



Soil health testing reveals simple solutions

Australian farmers manage approximately 60% of the Australian landscape and witness firsthand the role soil health plays in driving the productivity, profitability and sustainability of Australian farm businesses.

Recently soil, and the relationship between healthy soils and the environment, has been formally identified as a significant national asset under the Federal Government's \$196.9 million National Soil Strategy.

With an increasing focus on the importance of soil and soil health, the questions that's front of mind for many Australian farmers and their advisors is how best to achieve and maintain healthy soils within a productive and profitable farming system?

For senior agronomist, Jim Laycock, the ability to measure and monitor the soil's key biological, chemical and physical characteristics is essential to understanding and improving soil health.

Based at Cowra in Central West New South Wales, Jim has worked as an agronomist for 26 years, specialising in broadacre cereal and legume crop production.

He has been instrumental in the development of a new soil health test package from the Nutrient Advantage Laboratory, designed to help farmers better measure and manage their soil health.

"The package comprises four tests and looks at the total carbon and total nitrogen, and C:N ratio of soils, as well as aggregate slaking and dispersion, active carbon and microbial respiration," Jim says.

"These four quite simple tests, when taken together, can yield very useful insights that can be addressed in both the short term and over time, in the long term as well."

With soil health being linked to total nitrogen, total carbon and active carbon levels, these tests can alert farmers to shortcomings in their overall soil health, prompting practice changes to fix any problem areas.





Grenfell site trial results

Jim has been running IPF's long term trial site near Grenfell in Central West New South Wales since 2007, with recent results showing how inputs and management can impact on soil health over time.

Selected treatments were sampled and compared active carbon, organic carbon (Walkley & Black method) and total nitrogen in soil with just phosphorous applied versus with both phosphorous and nitrogen applied.

The results show both organic carbon and active carbon levels increased by 28% with the addition of nitrogen.

"Samples with 20kg of phosphorous applied annually returned active carbon levels of 234.5mg/kg," Jim says.

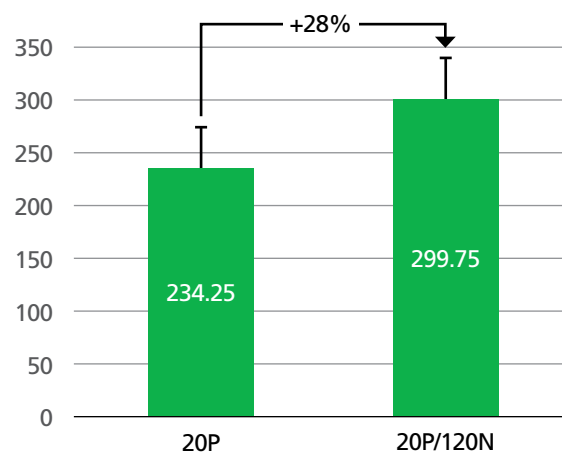
"Samples with 20kg of phosphorous and 120kg of nitrogen applied annually returned active carbon levels of 299.75mg/kg, so a significant increase.

"While active carbon levels vary greatly across soil and crop types, for the Grenfell site we now have a benchmark for active carbon levels at this point in a long-term cropping rotation.

"From here the aim is to continue with current best practice methods of stubble retention and zero tillage, and monitor changes in active carbon levels over time".

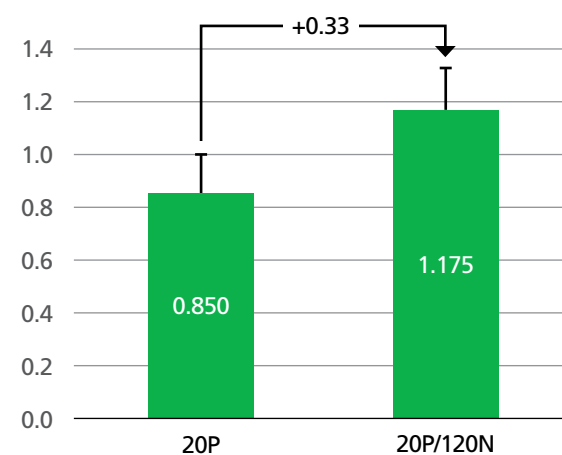
Active Carbon mg/kg

LSD (P=0.05) 39.38mg/kg



Organic Carbon %

LSD (P=0.05) 0.153%



The trial returned similar results for organic carbon, with organic carbon levels rising from 0.85% with the application of phosphorous alone to 1.175% with both phosphorous and nitrogen applied.

A significant increase in total nitrogen was also seen with the application of nitrogen, from 0.09% to 0.115%.

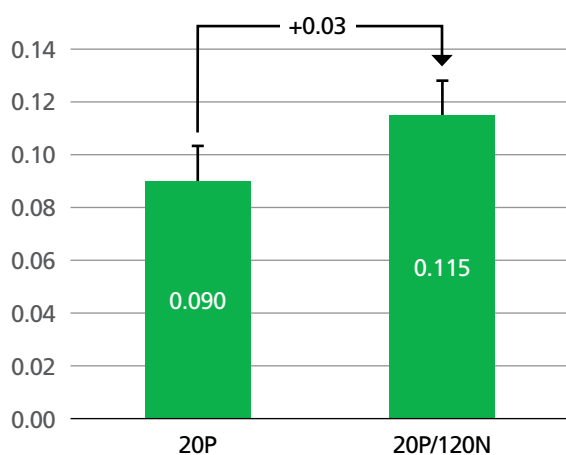
“Total nitrogen measures all the nitrogen in the soil, including both inorganic or plant available nitrogen and nitrogen in the form of organic matter that will mineralise into plant available nitrogen over time,” Jim says.

