PROJECT CATALYST

2023 - ***GROWING IDEAS ADVANCING BEST PRACTICE; DRIVING PRODUCTIVITY AND ENVIRONMENTAL SUCCESS***

CORAL NURSERIES
Engineering resilience and adaptive capacity on the GBR

CROPPING DISEASES
Mung beans, pulses and soybean pressures researched

AGEING ON FARM
The new approach to rejuvenating farming communities

Image: Andrew Campbell and Ross Neivandt

CATALYST COLLABORATION

We're excited to be back in beautiful Cairns for our 2023 Project Catalyst Annual Forum. As we weren't able to gather for the event in 2022, we're aiming to bring you a feature packed program with a mixture of live presentations, digital participation, and a day of interesting field visits around Cairns and the Atherton Tablelands.

The resilience of Project Catalyst shines through, and we're extremely fortunate to have the continued support of our committed funding partners, the Great Barrier Reef Foundation (GBRF) and The Coca-Cola Foundation. With their support, Project Catalyst is making real inroads in developing and adopting productive and environmentally beneficial farming techniques at scale. Following several years of disruptions with COVID, the project remains a leader in the practice change adoption space and is producing outstanding outcomes for growers and the environment across the Queensland sugar industry. Looking to the project's future, we encourage you to help by thinking about your next agricultural innovation ideas as we work to preserve the project's innovation heart and secure future funding. Please work with your on-ground service provider to get your ideas onto paper as we continue to seek interest from new organisations keen to drive future farm innovation opportunities.

Of course, the program does not exist without the generous and ongoing support from you, the growers. We have growers still involved with the program fifteen years after it began, sitting alongside others who have only joined the team in the last few months. Thank you for giving your time and making your farms available to work with our on-ground service providers in researching and implementing improved farm management practices.

Project Catalyst has achieved some impressive milestones in the two years since the last Forum - a great credit to all involved. Some examples of these are:

- Ten innovation trials were extended through the 2021 season. This was made possible by the Great Barrier Reef Foundation generously agreeing to fund on-farm innovation beyond the period originally agreed. These trials are now finished and trial reports are available on the Project Catalyst website
- 34 growers are now adopting practice changes annually under the GBRF's Mackay Whitsunday Water Quality Program
- 30 growers are now adopting practice changes annually under the GBRF's Lower Herbert Water Quality Program
- The Coca-Cola Foundation supported thirty-two growers to adopt practice change in 2021. Thirteen of these growers continued their practice change pathway in 2022 along with six new growers to the program. The 2023 program will allow the six 2022 growers to progress to their second year and bring an additional three (or more) new growers into the program
- The Queensland Department of Agriculture and Fisheries (DAF) completed and published a major body of Economic Analysis work on Project Catalyst trials in the areas of Nutrients, Water and Soil
- DAF also ran several training days for Project Catalyst on-ground service providers about statistical methods, trial design and sampling

Despite the challenges of holding events these past years, we were still able to make the most of every opportunity. Nutrien Ag Solutions, Farmacist and HCPSL all ran a number of very well attended grower information events for new growers wishing to improve nutrient management and adopt practice change to join Catalyst. These events included local agricultural shows, shed meetings, morning tea and lunch gatherings across the regions. Other extension and outreach activities included field days and workshops in the Mackay Whitsunday and Wet Tropics regions featuring fallow and cover cropping with legumes and multi species, grower designed and built bean planting equipment, inoculation methods, drones, EM mapping and variable rate ameliorant prescriptions and the use of chemical ripeners. Thank you to our on-ground service providers for running and supporting these events.

It was also great to see that Project Catalyst was singled out in the most recent Reef Report Card and acknowledged as a major contributor to the creation of important social outcomes. This is testament to the incredible outreach and interest that Project Catalyst has across not only the cane growing industry, but the broader community too. In 2021 the project gained considerable exposure with Coca-Cola South Pacific's virtual classroom guest speaking to Queensland high school students about Project Catalyst and their replenish programs, and independent case studies published by Planet Ark's Australian Circular Economy HUB and NRM Regions Australia. Continuing to build on our communications capabilities, in 2022 Project Catalyst launched a dedicated Facebook page and kicked off a regular series of high-quality Podcasts. These new channels continue to bring a huge variety of interesting and useful information to growers and the public.

