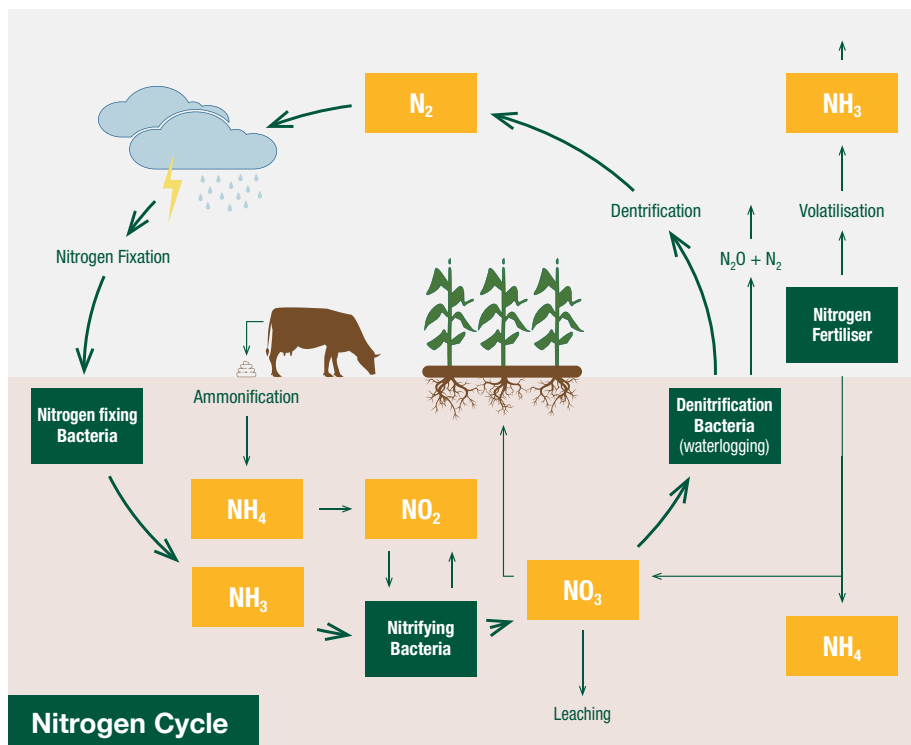


Is Nitrogen fertiliser burning a hole in your pocket and your soils? Maximise capture of native N

There is no doubt that high yielding crops, pastures and permanent plantings all require nitrogen (N). It is a major component of both chlorophyll, required for photosynthesis, and of amino acids, the building blocks of proteins.

While nitrogen fertilisers are the 'go to' for most farmers, the fact is that in high functioning soils, a large amount of nitrogen supplied to crops is native, soil borne or soil sequestered nitrogen.¹



1 Reference: Are Nitrogen Fertilizers Deleterious to Soil Health? Bijay- Singh ID, Department of Soil Science, Punjab Agricultural University, Ludhiana 141 004, India; March 2018; Accepted: 12 April 2018; Published: 14 April 2018

2 Chemical compounds that block the activity of the enzyme urease. Urease is found in soil as well as in plant residues. Urease, along with water, will hydrolyse, or break down, urea into ammonium. The loss process that urease inhibitors protect against is ammonia volatilisation. Volatilisation is the loss of N through the conversion of ammonium to ammonia gas, which is released to the atmosphere. The volatilisation losses increase at higher soil pH and conditions that favour evaporation (e.g. hot and windy).

How do soils get N?

High functioning soils exhibit several common factors. They have a balance of macro and micronutrients which support soil biology and increased soil organic matter (soil carbon).

Soil biology and soil carbon play key roles in the natural nitrogen cycle. Carbon acts as a food source for soil biology involved in nitrogen fixing and cycling.

In addition, high functioning soils are fertilised appropriately, in line with crop needs, both in amount and timing. Fertiliser is not over-applied which adversely influences biological communities in the soil and may also result in increased amounts of residual inorganic nitrogen, that can result in a loss of soil organic carbon.

Urease Inhibitors² and other fertiliser treatments are increasingly available to reduce nitrogen volatilisation and improve use efficiency. However overuse of these fertilisers can still create an imbalance in soils and disruption to natural nitrogen fixing.

