BioAg Country

Winter / Spring 2024

Biostimulants Increase Yield

Act now for better winter crop results

For the past four years, BioAg Agronomist and Area Manager Pete Emerson has been conducting a large-scale biostimulants demonstration with a grower near Brocklesby, southern NSW. The innovative grower is keen to explore ways to combat soil constraints and improve crop yield.

The demonstration is being carried out in three different paddocks on the property, all with a different soil type, within the grower's crop rotation. BioAg's biostimulant program is applied in 10ha blocks within each of the nominated control paddocks, where best farming practice fertilisation and chemical treatments for the region are applied.

Biostimulants improve crop performance and soil health naturally by enhancing the soil and plant microbiome, and providing beneficial metabolites to increase nutrient uptake by crops. They stimulate plant growth and resilience to abiotic factors, improve plant physiological processes, feed and enhance soil biology, and improve crop interactions. BioAg offers a range of biostimulants, each specifically formulated using a combination of fermented culture technology and other natural inputs to target the crop's specific growth stage.

For the first two years of the demonstration, BioAg's *Soil & Seed*® (*S&S*) was injected at sowing into both wheat, canola, and pulse crop dryland rotations. *S&S* is a proven natural soil inoculant that supports 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. *S&S* can be injected at sowing as well as applied by boom either pre or post-sowing.

- **AT SOWING:** ***Soil & Seed***® **injected at 4L/ha;**
- **VEGETATIVE:** ***Balance & Grow***® **at 2L/ha with weed spray or foliar nutrients; and**
- **PRE/EARLY FLOWERING:** ***Fruit & Balance***® **at 2L/ha with foliar fungicides.**

Treated Crop – Sulsa with BioAg's *Soil & Seed*® Biostimulant liquid injected at 4L/ha at sowing (no flutriafol)

Untreated Control – Sulsa + Flutriafol liquid injected at sowing

Photos taken from one paddock in 2020, show a significant increase in the root biomass at the third to fourth node stage from plant samples taken from the *S&S* treated section of the paddock, compared to the untreated control (UTC) root sample.

Over the past two years, 2022 and 2023, a full biostimulant program was applied to the 10ha sites within the grower's normal crop program. *continued overleaf*

Biostimulants Increase Yield

(continued)

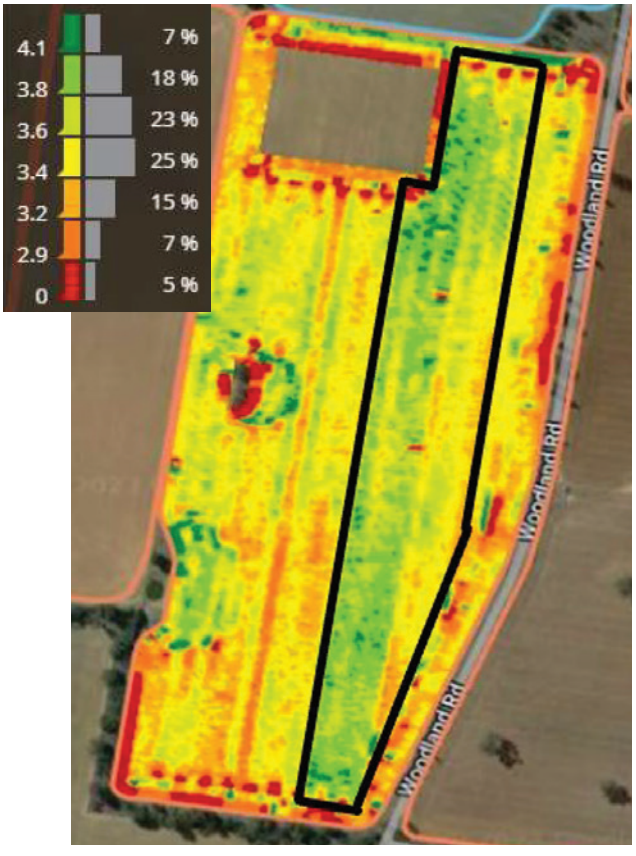
Balance & Grow® (*B&G*) provides plants and soils with a range of nutrients, carbohydrates, vitamins, minerals, amino acids, enzymes, and proteins. These components improve the supply of key nutrients and bioactive compounds enhancing plant uptake. As the components are in a biological form, they are readily absorbed supporting crops and pastures against abiotic stresses.