We must also congratulate the 2022 Reef Champion Award winners, including long term Project Catalyst grower Denis Pozzebon who received the Reef Nutrient Stewardship Champion Award and Project Catalyst On-Ground Service Provider Rebecca McHardie who took out the Reef Extension Officer Champion Award. Congratulations also to Project Catalyst's Audra Allan for being a finalist in the Reef Champion awards.

We also look forward to welcoming Tony Rossi, recipient of the Prince's Trust Australia Environmental Leadership – Reef Sustainability Award as guest speaker at Project Catalyst Forum 2023 – another great reason to come along to Forum and learn about Tony's farming journey.

I'd also like to welcome any growers who are

at Project Catalyst Forum for the first time. Please make the most of the opportunity to see what other growers are up to, discuss ideas and share your stories. We hope you find the presentations and activities interesting and informative.

From Andrew Campbell and I at Catchment Solutions, we hope you enjoy Project Catalyst Forum 2023 and can take time to catch up with old mates and make a few new ones. As always, let us know what you think so we can continue to provide you with information and opportunities that interest you and your fellow growers.

Ross Neivandt
Project Coordinator – Project Catalyst
Catchment Solutions

Australian Government | REEF TRUST

Great Barrier Reef Foundation

THE Coca-Cola FOUNDATION

WWF

FEATURE

GREAT BARRIER REEF FOUNDATION

Congratulates Project Catalyst achievements

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PROJECT CATALYST

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FORUM/CONFERENCE PROGRAM

SUNDAY, FEBRUARY 19TH

WELCOME FUNCTION Thanks to Nutrien Ag Solutions

Level 1, Foyer - Pullman International Cairns

17:00 – 19:30	Delegates Check-in (Collect name tag) - Join us for drinks and canapes

MONDAY, FEBRUARY 20TH

GROWER FORUM/CONFERENCE Thanks to Coca-Cola and GBRF

Grand Ballroom - Pullman International Cairns

07:30 – 08:00	Delegates Check-in (Collect name tag)
08:00 – 08:10	Housekeeping and Introductions - **MC Tony George**
08:10 – 08:15	Welcome to Cairns and Country - **Terrain NRM Representative**
08:15 – 08:30	**Great Barrier Reef Foundation - Catalina Reyes-Nivia**
08:30 – 09:20	Keynote Speaker - **Ryan Donnelly, CEO Reef Restoration Foundation**
09:25 – 09:40	Virtual Farm Tour - **Growing Ideas Advancing Best Practice**

09:45 – 10:15 **MORNING TEA** Thanks to Reef Catchments

10:20 – 11:20	**Project Presentations** Session 1 - 2 groups of 3x20min presentations each
11:20 – 12:20	**Trial Presentations** Session 2 - 2 groups of 3x20min presentations each

12:20 – 13:20 **LUNCH** Thanks to Wilmar Bio Dunder

13:20 – 14:20	Breakout Session 1 (same groups as morning) Group 1: **Growing Ideas** *1 - Lisa Kelly – DAF Mung bean disease research* *2 - Tony Rossi – Wet Tropics Grower* *3 - Ryan Donnelly Reef Restoration Foundation* Group 2: **Environmental Success** *1 - Mark Zatta – Wet Tropics* *2 - Lynn Hong – Coca-Cola 'Creating Sustainable Value'* *3 - Sam Marwood Cultivate Farms*
14:20 – 15:20	Breakout Session 2 (same groups as morning) Group 1: **Environmental Success** *1 - Mark Zatta – Wet Tropics* *2 - Lynn Hong – Coca-Cola 'Creating Sustainable Value'* *3 - Sam Marwood Cultivate Farms* Group 2: **Growing Ideas** *1 - Lisa Kelly – DAF Mung bean disease research* *2 - Tony Rossi – Wet Tropics Grower* *3 - Ryan Donnelly Reef Restoration Foundation*

15:20 – 15:50 **AFTERNOON TEA** Thanks to ALS Global

15:55 – 16:10	Virtual Farm Tour - **Driving Productivity and Environmental Success**
16:10 – 16:25	**Ross Neivandt**, PC Project Officer - 2023 and beyond
16:25 – 16:30	Wrap Day 1 & Preview Day 2 - CLOSE - **Kim Kleidon**
16:30 – 16:45	Group photo

FORUM DINNER Thanks to Odonata & Cultivate Farms

Grand Ballroom – Pullman International Cairns

18:00 – 18:45	Pre-Dinner Drinks Thanks to Suncorp
18:45 – 23:00	Formal Dinner - three courses with drinks MC - **Robert Bonassi, PC Wet Tropics Grower** Guest speaker - **Rob Watkins 'Turning Waste into Profits'** **Director Natural Evolution Foods, Mt Uncle Farmer** From the Banana Blankie to Green Banana Flour, Rob and his family continue to expand their operations and products. Be inspired by Rob's story 8 years after he first regaled Project Catalyst in Townsville.