Maximise capture of native N (continued)

Maximising this FREE source of N

Optimising the fixing and uptake of native nitrogen requires a healthy soil and root system. Increasing a crop or pasture's root zone increases soil crop interaction, better distributing exudates (carbon) and improving nitrogen sequestration and access to mineralised nitrogen and other nutrients.

Soil biology plays a critical role in sequestering and delivering nitrogen. However, it can be negatively impacted by a range of factors including flooding, drought, fungicide, or chemical applications. Soil biology can also be slowed during crop dormancy or cold conditions.

Supporting or stimulating soil biology then plays a role in increasing both fixing and supply of soil borne nitrogen.

BioAg's *Soil & Seed*® is a proven natural soil inoculant supporting germination, emergence, and early root growth in cropping. It is also beneficial in offsetting the impacts of stress and enhancing early seasonal growth and nutrient supply.

Colin Falls is a fourth generation broadacre cropping farmer in Victoria. He implemented a soil health program with BioAg over 20 years ago.

"After using the program we were able to move to continuous cropping because the soil was not depleted after each harvest. It's now a sustainable operation."

BioAg's *Soil & Seed*® is part of Colin's program and helps the crop adapt to environmental conditions, resulting in more balanced crops. A balanced crop can better withstand the shocks and stresses from weather, as well as offering a level of natural resistance to pests and diseases. The net result is higher yields and improved quality with residual soil fertility enhancement.

"We've really come to understand how important the health of the soil is for growing a healthy plant. When a plant is healthy then it will use as much nutrient and moisture as it can, and this maximises its quality and yield potential."



Colin Falls with oaten hay bales.



The program addresses the health of the soil as well as providing for the plant, and from this we have seen a consistent increase in the quality of our crops. The program has more than paid for itself.

- Colin



Scan for the complete Case Study on our website.

What tests are the best for soil?

When you arrange your soil test through BioAg, the soil samples are tested at either the Southern Cross University's Environmental Analysis Laboratory (EAL) in Lismore NSW or at Eurofins APAL in Adelaide.

Both are independent, accredited laboratories. Independent being the key word, and therefore not associated with any agricultural product manufacturers or distributors. Both have a strong focus on quality of data and accuracy.

EAL developed an Australian version of the Albrecht/Reams soil test (RA-PACK-001) suitable for Australian soil types. It includes:

- standard Australian testing for exchangeable cations (Ca, Mg, K, Na, H, Al)
- plant available micronutrients (Fe, Cu, Zn, Mn, B, Si)
- phosphorus tests (Bray 1, Bray 2, Colwell)
- nutrients (Nitrate, Ammonium, Sulphur)
- 'Reams' dilute Morgan extract for determining soluble nutrients (Ca, Mg, K, P)
- pH, electrical conductivity, basic colour, basic texture, total LECO carbon and total LECO nitrogen.

An extended suite of tests is also available (RA-PACK-02) to give additional information on nutrients adsorbed to soil particles and organic matter.

Testing includes:

- RA-PACK-01 tests
- 'Pseudo-totals' extracted with concentrated acids (Ca, Mg, K, Na, S, Fe, Cu, Zn, Mn, B, Al, Si, P, Co, Mo and Se).

BioAg agronomists can help with sampling, submitting the samples for analysis and interpreting the results.



Distributor Spotlight – Guyra Rural Services

Guyra Rural Services works with its customers from the soil up, following regenerative agriculture practices and principles.

With its emphasis on sourcing and supplying biologically friendly agricultural inputs for soil mineralising, and balancing and livestock mineralisation, the business is a natural fit for BioAg's natural fertilisers and biostimulants.

Located in the New England region of NSW, the high altitude and unique Northern Tablelands micro-climate of high sunlight levels in winter and cool summers supports a rich agricultural region including cattle, sheep, pasture, and forage crops as well as horticulture.

For over 20 years, Guyra Rural Services has been servicing Northern NSW, covering Guyra, Walcha and Armidale areas, expanding into a full-service agricultural supplies business specialising in pasture seeds, fertilisers and stock feed. Campbell Wolfenden came on board as manager in 2010 and moved the business along the regenerative agriculture path. BioAg is proud to have Guyra Rural Services as a long time distributor of the BioAg product range and soil health program.



guyrarural.com.au

Key soil analysis principles demystified

We often hear farmers concerns and frustrations about diminishing returns, despite doing the same thing that has worked in the past; or looking for a new way to raise productivity, trusting a product/input to deliver on its promises.