Fruit & Balance® (*F&B*) is a fermented microbial culture that contains a rich source of vitamins, minerals, enzymes, amino acids, and carbohydrates that support fruiting and are beneficial for fruit quality improvement and increase resilience to abiotic stresses such as heat, salinity, and water stresses. It is a natural bio-chelator of water-soluble nutrients and trace element salts. It also delivers a readily available source of phosphorus at a time when permanent plantings and crops have a peak demand.

F&B also enhances the nutritional value and quality of fruit by supporting plant functions that increase sugar levels, improve fruit firmness and storage quality, and reduce fruit splitting.

The yield map from the summer 2023 harvest clearly shows the positive impact of BioAg's biostimulant program on the harvested crop yield. The outlined black area in the map represents the 10ha biostimulant treated site and the green shading represents a higher yield t/ha result.

Given the strong yield response, the demonstration will continue in 2024. The grower is also keen to trial reducing urea rates to test if the BioAg treatments still deliver similar yields with lower nitrogen inputs.



Vale John Beckley

25/1/1963 – 12/2/2024

John Beckley, beloved father to Tom, Jessie, and Peta, was a valued member of the BioAg family. He was a truly remarkable character, lost to this world too soon.

John had a long association with BioAg before joining as the Operations Manager at BioAg's Batesford plant in Geelong, Victoria, in 2014. Anton Barton, the founder and owner of BioAg, first met John around 2008 when John worked as the truck coordinator for Kalari Transport. Kalari managed the ship-to-shore transport discharge for BioAg's reactive rock phosphate shipments.

When Kalari folded its Geelong activities, John moved over to PJT McMahon. His likable character and work ethic saw Kalari's customers, subcontractors, and drivers move with him to PJT McMahon. John personally visited Anton at BioAg's Narrandera head office to pitch for BioAg's business to ensure their strong working relationship was maintained.

In early 2014, the Operations Manager role at BioAg's Batesford solid fertiliser plant became available, and John was a natural fit and the first choice for Anton. He was also keen for a change in his career responsibilities and jumped at the chance to join BioAg. John single-handedly and meticulously ran BioAg's solid fertiliser plant for almost ten years, up until his brain tumour diagnosis in 2023.

Following brain surgery, radiation, and chemotherapy treatments, John's positivity and dedication saw him return to the Batesford plant to support new team member Bailey, sharing his invaluable experience and knowledge with a new generation. Sadly, John passed away on 12 February 2024.

John touched a great many people and will be missed by all who had the pleasure to know him. Our sincere condolences go out to John's family.

We miss you mate, your hard work and dedication, a superb person to have known. Thank you.

- From the BioAg team

Building sustainability into our business

'Doing things better' is a key value for BioAg. This extends to building sustainability into our products and business processes through harnessing innovation and new technologies.

While we discuss this approach in the soil fertility programs we develop for farmers, and in some of the products we produce and sell; there is more to know about our products and operations.

More recently, we have been asked about the carbon footprint of *BioAgPhos*® as a natural fertiliser versus traditional synthetic fertilisers. *BioAgPhos* is a sustained released P fertiliser, where 100% of the P becomes plant available. This is due to the use of high grade reactive phosphate rock (RPR) and our proprietary microbial phosphate digester we combine with the RPR.

While we don't have an exact number for its carbon footprint, we estimate from evaluations performed on synthetic fertiliser that *BioAgPhos*, on per kg of P basis, has a Green House Gas (GHG) footprint 25% lower than Single Superphosphate#. Much of this difference is due to the release of CO^2 in the manufacturing process of synthetic fertiliser.

If you are involved in a carbon farming project, ensure your advisor captures the benefit of using *BioAgPhos* or one of its blends. Our products are a natural and sustainable alternative to conventional fertilisers and are also Certified Allowed Inputs for use in Certified Organic systems.

> ***BioAgPhos*® on per kg of P basis, has a Green House Gas (GHG) footprint 25% lower than Single Superphosphate#**

And it's just not our products that are having a positive impact on the environment. BioAg's liquid biostimulants plant just outside Narrandera in South-Western NSW, is also contributing to BioAg's sustainability practices.