FIELD TRIP / FARM TOUR PROGRAM

TUESDAY, FEBRUARY 21ST

FIELD TRIPS Thanks to Farmacist & Mackay Sugar

GROUP 1

FNQ Food Incubator/Mt Uncle Distillery/NQ Tropical Seeds

08:00 – 08:30	Registration check-in
08:30 – 08:40	Board buses/cars - travel to FNQ Food Incubator *59 Dutton Street, Portsmith*
08:40 – 09:40	Group Tour of Commercial Facilities – Supporting entrepreneurs to manufacture foods and beverages sustainably and profitably
9:40 – 10:00	Board buses/cars - travel to Cairns Botanic Gardens *64 Collins Avenue, Edge Hill*
10:00 – 10:20	**MORNING TEA - CAIRNS BOTANIC GARDENS**
10:20 – 12:00	Board buses/cars - travel to Mt Uncle Distillery *1819 Chewko Road, Walkamin*
12:00 – 12:40	**LUNCH - MT UNCLE FUNCTION ROOM**
12:40 – 13:40	Group Tour of Agave plantation Mt Uncle Distillery
13:40 – 14:00	Board buses/cars - travel to North Qld Tropical Seeds *4872/6732 Kennedy Highway, Walkamin*
14:00 – 15:00	Group Tour production, grading and processing facilities of premium pasture seeds and legumes
15:00 – 16:30	Travel home/buses return to Cairns

GROUP 2

Mt Uncle Distillery/NQ Tropical Seeds/FNQ Food Incubator

08:00 – 08:30	Registration check-in
08:30 – 10:10	Board buses/cars - travel to Mt Uncle Distillery *1819 Chewko Road, Walkamin*
10:10 – 10:30	**MORNING TEA - MT UNCLE FUNCTION ROOM**
10:30 – 11:30	Group Tour of Agave plantation Mt Uncle Distillery
11:30 – 11:50	Board buses/cars - travel to North Qld Tropical Seeds *4872/6732 Kennedy Highway, Walkamin*
11:50 – 12:30	**LUNCH - NORTH QLD TROPICAL SEEDS**
12:30 – 13:30	Group Tour production, grading and processing facilities of premium pasture seeds and legumes
13:30 – 15:10	Board buses/cars - travel to FNQ Food Incubator *59 Dutton Street, Portsmith*
15:10 – 16:10	Group Tour of Commercial Facilities – Supporting entrepreneurs to manufacture foods and beverages sustainably and profitably
16:10 – 16:30	Travel home/buses return to Cairns

Australian Government

REEF TRUST

Great Barrier Reef Foundation

Water Quality Program

Photo by Jordan Robins

Water quality improvements for the Great Barrier Reef are being accelerated through our work with farmers to change farming practices now and into the future. Over 800 farmers and graziers are already working hard to improve land management to support sustainable and productive farming. This shift has contributed to the 187 tonnes of nitrogen, 229 kilograms of pesticides and up to 37 kilotonnes of fine sediment prevented from entering the Reef each year so far.

The Great Barrier Reef Foundation and the Australian Government's Reef Trust have a $443.3 million partnership that includes $201 million for improving water quality in the Great Barrier Reef catchments. The Partnership is committed to achieving significant, measurable improvements in water quality for the Reef, while supporting the sustainability of the agricultural sector.

To date, the Water Quality Program has:

- Engaged 1,300 sugarcane farmers and 369 graziers to participate in actions to improve water quality.
- Supported 504 sugarcane farmers to improve management practices and reduce nutrient and pesticide runoff on 101,816 ha of cane land.
- Supported 296 graziers to improve management practices on 478,721 ha of grazing land to minimise sediment loss.

The Partnership's five-year strategy prioritises water quality outcomes through activities that address key pollutants – dissolved inorganic nitrogen (DIN), pesticides, and fine sediment. This is achieved through six partnership activities - early investments, regional programs, conservation and protection of less disturbed catchments, innovation and system change, technical advisory and Traditional Owner-led water quality activities.