What is typically overlooked though, is right under the farmer's boots! To successfully improve productivity, first and foremost you need to understand what is going on with your soil(s). Soil testing and analysis will advise the chemical, physical or biological dynamics at play. If you know what your benchmarks are, you won't waste money, time and resources applying inputs your soil doesn't need or do harm.

BioAg Area Managers support farmers and consultants in the evaluation of soil tests. This evaluation starts by ensuring the right soil analysis is performed. We then review results, considering key principals to develop a recommended program.

Let's unpack four of those key soil analysis principles:

Liebig's Law

Liebig's Law of the Minimum states that if one of the essential plant nutrients is deficient, plant growth will be poor even when all other essential nutrients are abundant. Regardless of how abundant one or more macro or micronutrients in your soil are, or applying more of what has worked in the past, yield and quality are in fact determined by the deficient nutrient(s).

Liebig's barrel image simply depicts the Law: yield cannot exceed the limit placed on it by the constraining nutrient, soil or growth stimulant, just as the water level in the barrel is limited by the shortest stave.

Understanding that yields and quality are determined by the minimum, prevents over application of nutrients or inputs. Over-application of fertilisers/inputs are a costly expense, and in terms of soil balance, it is typically detrimental to overall crop or pasture performance.

Mulder's Chart

The overuse of fertilisers and the impacts this has on soil balance are graphically explained through Mulders Chart which illustrates the interaction between 11 of the essential plant elements.

Some interactions are positive (synergistic) where the elements involved help each other by aiding uptake or utilisation. Others are negative (antagonistic), and elements can hinder each other in uptake or utilisation. An abundance or shortfall of one nutrient therefore can have synergistic or antagonistic effects on a range of other nutrients.

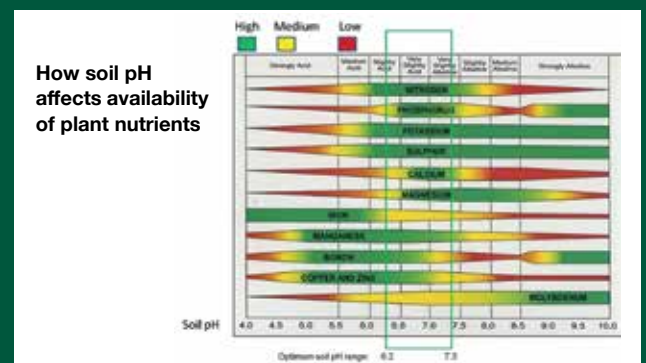
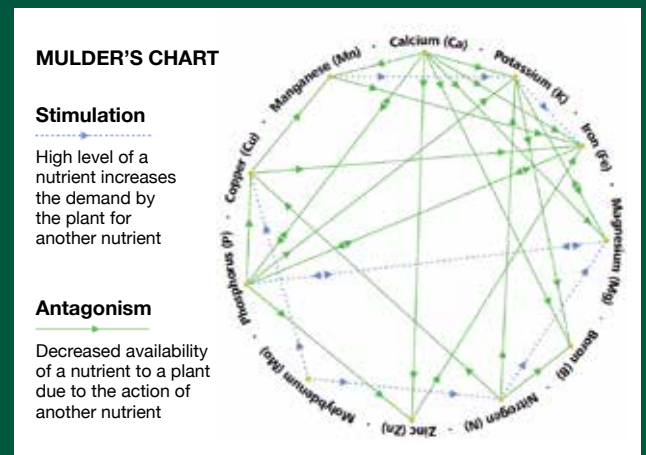
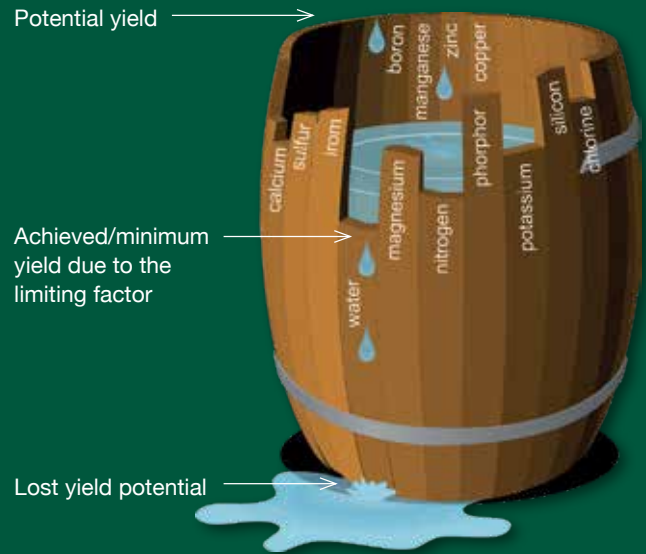
An apparent deficiency that appears in a tissue test or through animal health, may be caused by an excess of one or more other nutrients. Remediating this is about improving balance and possibly addressing the overabundance of an antagonist, rather than simply adding 'more on'.