Water is a key input to the manufacture of biostimulants. Consistent with our business ethos, BioAg's biostimulant range is manufactured using 100% rainwater. We capture and utilise all of our manufacturing water needs from both our own plant's significant-sized rooftop and our neighbour's large rooftop. Tank storage capacity on-site is 620,000 litres of water.

More recently, we invested in a solar power system. The system has a nameplate capacity of 80kW. In the last half of 2023, we were able to generate 50% of the power used at the Narrandera plant, as well as sell back to the grid. Over the course of a year, we are a net exporter of electricity.

In addition, we schedule manufacturing in line with the seasons. Products that require cooling during manufacture are produced in the cooler months, while the handful of products that require heating are produced in summer. This reduces the energy required to control temperatures.

80kW nameplate capacity solar power system

620,000L rainwater tank storage capacity

At our Batesford operation near Geelong in Victoria, water is also a key input for the manufacture of our solid fertiliser range. Water is added during the composting of RPR into *BioAgPhos* and is also used to control wind losses by spraying stockpiles.

The water at Batesford is sourced from a nearby lime quarry operation. The quarry itself is below sea level and is continually filling with groundwater. The groundwater needs to be removed, and while we only use a small portion, it means we are both helping the quarry solve its dilemma and not using any town water.

At BioAg, we deeply care about the health of the soil, crops, livestock, farmers, and the environment. That's why we offer natural solid fertilisers and biostimulants that are designed to nourish soil health biologically. This approach allows the innate properties of healthy and balanced soils to support strong, high-yielding crops and livestock.

We believe that this sustainable farming approach is superior to the ongoing intensive use of synthetic fertilisers. BioAg's fertilisers build fertility and mineral balance while also benefiting soil biology, building long-term health of soils, crops and livestock.

Estimated from the evaluation of the GHG emissions of SSP manufactured in New Zealand in 2018-2019.

Soil-Nutrient Relationships

Understanding CEC and why it matters for Soil Health

Think of your farm's soil as the storeroom for your plant nutrients.

Nutrients, such as calcium and magnesium, may be supplied to plants solely from reserves held in the soil. Others like phosphorus and nitrogen are added regularly to soils as fertiliser to be withdrawn as needed by crops.

> **It's a complicated concept, but critical to understanding your soil's fertility. We've tried to simplify the concept to help you understand why measuring CEC as part of your soil testing and analysis is important and useful.**

All nutrients are either positively or negatively charged particles/ions. Positive particles are called cations and negative charged particles are called anions.