The Water Quality Program has now committed 90% of the available funding and 77 projects are underway across 20 Reef catchments. The majority of these are focused on achieving enduring improvements in land management practices while also maintaining or improving productivity and profitability for farmers.

Ten regional water quality programs in priority catchments with catchment-specific pollution load reduction targets are currently delivering better water quality for the Reef. Five sugarcane programs are in the Mackay Whitsundays, Lower Burdekin, Lower Herbert, Tully Johnstone, and Mulgrave-Russell catchments. Five grazing programs are in the Upper Herbert, Upper and East Burdekin, Bowen, Broken and Bogie, Fitzroy, and Mary catchments. Projects funded under the regional programs primarily involve:

- Practice change: working with farmers and graziers to improve management practices related to stock management, nutrients, pesticides, and irrigation.
- Landscape remediation: restoring gullies and streambanks, including earthworks and revegetation, to reduce erosion and the amount of fine sediment impacting the Reef.

A range of novel approaches and systems have been implemented to improve the delivery of the regional water quality programs, such as developing an in-house spatial database to capture real-time information from delivery providers, as well as dashboards that show real-time data on progress providing unprecedented transparency and accountability.

More information on these and other projects is available at barrierreef.org. To keep up to date with the program, subscribe to our e-newsletter at barrierreef.org/you-can-help/subscribe.

SPEAKER PROFILES

Tony George

Emcee Extrordinaire

Finding talented emcees can be like discovering a diamond in the coal mine.

But finding one that plays guitar and sings as well, that's like winning the MEGA Jackpot.

Tony George is one of Cairns most popular entertainers and bands, providing 20 years of high-quality musical entertainment and M.C services. Born In Kyabram, Victoria, and later raised in Melbourne, Tony has lived and built his successful career in Cairns since 1994.

Working for the State Bank of Victoria, then a resort Manager in the Northern Territory that also included Crocodile spotting tours, Tony eventually became a professional entertainer fulfilling his dream of working and having fun with people.

"I specialise in corporate conferences, weddings, and events of all natures. Since 1994, I've owned and managed Tony George Entertainment, performing as a solo singer guitarist and even in 7-piece bands."

Tony doesn't limit himself as an M.C and host to a range of conferences, corporate events, Weddings, and Awards nights, he also works for clients providing voice overs for ads, documentaries, and films.

"Highlights of my career have included performing as a musician for Prime Minister John Howard and other Government dignitaries, high profile film and Television actors, celebrities and a host of VIP's from around the globe."

Tony may have to avoid including this event on his resume due to our low profile and lack of celebrities. He should appreciate the lack of formalities and interesting characters.

Tony also wants you to know of his prowess, performing as musician and M.C for a huge list of world-wide companies including Ford Motor Company, Coca-Cola (who's delegates are here), Commonwealth Bank, McDonald's Australia, Macquarie Bank and Metcash.

I think we need to befriend this man and connect with his contacts....KK

Please make him feel like part of the Project Catalyst family and whatever you do, don't take him to the Casino with you – his reputation depends on it.

Ryan Donnelly

CEO Reef Restoration Foundation

Resilience and Adaptive Capacity on the Great Barrier Reef: the Role of Reef Restoration

Coral is an important and diverse ecosystem, protecting coasts from storms and erosion. It also provides a home for an abundance of marine life, serving as a source of food and shelter. If coral reefs disappeared, essential food and spawning grounds for marine organisms would disappear, and biodiversity would suffer.

To prevent this from occurring, the Reef Restoration Foundation planted coral on underwater frames in 2017, after the Great Barrier Reef Marine Park Authority granted a permit for the pilot research program.

A tropical fisheries researcher with a long history of marine conservation Ryan leads the not-for-profit organisation pioneering offshore coral nurseries on the Great Barrier Reef.

Growing coral fragments in ocean-based nurseries to assist the natural process of recovery after disturbances, Ryan is heartened by recent events.

"After much anticipation, on Saturday 12 November 2022, we witnessed our nursery reared corals at Fitzroy Island releasing millions of egg-and-sperm bundles for the first time, playing their natural role in this extraordinary reproductive event."

The techniques employed by these scientists are based on reef restoration sites in Florida, where healthy coral was attached to underwater frames, and then planted onto hard substrate after a growing period of around six months.

