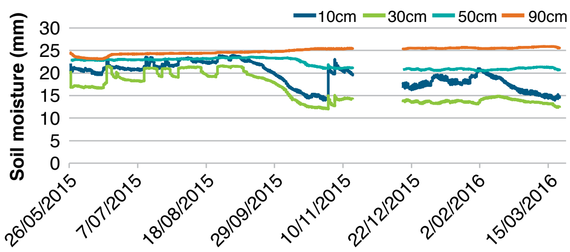

FIGURE 23 Soil moisture levels at South-west Rutherglen, Victoria June 2015–March 2016

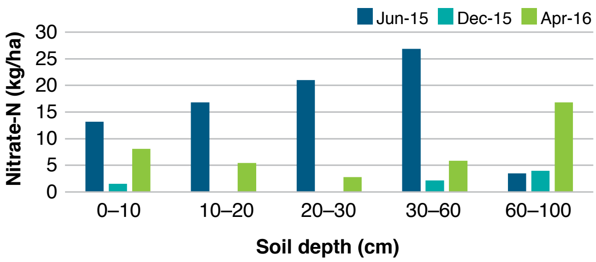

FIGURE 24 Plant-available soil nitrogen levels, at South-west Rutherglen, Victoria June 2015–April 2016

Importance of incremental depth sampling

The accepted practice for sampling DSN is to take a core soil sample down to 60cm or 100cm, homogenise the sample and take a subsample from that for laboratory analysis. This effectively provides an average nitrogen sample for the whole core. While this provides an indicator of stored nitrogen across the whole season, it doesn't provide any information on when the plants will be able to access this nitrogen.

The incremental depth sampling was carried out to help growers appreciate the averaged deep nitrogen sample has limitations.

Feedback to date from this project is that some growers are already changing the way they carry out their sampling, with the soil core being broken up into at least two increments (0–30cm and 30–60cm) to better understand where the nitrogen is stored.

Splitting cores into more than two increments would become cost-prohibitive, however even the simple change to two increments can provide useful information on nutrient availability, resulting in more informed decision-making and greater environmental stewardship.

Two examples from the June 2015 dataset are shown in Table 1 and Table 2 to demonstrate the value of incremental sampling.

Based on the 0–100cm depth average of 56kg N/ha at East Rutherglen in Table 1, a grower may decide to apply more nitrogen to the crop soon after sowing. However, based on the 0–30 and 30–100cm averages, which show plentiful nitrogen in the surface soil available for plant uptake, the grower may decide to apply less nitrogen early in the season, reserving some for topdressing later during the season if the conditions (and soil moisture availability) allow, as there is little nitrogen available at depth for plants to access through spring.

The Springhurst/Lilliput site has a larger amount of nitrate-nitrogen at depth than the east Rutherglen (Table 2).

TABLE 1 Example of the value of incremental soil sampling from East Rutherglen, 2015

Depth (cm)	Nitrate-nitrogen (kg/ha)	Average soil nitrate-nitrogen levels across incremental depths	
0–10	168.0		
10–20	67.2	Average 0–30cm = **82**kg/ha	
20–30	12.7		Average 0–100cm = **56**kg/ha
30–60	18.9	Average 30–100cm = **17**kg/ha	
60–100	15.1		

TABLE 2 Examples of the value of incremental soil sampling from Springhurst/Lilliput, 2015

Depth (cm)	Nitrate-nitrogen (kg/ha)	Average soil nitrate-nitrogen levels across incremental depths	
0–10	21.0		
10–20	15.4	Average 0–30cm = **17**kg/ha	
20–30	13.4		Average 0–100cm = **28**kg/ha
30–60	42.0	Average 30–100cm = **46**kg/ha	
60–100	49.3		

If a grower used the results from the 0–100cm sample (28kg N/ha), a decision could be made to apply a lot of nitrogen early during the season due to a perceived nitrogen deficit through the profile. However, if the core was split into the 0–30cm and 30–100cm layers, the grower would identify the shortfall of nitrogen in the top layers, but also see there is some nitrogen sitting at depth, which could contribute to finishing the crop off in a favourable season without additional nitrogen being applied.

Total nitrogen vs available nitrogen

The results presented to date mostly focus on the available soil nitrogen (measured as nitrate-nitrogen), which is the form of nitrogen crops access during the growing season. Another form of plant-available nitrogen is 'mineral nitrogen', which includes both nitrate (NO_3) and ammonium (NH_4) forms of nitrogen, which is a more complete measure of available nitrogen. However, as some of the ammonium results received during this project were questionable, the ammonium results were omitted.

A key part of the nitrogen story for crop production is the cycling of nitrogen through organic (plant matter, decaying roots, microbial biomass) and inorganic (nitrate, ammonium) forms. To this end, we measured the total soil nitrogen in addition to the available/nitrate-nitrogen to understand the size of the complete soil nitrogen 'bucket', which is already in the soil, additional to any fertiliser applied.