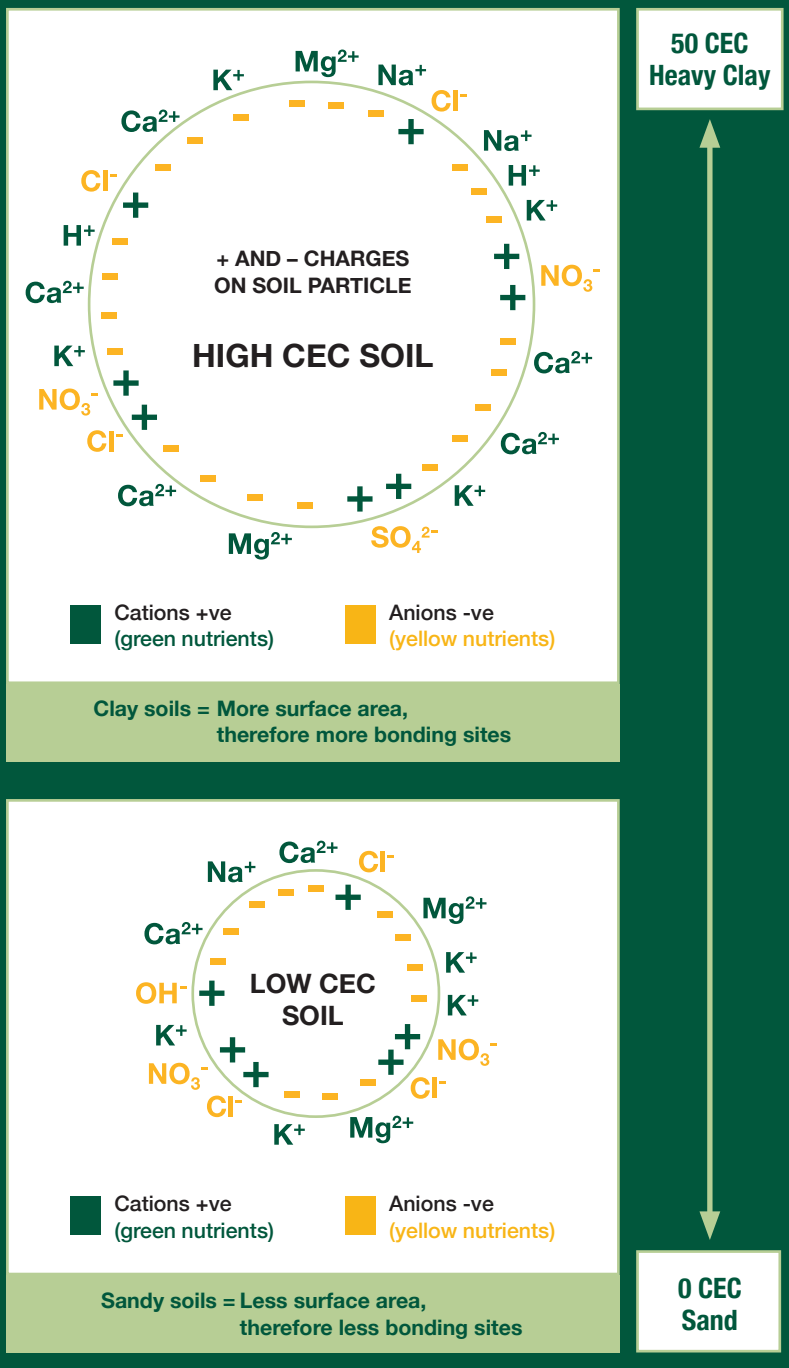
Soil cations essential for plant growth include calcium (Ca++), ammonium (NH4+), magnesium (Mg++), and potassium (K+). Three additional soil cations that are not essential plant elements but affect soil pH include sodium (Na+), aluminium (Al2+), and hydrogen (H+). The calcium soil cation is the most important and dominant cation affecting the uptake of nutrients and consequently plant growth. Calcium not only acts as a bonding agent in the aggregation of soil particles to help bind organic and inorganic substances, but it is also responsible for contributing to the building of cell walls in plants. Calcium deficiency can lead to improper cell wall formation in new tissue which may show up as distorted new growth on plants.

Additionally there are other cations, equally important for plant health but less abundant called minor and micronutrients. These micronutrient cations include iron (Fe); manganese (Mn); zinc (Zn); copper (Cu) and cobalt (Co).

Given the importance of cations, in particular calcium cations, the ability of your soil to store or hold them is important to soil fertility optimisation. The relative ability of soils to store positively charged nutrients essential for plant growth is referred to as cation exchange capacity (CEC).

CEC is an inherent soil characteristic that is difficult to alter significantly but can have a significant effect on the fertility management of your soil, and therefore your crop growth. A high CEC soil can hold more positive nutrients and deliver them to the plant when it's needed.

Soil cations (i.e. essential nutrients) are consumed in the production of crops and stock and must be replenished to avoid reduced yield output and quality. Given the critical importance of CEC in determining your soil's health and ability to sustain your crop, BioAg includes CEC analysis in its soil testing and analysis program.



Soils are composed of sand, silt, clay, and organic matter/humus. Clay and organic matter ions/particles have a net negative charge and are therefore anions. Cations are held by negatively charged particles of clay and humus called colloids (*see diagram*). They act as a storeroom of nutrients for plant roots.

As plant roots take up cations, other cations in the soil water replace them on the colloid. If there is a concentration of one particular cation in the soil water, those cations will force other cations off the colloid and take their place, potentially causing toxicity or poor plant growth.

Soils containing clay and/or organic matter have a higher CEC while sandy soils have a low CEC. In low CEC soils many of the cations that are present may be in the water around the soil particles, and not actually held by the particles. These cations are very susceptible to being leached or drained away in the soil water. Low CEC soils are typically low in calcium.