A grassroots movement, working in partnership with the marine tourism industry and community, Reef Restoration is resourced by individuals and businesses locally and from across the planet. Supported by volunteers in the field, importantly, all work is underpinned by sound science and is replicable in other communities.

"Nature will always produce far more corals than we will ever plant so our aim is to breathe life back into corals that would otherwise die and care for them through to reproductive viability. Reproduction marks the completion of the first full cycle. It'll be the first of many to follow."

Dr Catalina Reyes-Nivia

Great Barrier Reef Foundation

Climate change is the greatest threat to coral reefs. But the science is clear: coral reefs need action both at the local and global level. Improving water quality is a critical and practical local pathway to improve Reef health.

In 2018 the Australian Government announced an unprecedented investment in reef protection. Creating a $443.3m partnership with the Great Barrier Reef Foundation, to help fund new and existing projects that protect and restore the Reef into the future. The Reef Trust Partnership includes $201 million to contribute to efforts aimed at addressing water quality issues.

Dr Catalina Reyes-Nivia is the Associate-Director of Water Quality for the Great Barrier Reef Foundation. Catalina holds a BSc (honours) degree in Biology, a MSc in Biological Sciences and a PhD in Marine Sciences and is a passionate and committed environmental researcher and program manager with over 18 years' experience applying domain expertise to both research and practical impact-driven implementation of projects focused on long-term dynamics, health condition, water quality and climatic impacts on catchments, coastal and marine ecosystems in the Caribbean and Australia.

"In the last five years my work has focused on planning and managing a portfolio of programs and projects that improve farming practices, reduce fertiliser use and promote the uptake of new technologies while enabling strategic partnerships to protect the Great Barrier Reef."

The presentation will summarise the suite of workstreams and types of activities that are being funded to cost-effectively achieve target pollution load reductions in priority catchments, with a particular focus on the Region Programs model and progress towards targets.

SPEAKER PROFILES

Lisa Kelly

Department of Agriculture and Fisheries

Diseases impacting pulse crops in a sugarcane rotation

With legume crops adoption continuing to rise throughout the sugar industry, research is being conducted into disease pressures – particularly in North Queensland.

Lisa Kelly is a Senior Plant Pathologist with the Queensland Department of Agriculture and Fisheries with over 16 years' experience researching grain fungal and bacterial diseases.

Currently she leads a GRDC funded project on disease diagnostics and surveillance in grain crops throughout Queensland and northern New South Wales. But it's her involvement in research projects on mung bean powdery mildew, mung bean breeding, pulse root diseases, soybean extension, and diseases in crops that you'll find interesting.

Lisa has extensive experience undertaking disease diagnostics and pathology research in grain legume crops, particularly mung beans.

" I'm undertaking my PhD part-time on the powdery mildew pathogens infecting mung bean and other legumes through the University of Southern Queensland. I'd like to present an overview of the major soybean and mung bean diseases persisting in crops grown in sugarcane rotations in recent years."

Lisa has been the main point of contact for Queensland growers experiencing plant disease issues in their soybean and mung bean crops growing in sugarcane farming systems.

"As pulse production has increased in sugarcane farming systems, the incidence of fungal disease has risen, at times to detrimental levels. The warm, humid, and wet conditions that occur in northern Queensland environments favour fungal pathogens that infect pulse crops and cause disease."

In recent years, the incidence of fungal diseases, such as Anthracnose (caused by Colletotrichum spp.), Target Spot (caused by corynespora cassiicola), Pod and Stem Blight (caused by Diaporthe/Phomopsis spp.), and Cercospora leaf spot (caused by Cercospora canescens) have increased significantly in soybean and mung bean crops growing in rotation with sugarcane.

Sam Marwood

Cultivate Farms

Rejuvenating Farming Communities and Planning for Ageing on Farm

Growing up on a dairy farm in Central Victoria, forges strong connections to farming and agricultural communities. Perhaps that's why Sam is described as "a community driven problem solver who is redefining the farming and agriculture industry."

Sometimes you must create distance to appreciate those early childhood experiences and return to your roots. Sam spent 12 years working in environmental policy for the Victorian Government before deciding that he wanted to take stronger action toward connecting land, people, and environment.

"I was shocked to learn that so many farmers saw selling their farm as the only option when they wanted to retire. Fifty percent of our farmers will retire in the coming decade, and many young farmers feel locked out by surging prices."