Soil pH and Nutrient Availability

Nutrient availability in relation to pH. The thicker the bar the more available the nutrient.

A key influence on nutrient availability is soil pH. It doesn't mean the nutrient is not in the soil, it just means the soil chemical environment is not suitable for uptake of that nutrient.

Understanding the implications of total and available nutrients in the soil in response to pH, and the time it takes to influence soil pH, is important when deciding on fertiliser or lime.



Nutrient Mobility

Nutrient mobility is the ability of nutrients to move within plants and soil. Understanding the process is helpful in diagnosing plant nutrient deficiencies and the root cause of the deficiencies. Soil structure and composition will impact aspects such as nutrient leaching, lock-up and cycling (from unavailable to plant-available forms). To enhance nutrient availability, you need to review soil composition, carbon levels, biological activity as well as the type of fertiliser and timing of application.

Similarly, while nutrients are absorbed and at times stored by plants, each plant will have a differing capacity to relocate nutrients once in the plant.

As an example, Boron is an important nutrient for a range of plant physiological processes. Its availability is critical at flowering, seed-set or at sugar/starch content increase. It is important to consider which Boron application is best suited based on the ability of the plant to translocate Boron within the plant. Some plant species can translocate Boron meaning foliar application is acceptable. However for plants with restricted Boron mobility, it is important and more efficient to have the nutrient available in the soil.

What does this all mean?

The net result of these interactions and their effects on any crop, is that we need to measure before we can remedy. While a poor yield is likely related to a nutrient deficiency, the deficiency may not be addressed by simply applying more, it may be a result of antagonists, pH or mobility within the soil.

Soil testing along with tissue testing when issues are identified, provides the critical information needed to improve crop yields. When testing we recommend a range of tests that help to identify the total as well as plant available amounts of nutrients. With this information, we can help farmers build an efficient and effective program for soil and fertility improvement.

No matter if it is traditional farming, or a system based on Biological, Biodynamic or Organic inputs or needed to fit into a Regenerative or Carbon Sequestration system; BioAg's agroecology experience along with an individual approach, guarantees the successful investment in building a resilient sustainable farming system.



For more information contact us.



Scan for more information on Nutrient Mobility.



Nutrients required for plant growth

Understanding nutrient mobility is helpful in diagnosing plant nutrient deficiencies.

Generally available to plants in sufficient quantities through air and water.

NON-MINERAL MACRONUTRIENTS

C

CARBON

H

HYDROGEN

O

OXYGEN

Supplied from soils. Deficiencies are common which are corrected through fertilisers.

PRIMARY MACRONUTRIENTS

N

NITROGEN

P

PHOSPHORUS

K

POTASSIUM

Supplied from soils. Deficiencies or imbalances are common which are corrected with ameliorates or fertilisers.

SECONDARY MACRONUTRIENTS

Ca

CALCIUM

Mg

MAGNESIUM

S

SULFUR

Supplied from soils. Deficiencies are corrected with trace element salts.