Maintaining the amount and ratio of available cations (as measured through soil test base saturation) is key to high-performing crops or pastures and is a key measure in BioAg's soil testing and analysis program. Lower CEC sandy soils are frequently acidic and respond well to lower rates of lime and/or dolomite. BioAg's approach is to balance cations as part of the nutrient input recommendation. The *BioAgPhos*® solid fertiliser range and biostimulant options are proven to build organic matter and provide long term nutrient availability, especially important in low CEC soils where nutrients not bound to clay colloids are more susceptible to leaching and lockup.

Soil & Seed® biostimulant, in particular, is a source of humus and soil carbon, thereby providing short-term improvement in CEC in sandy soils, and greatly reducing the amount of nutrients lost through leaching.

Scan for more information on:

Building Organic Matter

Local Land Services CEC Factsheet

Challenging Terrain

Getting *BioAgPhos*® onto your hills & valleys

Since the 1950s, fertiliser and ameliorants have been spread using planes and more recently helicopters. In hilly and remote terrain this is common, allowing farmers better use of more of their land. While sometimes it isn't easy to locate someone to do aerial spreading, at BioAg, we know some long-term experienced operators who can do the job!

Jason Neutze, Director and Chief Pilot at MAS Agwork, has a 30-year history of aerial spreading of Reactive Rock Phosphate in NSW and Victoria. Jason sees the main advantage of aerial application is that it is a very simple process. The farmer simply needs to order the product from BioAg or their distributor, and Jason and his team will take care of the rest.

The product is applied with great precision due to the plane's ability to fly in a constant line, at constant speed above the terrain. Pilot skill and experience are critical here as the aircraft is guided by a highly trained and qualified pilot with the most up-to-date GPS technology. Spreading fertilisers by plane is a fast and effective process with average output of 100 tonnes per day.

masagwork.net.au

> **My clients use MAS Agwork to spread the whole or part of their farm where no other method of spreading is possible due to the terrain challenges, or sometimes a combination of steep terrain and the ground too wet.**
>
> *- Matt Helder, Agronomist at Dindi Ag and BioAg partner*

Getting the soil balance right

Case study: Zucchinis, Shepparton Victoria

Dhami Singh, originally from the Punjab region of India, has always been passionate about farming. After immigrating to Australia, he now leads a team of 14 people in Shepparton Victoria, growing 200 acres of zucchini under contract. With a master's in mathematics, Dhami is not your typical zucchini farmer.

However, in December 2023, Dhami and his team faced a serious challenge when the fruit/flowers of their zucchini crop started to dry out and decompose from the top. Despite trying every remedy they could research and working with local agronomists, nothing seemed to work. In an exasperated conversation with a contact in the UK, they were recommended to contact Dr Parmjit Singh Randhawa, BioAg's Extension Area Manager. Parmjit has extensive experience in Vegetable Agronomy in leading vegetable companies throughout Australia and New Zealand.



Top-down dying of the zucchini female flower and fruit was diagnosed as blossom-end-rot.

Healthy soils are soils that have both macro and micro-nutrients in balance. Therefore Parmjit's first request was for any available soil test results to see what nutrients were out of balance within the soil. Unfortunately, the paddock in question had not undergone any soil testing. The only information available was photos of the paddock and zucchini plants, which indicated disease.

Using his scientific research skills and PhD in Soils knowledge, Parmjit used the law of elimination to diagnose the zucchini plant issue. He learned that Shepparton had experienced unusual and prevailing wet weather in December 2023. This resulted in plants being exposed to excessive amounts of naturally derived nitrogen, causing a nitrogen imbalance in the zucchini plants.

The nitrogen imbalance negatively impacted the availability of calcium for the zucchini plant and developing fruit. Calcium is critical for fruit development, especially for zucchini. The calcium deficiency led to blossom-end-rot in the developing zucchini. Applying too much nitrogen to zucchini plants (either naturally from rain and/or nitrogen fertilisers) can reduce calcium uptake and affect the developing fruit quality and yield.

BioAg recommended fertigating the zucchini crop with soluble liquid calcium as soon as possible. The results were astounding, with healthy new zucchini fruit appearing after only 72 hours of fertigation with calcium.