Sam engineered a method that helps young, aspiring farmers connect with retiring farmers. Co-founding Cultivate Farms in 2016 to help younger farmers get a foothold on their farming dreams, with a long-term transition of farm ownership, both retiring and aspiring farmers can benefit.

During the breakout session you will discover how to generate strong legacies for your farms and influence the ongoing management of the farms. Using the Ageing on Farm guide prepared by Cultivate Farms, retiring farmers can stay on their farm, while using capital tied up in the farm to enjoy a retirement.

"For young farmers, they will understand how they can support farmers to create a legacy on their farms and assist aspiring farmers to work alongside and transition the farm business to the young farmer."

At the end of the session, participants will have developed their own Ageing on Farm plan.

Sam is also the CEO of Odonata Foundation, a charity that aims to end extinction. He combines sustainable farming visions with high biodiversity outcomes.

He lives with his wife and two young boys in Kyneton, Central Victoria, and hopes his boys will grow up to be farmers.

Tony Rossi

TnT Farm Techniques Pty. Ltd.

Aloomba grower Tony Rossi is preparing a legacy for generations of farmers to follow.

A sugar chemist and Landcare advocate, there's nothing more important to Tony than sharing knowledge, and even through his own experience he has a lot to share.

With twin brother Chris, the Rossi family were recently recognised for their environmental stewardship by the QFF Reef Champion Awards, supported by the Australian and Queensland governments and the Prince's Trust Australia. Tony won the Prince's Trust Australia Environmental Leadership – Reef Sustainability Award, for applying his scientific skills on farm.

With an interest in soil health and soil testing, developing precision agricultural techniques & regional environmental issues, he has become an advocate for demonstrating on-farm sustainable environmental practices to other farmers and industry. Working closely with Landcare and Wet Tropics NRM Terrain.

"It's a real team effort with my brothers and great support from Mulgrave Landcare and Catchment Group."

Five years ago, they received assistance through funding from the Australia Governmet's Reef Trust, allowing them to invest in commercial composting equipment.

"With our plant cane, we were still applying 140 units of Nitrogen, but we were getting 70 parts from Soybean and the other 70 parts from compost. We were on a steep learning curve then, doing some big harvest trials that found the compost matching the fertiliser. Not turning our back fully on fertiliser but there's a good way of helping the soil chemistry quite a bit by using natural sources of organic carbon."

Tony and Chris have reduced Nitrogen inputs from 140kg/ha to 83kg/ha and less through addressing organic carbon levels in their soils. You'll hear all about the trials, techniques developed with mixed species fallow crops, farm made compost and precision application to the cane row.

Mark Zatta

Wet Tropics Grower
Abergowrie

Mark believes that agronomy is key to understanding what you can grow, including varieties. Knowing Ph, Aluminium levels and what's living in your soil.

"I think there's easier ways of doing things. I'm fortunate to have good ground, others have tougher ground, with water logging, My farm is light sandy soils, no flooding, so my practices are probably different. I don't have to work them as much. Everything begins with the soil."

Eight years ago, Mark had been working on the farm, until his Uncle passed away and he had to step up. He started to ask questions in his quest to learn more than what he'd come to understand following the practices of his forebears.

"I started attending events with HCPSL, connecting with other growers, and even asking my neighbours about what they were doing. You can learn from everybody no matter what their practices and choose to implement what you want."

That's how Mark began using a bean planter to grow a mixed species fallow crop. His neighbour asked him if he would try planting beans, to which he responded 'mate, not interested'. He felt it was too much extra work even on 200acres – he has to disc up, go over the ground 3 times and maybe rotary hoe it. Taking him away from other work.

The neighbour challenged that notion and invited him to look at a planter they were building.

"I couldn't believe what I saw, it simplified the whole process, so I asked if I could borrow it to do 10acres. The next year it was 50, and now it's anywhere up to 200acres.It allows us to plant 75acres a day."

Admitting to having a 'basket case' farm, the results speak for themselves. The 100-acre block struggled to produce 25-29t to the acre, previously yielding 35-40t, Mark explained the soils depleted due to not being rested long enough between crops.

"I ran into an agronomist at a field day who offered to evaluate it, showing me how to take a proper soil test with a clean shovel (laughs) not one I'd been mixing concrete with that had calcium on it. He introduced me to fallow crops and after five years that farm is yielding 35t."