MICRONUTRIENTS

Ni

NICKEL

Fe

IRON

Mn

MANGANESE

Zn

ZINC

Cu

COPPER

B

BORON

Mo

MOLYBDENUM

Cl

CHLORINE

+

OTHERS

BioAg Newsletters and Emails

BioAg will be sending topical and timely information by email from now on, with posted (and emailed) Newsletters provided as a summary every six months. To receive the latest news from BioAg via email, scan the QR code to sign up.



Organic Matter Matters

Soil organic matter (SOM) is decomposing plant or animal tissue that is being returned to the soil. It plays a key role in high performing soil; it is a primary source of carbon (C) which gives energy and nutrients to soil organisms, enhancing biodiversity, and it also helps protect the soil from the effect of rainfall, wind, and the sun. SOM is something that can be influenced through farm management practices.

Case study

A long-term customer of BioAg's in the Upper Murray region of NSW has experienced ongoing gradual improvement over 20 years to build resilient healthy soils for the long-term.

Summary of soil test results for organic matter

Block	Hill	Flats	Bowls
2003 Organic Matter	3.06%	7.18%	3.58%
2023 Organic Matter	6.60%	11.00%	5.80%
Change in Organic Matter	↑ 1.8x / 3.54%	↑ 1.5x / 3.82%	↑ 1.6x / 2.22%
Increase in Carbon T/Ha #	26.7	28.8	16.7
Benefit expressed as Tonnes of CO ₂ / Ha	98	106	56

Based on 58% of organic matter being carbon and sequestration of 10cm in the soil profile being equal to the soil probe samples.

The organic matter content of agricultural topsoil is usually in the range of 1-6%. A study of soils in Michigan USA demonstrated potential crop-yield increases of about 12% for every 1% increase in organic matter. Across the three measured farm sites, there has been a significant increase in SOM ranging from 1.5 to 1.8 times increase. This has generated significant yield increases and crop quality improvements.

With the property acquired in a run-down state, the owners set about changing their stocking program from set stocking to rotational grazing to help maintain ground cover and build structure in the soil. BioAg also developed a long-term soil health program to deliver improved soil fertility and structure, for improved yields and quality, while gradually regenerating and building resilient soils.

The program includes regular soil testing to ensure only what is needed is added. A bespoke mix of *BioAgPhos*[®], lime and gypsum on a biennial basis, applying to half the farm each year which has significantly reduced spreading costs. BioAg's *Soil & Seed*[®] is used as a winter / post winter stimulant to enhance nutrient cycling especially of trace elements. Additional trace elements and Dolomite (to increase Magnesium) are applied from time to time as determined by soil test results.



Scan for the complete Case Study on our website.

“
Too much chemical and mechanical intervention can indeed lead to reduced yields at increased cost. However, biological management of soils, will support a healthy and high yielding crop with less need for expensive fixes.
”

