
PROJECT CATALYST

# PRACTICE FACT SHEET

## HIGH EFFICIENCY LIQUID PHOSPHATE FERTILISERS

*Project Catalyst is a grower-led innovation project in sugarcane that was formed to explore, validate and broadly adopt management practice changes for productivity gains and improved water quality for the Great Barrier Reef.*

## FINDING SOLUTIONS FOR SUGARCANE GROWERS

Finding more efficient forms of nutrients, that can enable a reduction in the use of traditional fertilisers (and thus the potential for loss), whilst not compromising productivity, is a key focus for cane farmers and all industry stakeholders.

There are an increasing number of "high efficiency" proprietary formulated liquid phosphate products becoming available, that resist tie up by competing with phosphate for soil absorption sites on cations such as Al, Fe, Ca, Zn and Mg within the soil, allow for lower application rates and potential loss to the environment. This article shines a light on the Nutrient Use Efficiency problem and what some of these new products can offer as part of the solution.

*Grower walking through plant cane*

## THE PROBLEM FOR SUGARCANE GROWERS

Phosphorus is an essential plant nutrient responsible for cellular growth needed for cell division, protein formulation, early root formation, growth, photosynthesis, respiration development of the plant's growing tip, tillering and crop maturity. Phosphorus provides energy to cells powering adenosine triphosphate (ATP) when in contact with moisture. Britannica, 2023.

Unfortunately, when applied into soil the phosphorus is highly susceptible to tie up (phosphorus fixing) before the roots of the sugarcane have a chance to take it up. This makes it necessary to apply up to five times more phosphorus than sugar cane will remove in a year just to ensure that phosphorous doesn't become a growth limiting nutrient.

## PHOSPHATE HISTORY IN AUSTRALIA

Dry phosphate fertilisers have been available to Australian farmers for decades. The issue with phosphate is that when added to soil for our crops it binds up quickly and the majority of the phosphorus quickly becomes insoluble (P-sorption) and unavailable for this year's crop. According to the NSW DPI, only 5 to 20% of this formulation of phosphorus is available for the current year's crop.

Chemically, phosphate (which contains Phosphorus) is a very stable compound and does not move far from where it is applied, because it reacts rapidly with soil. Phosphorus quickly binds with high iron and high aluminium in the soil which then makes it unavailable to plants, especially in acidic soils (pH below 5). In high pH soils (pH above 7) phosphate binds with ions like calcium, magnesium and zinc which also reduces plant availability (NSW DPI).

# PHOSPHATE FERTILISERS ON THE FARM

Looking at a typical example, soil testing of several blocks showed that the soils had a high Phosphorus Buffering Index (Colwell) (PBIc) of 330 and very low available Phosphorus (BSES) of 5 mg/kg. It was calculated that 80 kg/ha of phosphorus would need to be applied in plantcane. Coupled with very high aluminium levels, the potential for Phosphorus lock-up in the soil was also very high which would normally limit plant availability using traditional dry fertiliser products.