The real challenge lies in estimating the nitrogen *mineralisation* rate — the rate at which the organic (plant unavailable) nitrogen is transformed into plant-available forms. The mineralisation process depends heavily upon environmental factors including temperature and moisture, and also varies according to the type and amount of plant residue present on the ground.

A comparison of total nitrogen vs plant-available nitrogen is presented in Figure 25. Figure 25 illustrates an accumulation of organic nitrogen (represented as total-nitrogen minus nitrate-nitrogen) in the 0–10cm layer, which is expected as this is where most of the nutrient-cycling microbes are located.

To provide context as to the size of this organic nitrogen 'bucket', nitrate-nitrogen is plotted alongside, and barely registers on the scale of this graph.

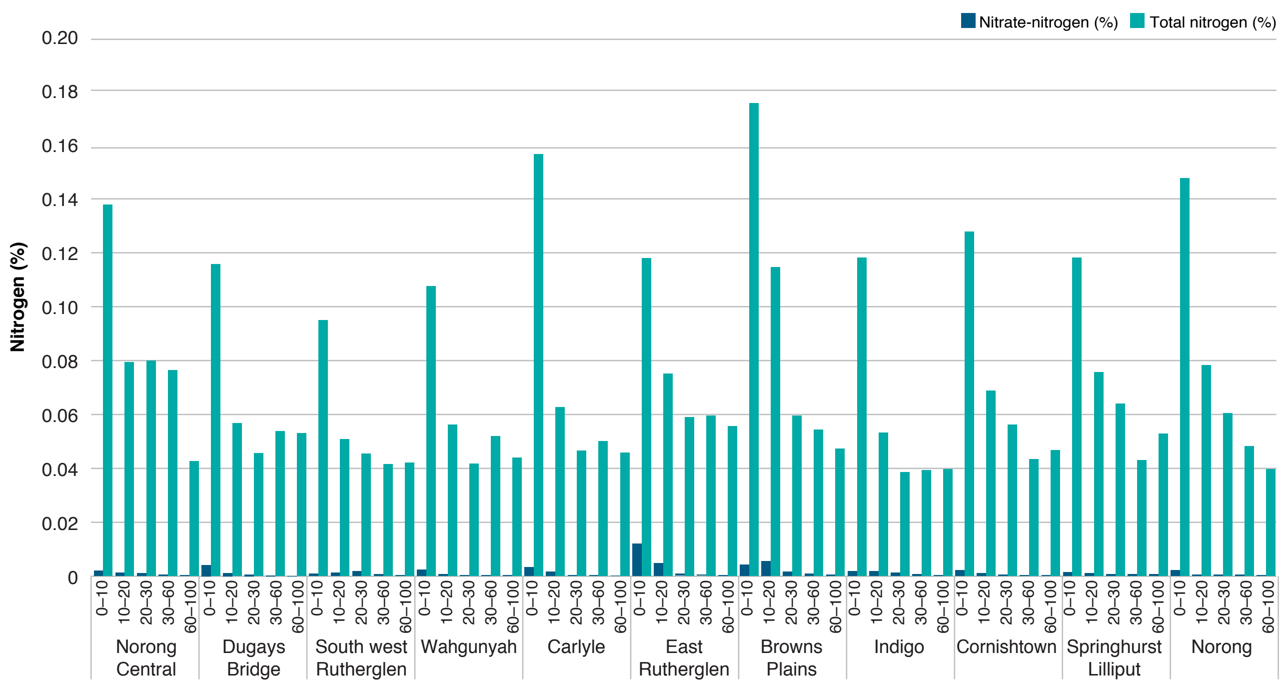

FIGURE 25 A comparison of total nitrogen vs plant-available (nitrate) nitrogen



Observations and comments

Although all of the sites for this project lie within the Rutherglen region, there is a range of soil types. However, the duplex, texture-contrast soil type dominates, with a sharp increase in clay content in the subsoil. This means water is strongly held in this zone and is only extracted for plant use after the topsoil layers are depleted of moisture.

The sites vary in both the amount of nitrate-nitrogen stored in the soil, and the depth at which it is stored. As the traditional DSN measure doesn't account for the distribution of nitrogen, it is worth considering splitting DSN samples into two increments — a 0–30cm and a 30+cm depth sample. This will provide more accurate information on the availability of nitrogen as the season progresses, supporting better and more timely fertiliser application decisions.

The nitrate-nitrogen component is only a small proportion of the total soil nitrogen, with the large pool of soil organic nitrogen being responsible for the ongoing cycling and mineralisation throughout the season and during summer.

While the soil moisture results presented here show a dry soil profile going into the 2016 season, as this report is being written the ground outside has turned to mud, thanks to the fantastic rain received during early May. With between 60–80mm rainfall across the region, it certainly will go a long way towards refilling the soil profile!

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