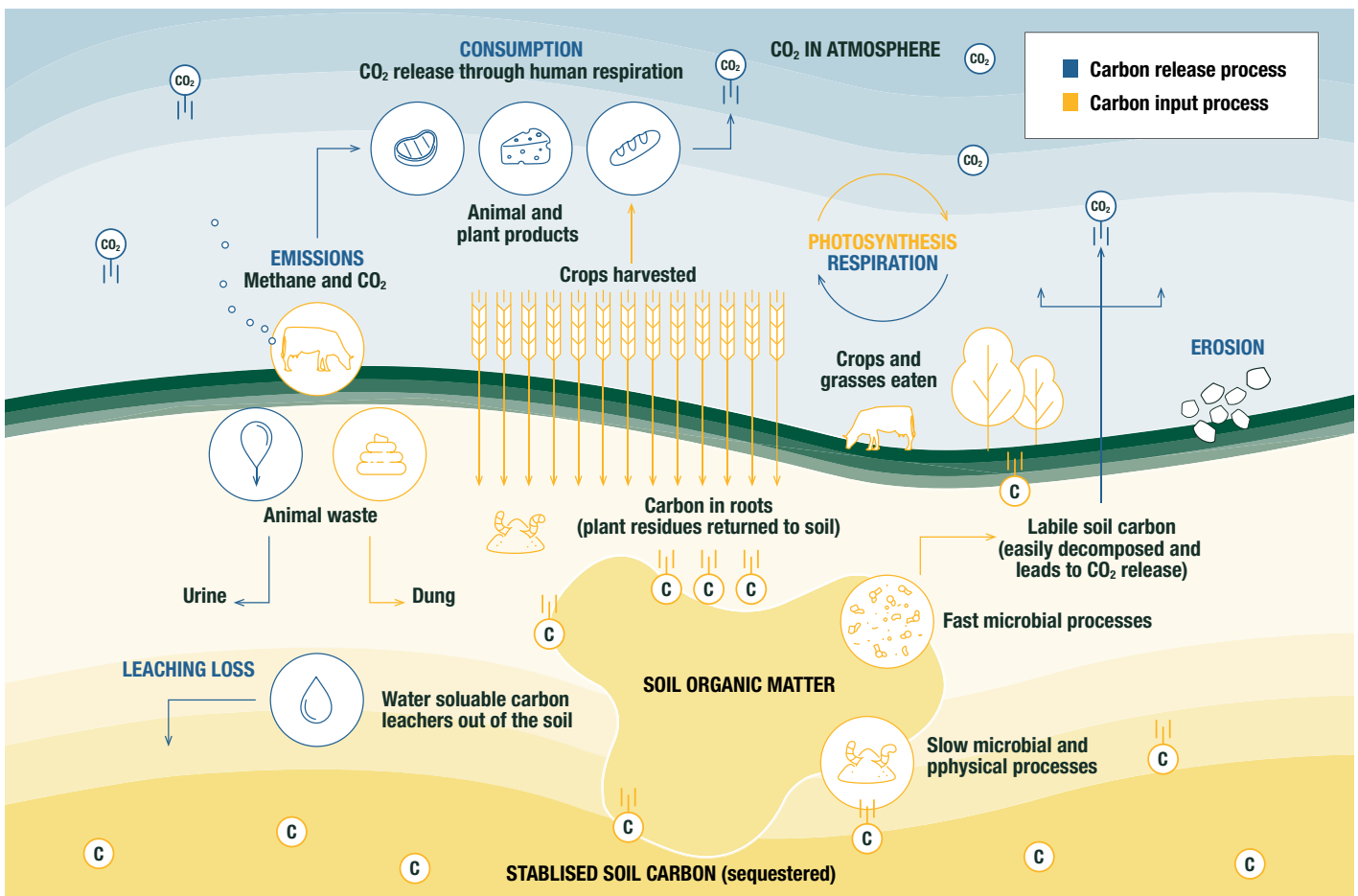
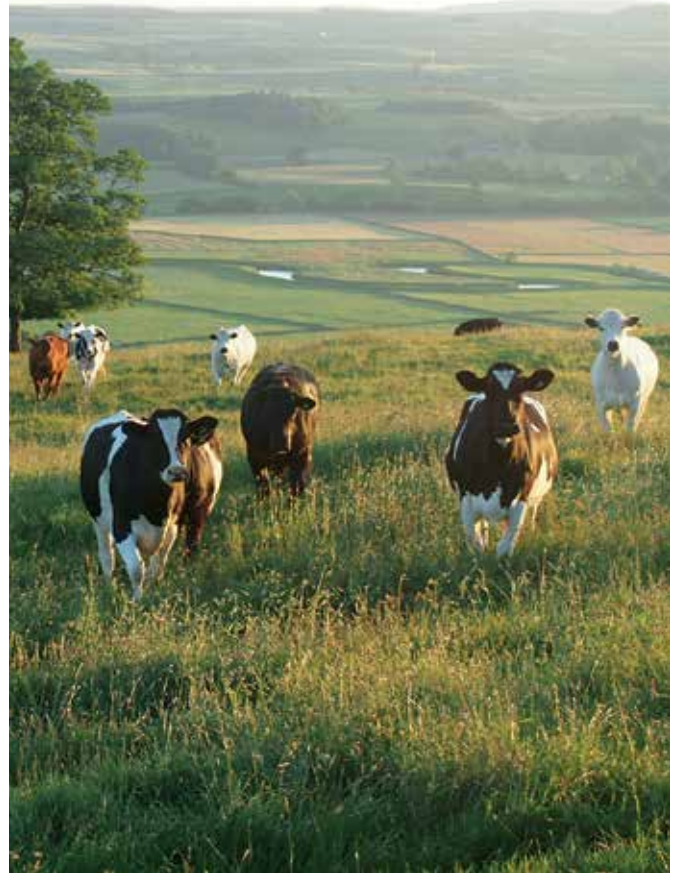
Carbon Sequestration

SOM plays a significant role in the carbon cycle. More carbon is stored in soils than in all plants, animals and the atmosphere combined. It is estimated that SOM stores four times as much carbon as living plants and that carbon stored in all the world's soils is two to three times the amount in the atmosphere. What a bonus for our planet in addition to the everyday benefits for farmers who are growing our food and fibre.