To prevent further issues in future crops, Dhami and his team will implement a full BioAg program. The program includes regular soil testing and the application of natural fertilisers and ameliorates to address soil deficiencies and build soil structure to buffer any recurrence of surplus natural N. Dhami's 2024 crop program is currently evaluating zucchini, okra, and sweet corn for the upcoming season.

Post calcium fertigation: healthy Zucchini fruit replace the disease affected fruit.

GV Roo's Pty Ltd Director Dhami Singh with BioAg Extension Area Manager Dr Parmjit Singh Randhawa.

Biostimulants to the rescue – enhancing fertiliser efficiency

Helping soils do what they do naturally

Nitrogen Use Efficiency (NUE) is the term used to describe the effectiveness of nitrogen uptake by plants, whether it be nitrogen latent in the soil, sequestered from the air, or applied as fertiliser.

NUE is impacted by two main factors; the ability of nitrogen to be transformed into plant usable forms, and the ability of those nutrients to be transported and taken up by the plant. The presence of soil antagonists, competing chemical processes that lead to losses through volatilisation, and leaching out of the root zone, are three key loss pathways that need to be mitigated or combatted.

As all farmers know, Nitrogen (N) is a key nutrient to promote growth, and in cereal crops protein. It is also important to plant metabolism and the creation of chlorophyll. Having enough N available to your crop is critical to yield and quality.

The N naturally occurring in soils is only partially available to plants, with the majority present in organic forms that need to be converted to plant-available forms by soil biology this process is called mineralisation.

In contrast, plants can readily take up mineral forms of N, including nitrate and ammonia, which are common forms of fertiliser. Urea is the most common N fertiliser. It readily converts to plant available forms of N in the presence of moisture. However, with all fertilisers there are losses to antagonists, volatilisation or leaching.

The importance of N to yield and quality means fertilisers are often overapplied. This increases losses, increasing money lost, and environmental risks (soil degradation, waterway eutrophication, and greenhouse gas emissions).

Given the impact on costs and the environment, NUE is extremely topical. More so when fertiliser prices are high, with farmers offered products with chemical inhibitors to reduce losses or applying fertiliser when required but at lower rates (less N more often), adding cost, and not able to apply when conditions are too wet.

BioAg's founder and Executive Chairman, Anton Barton.

There is an alternative: Helping soils do what they naturally do.

Biostimulants containing labile carbon (sugars and carbohydrates) when applied with N fertilisers increase the formation of organic compounds that contain both nitrate and ammonia. When applied with Urea they form the same compounds as the N in Urea converts to ammonia or nitrates.

These N-containing organic compounds hold the N in the root zone. As crops or plants look for N, these compounds are broken down releasing N. In addition, feeding the rhizosphere means crops are better able to sequester N from the atmosphere, leveraging the natural N cycle.

> **Growers following a BioAg program have been able to achieve equivalent or superior yields using less N fertiliser than convention dictates. In addition, trials have shown that the use of BioAg biostimulants has delivered as good, or superior yields when applying all N upfront.**

Using BioAg's *Soil & Seed*® and carbon-enriched *HydraHume*® biostimulants in combination with N fertilisers can enhance N efficiency and its retention in the soil. They can be applied pre-sowing, at sowing, or as required during important plant growth stages, via fertigation, soil-applied, seed-applied, or foliar boom spray. *continued overleaf*

Biostimulants to the rescue – enhancing fertiliser efficiency *(continued)*

Soil & Seed improves soil structure, thereby increasing nutrient and moisture retention in the soil and greatly reducing the amount of nutrients lost through leaching. It encourages rapid germination and early root development and helps buffer the crop against stresses such as pests, heat, frosts, drought, and disease.

HydraHume builds soil humus thereby increasing soil fertility. By directly contributing to humus development, *HydraHume* increases the soil's water and nutrient-holding capacity.

Balance & Grow® is recommended with foliar application of N to increase its bioaccumulation (gradual accumulation of substances) and efficiency. It is formulated to deliver a broad spectrum of beneficial nutrients and biological compounds. Hence, crops have access to a complete suite of food sources during the critical vegetative growth phase.

BioAg's range of foliar biostimulants is designed to deliver foliar macro and micronutrients, and also an additional broad range of biologically active compounds to enhance crop physiological processes and increase nutrient assimilation and resilience to environmental stresses.

Scan for more information about Biostimulants and Maximising NUE

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