Rob Watkins

Evolution Industries

Being a banana farmer in Far North Queensland is challenging – torrential rains, cyclones, disease and market constraints, requires innovative thinking and diversification to thrive.

Second generation farmer Robert has a strong farming philosophy and believes that ultimate nutrition begins with healthy soil and plants.

"For many years our family were among the largest banana growers in Australia, specialising in Lady Fingers. This variety requires 25-30% more labour to grow than Cavendish bananas and has a reduction of 50% less plants per acre due to their height."

In 2008 Rob who is always inventing efficient practical solutions to farming, designed a fully recyclable packaging system known as "Banana Blankey", which reduces cost, handling, and most importantly plastic packaging that bananas require for transport. Made from a fully recyclable P.E.T liner that fits into a fruit carton, cushioning the fruit on their sometimes 15000 km journey.

"Fruit would arrive in store ready to be presented, with the only waste (the blankey liner) collected and recycled."

In 2010 Rob was crowned Young Farmer of the Year for his ingenuity, but also in his new field of invention machinery designed specifically for banana harvesting and maintenance.

But it was dumping tonnes of beautiful fruit because they were too big, too straight or too bendy for the supermarket giants, that led to his next innovation. Perfectly good for eating and packed full of nutrients. Cattle would break fences to get to green bananas unsuitable for specific supermarket guidelines, equating to approx. 500 tonne in Australia every week.

Late one summer afternoon Rob accidentally drove over a hand of lady fingers on the bitumen, what he saw in the rays of the setting sun was like dust, something he later named "diamond dust" due the difficultly in producing this superfood. He asked himself, 'Could this be a flour'?

Rob will share his story of successfully 'Turning Waste Into Profits".

Lynn Hong

Coca-Cola

Head of Climate and Water

Water is a precious resource that flows and connects us as people, our livelihoods and natural ecosystem such as the Great Barrier Reef. In addressing the complex socio-environmental challenges, we must focus on restoring nature to combat climate change, water insecurity and social issues. But we know we cannot do this alone.

As the Head of Climate and Water for the ASEAN and South Pacific region at Coca-Cola, Lynn recognises that partnership and collaboration are vital in creating real and lasting change. She is dedicated to preserving and enhancing the health of our waterways and realises that this is not only beneficial for the environment, but also for society and businesses.

Lynn's decade of technical and sustainable environment, combined with passion for her cause make her a powerful advocate for the protection of water, our planet's most precious resource. Based in Sydney, she leads the charge in developing and executing the water and climate strategy for Coca-Cola across 25 markets in the region, working to ensure clean and healthy waterways for generations to come. To Lynn, water stewardship and building climate is essential for a thriving ecosystem, community, and economy.

"After suffering mild coeliac symptoms for years, I began producing a small batch - 6kg of gluten free banana flour per week, sold through my families' Café."

ROB WATKINS


THE
Coca-Cola
FOUNDATION

Photo by Kim Kleidon

TOWARDS 2030: FRESH FACES AND NEW HORIZONS

Looking back through the last Catalyst Forum message, this line struck me as particularly poignant: 'Here's hoping 2021 throws a few less challenges for everyone.'

It's hard to believe we're now well and truly into 2023, but it's safe to say both 2021 and 2022 threw a few more curveballs than we would have hoped for or anticipated.

Nevertheless, such is the new world we are now living in and I'm excited that everyone will have the opportunity to finally meet again on the home soils of Project Catalyst in 2023.

Nothing beats face-to-face meetings and the opportunity to build meaningful relationships over an icy cold drink together. Bringing people together is part of our DNA at Coke, and so it has been fantastic to see progress on the broader adoption validation program via a number of face-to-face shed meetings that have taken place over the last couple of years. In 2023, our wish is that we will be able to join some of these shed meetings and hear more first-hand about the incredible progress being made every day by the passionate group of Catalyst growers.

On the Coca-Cola side, the last few years have been significant years of growth and transition, and I'm delighted to introduce the Project Catalyst community to two new key Coca-Cola team members.

Lynn Hong is the Head of Climate and Water for the ASEAN and South Pacific region and Natalie Helm is the Public Affairs, Communications and Sustainability Director for the South Pacific.

Lynn has been in the Coca-Cola 'system' for over 10 years and has a wealth of technical expertise and experience in the water, sustainable agriculture and climate space. She also brings passion and commitment like no other and is already proving to be an incredible asset to the Project team. During the 2023 Forum, Lynn will present insights on how Project Catalyst is adding value through nature-based solutions.