Nutrien Ag Solutions

**SoilMate Sugarcane Report**
**23-Mar-2023 - 5-1**

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| Nutrient (Depth 0.00 - 20.00) | Result | Low | Marginal | Sufficient | High | Excess | Sufficiency Range |
|---|---|---|---|---|---|---|---|
| pH (1:5 H2O) | 5.3 | | | | | | 5.5 - 8.5 |
| pH (1:5 CaCl2) | 4.1 | | | | | | 4.7 - 7.7 |
| EC (1:5 H2O) dS/m | 0.03 | | | | | | 0.00 - 0.20 |
| EC (se) (dS/m) | 0.2 | | | | | | 0.0 - 1.7 |
| Organic carbon (Walkley Black) % | 1 | | | | | | 1.20 - 2.00 |
| Phosphorus (Colwell) mg/kg | 33 | | | | | | 41 - 50 |
| Phosphorus (BSES) mg/kg | 5 | | | | | | 41 - 50 |
| Phosphorus Buffer Index (Colwell) (PBIc) | 330 | | | | | | 15 - 420 |
| Potassium (Amm-Acet.) cmol+/kg | 0.23 | | | | | | 0.40 - 2.00 |
| Potassium (Nitric K) cmol+/kg | 3.5 | | | | | | 0.70 - 2.00 |
| Potassium % of CEC | 3.9 | | | | | | 3.0 - 10.0 |
| Sulfate-S (MCP) mg/kg | 29 | | | | | | 15.0 - 25.0 |
| Calcium (Amm-Acet) cmol+/kg | 1.7 | | | | | | 2.0 - 20.0 |
| Calcium % of CEC | 29.1 | | | | | | 55.0 - 90.0 |
| Magnesium (Amm-Acet.) cmol+/kg | 1.1 | | | | | | 0.3 - 10.0 |
| Magnesium % cations | 18.8 | | | | | | 0.0 - 25.0 |
| Sodium (Amm-Acet.) cmol+/kg | 0.11 | | | | | | 0.00 - 1.00 |
| Exch. sodium % | 1.9 | | | | | | 0.0 - 6.0 |
| Electrochemical Stability Index | 0.016 | | | | | | 0.050 - 10.000 |
| Aluminium (KCl) (prewash) cmol+/kg | 2.7 | | | | | | 0.00 - 0.50 |
| Aluminium Saturation % | 46.2 | | | | | | 0.0 - 10.0 |
| eCEC cmol+/kg | 5.8 | | | | | | 2.0 - 40.0 |
| Copper (DTPA) mg/kg | 1.1 | | | | | | 0.20 - 1.00 |
| Zinc (DTPA) mg/kg | 0.73 | | | | | | 0.30 - 1.00 |
| Zinc (BSES-HCl) mg/kg | 1.2 | | | | | | 0.6 - 1.0 |
| Manganese (DTPA) mg/kg | 230 | | | | | | 2.0 - 200.0 |
| Iron (DTPA) mg/kg | 91 | | | | | | 4.0 - 400.0 |
| Silicon (CaCl2) mg/kg | 58 | | | | | | 10.0 - 2,000.0 |
| Silicon (BSES) mg/kg | 330 | | | | | | 70.0 - 2,000.0 |

Soil Colour : Brown

Soil Texture : Medium Clay

BACK PADDOCK SOILMATE

Report generated with independant specialist support from Back Paddock Company

http://www.backpaddock.com.au

*Recommendations are based on the "Six Easy Steps"

Commonly, a cost-effective way to address the soil constraints on these blocks would be to either broadcast mill mud pre-plant and incorporate within 3 days of application, or to apply high rates of granular phosphate fertiliser at plantcane and ratoon crop stages. The terrain, particularly the slope on this block was far too steep, creating issues with safety for mud truck traffic and/or using a spreader. Blocks with steep slopes and high phosphorus requirements are also potential sources for sediment losses and thus phosphorus movement. Because phosphorus contained in sediment from farming land negatively effects reef catchments the Queensland Government has put upper limits on the amount of elemental phosphorus that can be applied in Great Barrer Reef catchment areas. Finding more efficient forms of nutrients can enable a reduction in the amount of fertiliser used across farms.

In this case, the grower normally used the traditional fertiliser GF Planter 5 at 160 kg/ha which only applied 6 kg/ha of phosphorus for plant establishment, so an additional application to meet the crops phosphorus requirements for optional growth would be required. To make up this phosphorus deficit, Loveland Structure™ was applied. Structure is formulated using Reactive Carbon Technology (RCT) which helps alleviate the phosphorus tie up issue and offers much greater phosphorus availability to crops in the current cropping year. In addition to highly available phosphate, RCT products also have the advantage of stimulating microbial populations and buffering salts in the soil. Structure is one of numerous high efficiency phosphorus products on the market. A couple of other well-known ones include Stoller N-Phos and NTS Phos-Force™ and all have high performance formulations that deliver improved early root development and vigour.

In the case of Structure, it is formulated using a manufacturing process utilising heat and pressure, which causes bonds to form between high molecular weight organic acids and phosphate ions. Structure is formulated to produce these bonded organic acids and phosphate ions, which makes the phosphorus much more available for root uptake. High efficiency fertilisers make 75 – 80% of their phosphorus available to the plant, which remains available for 50% longer than traditional forms of phosphorus. The potential for phosphorus uptake with these products is much greater than for traditional granular DAP and MAP or traditional liquids like phosphoric acid or ammonium poly phosphate (APP) and therefore application rates at planting can be reduced by 20 to 40%. This represents a considerable cost saving and reduces the risk of phosphorus not being used by the plant and lost into sensitive reef catchment areas.