Soil carbon sequestration is a normal part of farming, however when it becomes a focus it is known as 'carbon farming', which focuses on adopting land management practices that increase the amount of carbon stored in soils. The practice of carbon farming is often done by landowners who are given incentives through policies created by government programs and there are independent consultants who specialise and can advise on this. BioAg's focus is purely on working with farmers to improve their soil health for the long term for improved yield and quality.

How the Soil Carbon Sequestration Cycle works:

Carbon naturally enters and leaves the soil through a range of complex processes occurring simultaneously. The amount of carbon stored in soils can be increased or decreased by changing and adapting land management practices.



Trial Updates

Domestic

The second year of the South Australian grain trials has been completed. The trials commenced in 2021 with the objective to evaluate the efficacy of BioAg products for improved crop productivity and soil fertility in both lentil and oat crops.

Above average rainfall across the season meant that all treatments performed very well. Given the better than normal season and great growing conditions there was, as would be expected, no significant crop stresses and therefore no significant statistical difference between treated plots and standard practice.

While not statistically significant, results for year two show slightly higher yields and financial returns in 9 out of the 10 treated plots.

Post harvest there will be an assessment on soil health, leading into a third season of trials.

International

AgScience Research commenced multi-year independent pasture trials in 2021 in the in low rainfall high-country of the Mackenzie Basin near Twizel, located in the South Island of New Zealand.

This trial objective is to evaluate the effectiveness of *BioAgPhos*[®] (a RPR based fertiliser) in a low rainfall environment and when used with lime. A total of 516.5mm of rain was recorded in the district over the eight-month period, which is typical for this low rainfall area.

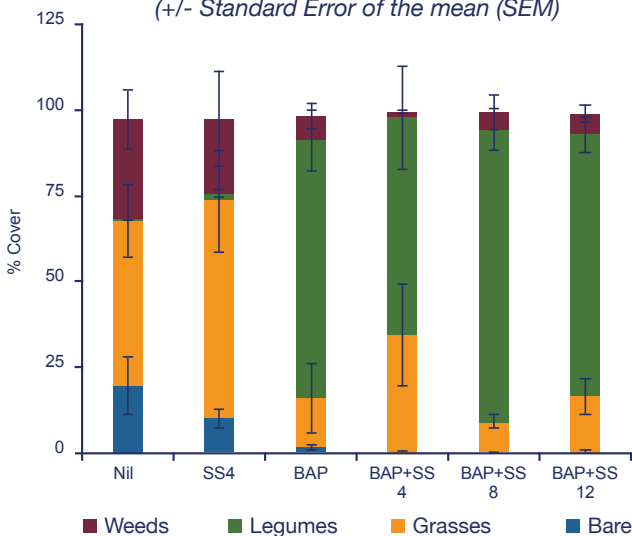
The results are statistically significant and were recently presented at the International Grassland Congress (IGC) Conference in Kentucky USA. Established almost a century ago in Europe, the Congress now amasses over 1,000 delegates from 80 countries worldwide, including leading scientists, industry, students and producers.

January 2022 harvest results overview – increased Dry Matter yields

BioAg Soil & Seed	BioAgPhos	BioAg Soil & Seed and BioAgPhos combined
Up to +17%	+60%	4L/ha increased yield +120%

BioAgPhos[®] in combination with lime and sulphur, significantly increased dryland pasture production and positively changed pasture species composition. The addition of BioAg's *Soil & Seed*[®] over fertilised plots increased dry matter yields compared to non-fertilised plots.

Effect of BioAg applications on pasture composition - dryland trial site (+/- Standard Error of the mean (SEM))



Better soils. Better crops. Better stock.

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