“The higher the total nitrogen levels in the soil profile, the more potential there is for mineral nitrogen cycling. The more nitrogen you can retain, the quicker that soil nitrogen pool builds up and the quicker your organic and active carbon levels also rise.

“The more you can grow, the higher your yields will be but you’re also then able to retain greater levels of biomass, and this residue retains and builds carbon and nitrogen levels in your soil. It’s a simple equation, but higher nitrogen and carbon levels lead to higher rates of microbial activity, and ultimately healthier soils.”

Total Nitrogen %

LSD (P=0.05) 0.13%



Simple solutions

Jim says that while soil health and building total carbon in soils is a long-term and wide-ranging pursuit, there are short term practice changes that can help counter particular issues.

“For example, if a test reveals low levels of labile, or active, carbon in soils, that means soil microbes are short on nutrients and nitrogen supply and recycling can be slowed.

“Fortunately, once identified it’s relatively easy to increase labile carbon levels within a twelve-month period, for instance by implementing a pulse crop into your rotation to boost biomass.”

Similarly, the aggregate slaking and dispersion test looks at the response of a soil aggregate to water by identifying sodic and dispersive soils with structural instability, and determining if a soil will slake, set hard or crust when wet.

“Slaking, hard setting and crusting all increase erosion potential and nutrient run off, and reduce air and water movement through soil,” Jim says.

“So, if the soil health package reveals highly dispersible soils, simple agronomic tools like the addition of calcium can be used to correct the issue.”

While increasing data on overall soil health is the first step to improving it, Jim sees the recommendations and guidance that comes with that data as absolutely critical.

“The real value for farmers is in having support around their decision making,” Jim says.

“The Nutrient Advantage soil health package delivers tailored recommendations alongside its laboratory data test results.

“The decision support system is invaluable for growers and farmers as they go about both identifying and then correcting any issues or barriers to soil health, both in the short and long term.”



About the IPF Grenfell Trial Site

IPF's long-term nitrogen by phosphorus trial was established to describe the cumulative effect of five different rates of nitrogen fertiliser and five different rates of phosphorus fertiliser on grain yield and protein percentage in a controlled traffic cropping rotation.

This site was established in 2007, with soil nitrogen to 0-60cm of 160 kg/nitrogen/ha sampled pre-plant in 2007 (field peas, 2006) and a site Colwell phosphorus of 26 mg/kg. There are 25 fertiliser treatments replicated four times, and the crop rotation is sown over the same plots row on row annually.

In 2015, the original 20 metre long plots were cut in half. From 2015, the 2007 'A trial' nitrogen and phosphorous rates were retained on the western half and the 2015 'B trial' nitrogen and phosphorous rates were applied on the eastern half of the original plots.

The 'A trial' treatments continue to build soil phosphorous and nitrogen while 'B trial' treatments now run down and also build phosphorous and nitrogen. There are now 200 plots on the site.

Triple Super (20% phosphorous) was banded with the seed, 50% of the urea (46% nitrogen) rate applied at planting banded below and to the side of the seed up until 2014. Since 2015, urea is now placed 5cm directly below the seed.

The balance of urea is applied as urea broadcast in wheat at GS31 and at the pre rosette stage in canola. Urea was not applied in 2010 (Albus lupins) and urea was not top-dressed in 2007, 2014 (low yield potential due to replant) and 2018 (dry conditions).

Sulphur has been applied four times during the life of the trial as broadcast gypsum (2), banded potassium sulphate (1) and broadcast Gran-Am® (2017). A total of 5kgs/ha of zinc and 2kgs of boron have also been applied.

Acknowledgements

Thanks go to trial site co-operators, Duncan Lander 2007-2015, David Partridge 2016-2021 and Kaylx for managing the site.

Nutrient Advantage – Soil Health Package

For over 50 years, Nutrient Advantage® has been Australia's leading provider of nutrient analysis and expertise, helping farmers cost-effectively manage their input requirements.

The Nutrient Advantage Laboratory Soil Health Package has been developed to help farmers better measure and manage their soil health, and empower them to make decisions that boost their productivity today while safeguarding the sustainability of their businesses into the future.

It is recommended the tests be repeated every two to three years at the same time of year. Using the **Health1** code, they can be ordered as a standalone package for \$80, or added to any existing Nutrient Advantage test order for \$70.

To order or find out more, visit www.soilhealthtesting.com.au or call 1800 803 453.

The first in a series of soil health tests, the new package comprises four test components:

- Total Carbon & Total Nitrogen & C:N ratio (combustion)
- Aggregate Slaking & Dispersion (Loveday & Pyle)
- Active (labile) Carbon (0.033M KMnO4)
- Microbial Respiration (1 day Solvita CO2 burst)