## PRACTICAL APPLICATION

In November, DAP was side-dressed sub-surface on the block previously described and Structure was stool-split using the grub control applicator sub-surface. Careful placement of both products was necessary due to the slope of the block and the potential of a large rainfall event occurring at the time of application. Applied on the eastern side of the block was DAP at 250 kg/ha, delivering 50 kg of elemental phosphorus/ha. On the western section Structure was applied at @ 100L/ha, delivering 11.9 kg/ phosphorus/ha. The plantcane was filled-in and side-dressed with GF Marian Ratooner @ 253 kg/ha to finalise the crop requirement.

## RESULTS

Monitoring of the crop throughout the growing period is showing that visually there has been an improvement in crop growth compared to what has been see on these blocks in the past and it is expected that harvest results will reflect improved yield and maturity benefits. High efficiency fertiliser product will continue to be used on these blocks in coming seasons to maintain or improve crop yield and improve crop health and potentially also improve soil condition. It is also expected that runoff from the block will contain less phosphorus and future monitoring of water quality may be able to verify this.

## CONSIDERATIONS

High efficiency liquid phosphate fertilisers are placed in the crop at or prior to planting, the same stage as other phosphate fertilisers. They can also be blended with nitrogen products like Urea Ammonium Nitrate (UAN) to optimise the N:P ratio. Liquid products with reactive carbon do require agitation prior to use and should be used in the year of purchase for the best results.

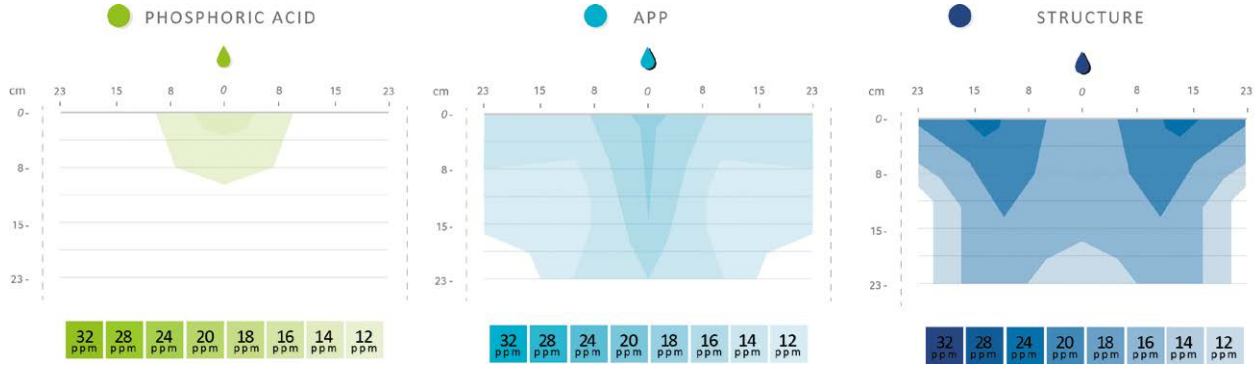
*Steve Vella applying liquid phosphate fertiliser to plant cane with stool splitter*

## SUMMARY

High Efficiency Phosphorus fertiliser products are more expensive than traditional phosphorus products due to higher manufacturing costs but most also have very important trace elements or growth promotants which are an added benefit to the crop and support productivity. Whereas DAP type fertilisers typically cost around $320/ ha, high efficiency liquid phosphate fertilisers such as Structure cost $390/ha, however they also deliver a greater quantity of phosphate and zinc to the crop and provide other benefits such as lowering crop stress by buffering aluminium, sodium, and chloride toxicities from the roots, creating a healthier crop root environment.

In the example here, high efficiency liquid phosphate fertilisers were used in combination with traditional fertilisers to ensure that phosphate levels matched crop requirements. The longer-term advantage of this combined approach is better supporting the crop during growth and development and reduce the amount of phosphorus locked up in soils that may be lost through runoff water to local waterways.

***Watch our 4 minute video on how this practice is being adopted by growers in the Mackay region:***
https://youtu.be/bWYAepwy9uU

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Australian Government | Reef Trust | Great Barrier Reef Foundation | The Coca-Cola Foundation | WWF

Project Catalyst is funded by the partnership between the Australia Government's Reef Trust and the Great Barrier Reef Foundation, The Coca-Cola Foundation and WWF-Australia.



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