Water Leadership is one of six global sustainable business priorities at Coke. Our renewed ambition for 2030 is to ensure there is good quality water for all - people, nature, and business. Through programs such as Project Catalyst we want to not only to preserve environmental health but also bring positive impact to grower communities.

The potential of Nature-Based Solutions is clear, but we need to build the business case, generate more interest from the private sector and investment in this space. To enable this, we have worked with Denkstatt to develop and pilot a methodology to quantify the benefits of water replenishment in economic terms. Our pilot projects show that in different contexts, water restoration can enhance a range of ecosystems beyond providing water, including carbon sequestration, water quality improvement, flood protection, recreational benefits, as well as increasing productivity. We look forward to sharing more about Project Catalyst's role in this study during the Forum.

In addition, Natalie Helm also joins the team and brings a depth of experience working with large-scale clients on Agency side for over 20 years. Natalie is also a born and bred country girl, hailing from Murrumbateman in ACT's wine region and looks forward to waxing lyrical on all things sustainable agriculture down the track.

Finally, Sarah Prestwood who many of you have known over the past seven years transitions off the Project Catalyst team as she pursues an exciting senior role in Communications in the Coca-Cola regional structure. She will never be a stranger to the Project Catalyst team however and looks forward to bringing greater visibility to Project Catalyst via ongoing communications opportunities.

With Coca-Cola's new regional structure across South East Asia and South Pacific comes extensive new networks within both the regional and global organisation that will only strengthen the way we can add value to the future growth and sustainability of Project Catalyst.

We have just received notification of further funding from the global Coca-Cola Foundation for 2023 – marking the 15th year of funding. This is the longest serving project of its kind in our Australia business and one we can all be extremely proud of.

Thank you again to the team from WWF including Sharelle Pollock who is new to Project Catalyst, Andrew Campbell and Ross Neivandt for their continued leadership and commitment to making this project the success it is. Have a great Forum, the Coca-Cola team is looking forward to seeing you there!

Anna Dear
Community and Partnerships Senior Manager
Coca-Cola ASEAN and South Pacific

Innovative Practices

Photo by Kim Kleidon

This year, Project Catalyst has again made a valuable, and expanding, contribution to realising the Great Barrier Reef (GBR) Long Term Sustainability Plan. By adopting best management farming practices, all those involved have contributed towards the common vision of sustainability in the Queensland cane industry. We recognise, and warmly welcome, all the steps that are contributing to the 2025 water quality targets in the Sustainability Plan and improved health of the GBR.

We appreciate the enthusiastic support of the Great Barrier Reef Foundation and the Coca-Cola Foundation for this work. Their assistance has enabled a further 82 growers to adopt practice change across the Mackay Whitsundays, Burdekin and Lower Herbert regions, with events held in each region (despite COVID challenges).

Knowledge sharing through such events is at the heart of Project Catalyst. Together with the wealth of resources on the project website - including the latest videos and podcasts, and information and trial updates - bringing people together to share their experiences is pivotal to this work. If you haven't checked it out recently, please visit https://www.projectcatalyst.net.au/project/ to find out more.

To extend our learnings, this year WWF-Australia, together with the other project partners, will be coordinating an evaluation of Project Catalyst. The evaluation will include consultations with different stakeholders and supporters, and the results will be shared with everyone involved in the Project. This will be an opportunity to capture the lessons learned that can inform continuous improvement and potential opportunities to consider going forward, and how the Project Catalyst model might be applied to other sustainability projects.

We are heartened that once again the Project Catalyst community will be able to come together for Project Catalyst Forum 2023. We look forward to connecting again with the communities throughout the GBR catchments.

We wish you all a productive and sustainable year.

Sharelle Polack
Senior Manager, Sustainable Agriculture
WWF Australia
E: spolack@wwf.org.au

Food and Fibre companies eager to back Aussie farmers through preferential purchasing

Nigel Sharp, Chair of Odonata Foundation at Tiverton Sheep Farm

We know that mismanagement of financial capital leads to its lessening value over time – if we spend more than we replace, we lessen the amount of money available. It's the same with Natural Capital, using more from nature than we replace is degrading the amount of natural resource available to farmers. Odonata Foundation are helping to refine mechanisms to help repay the natural debt - through increasing biodiversity, rehabilitating waterways, and replanting native species – while also supporting the financial health of farming enterprises; through The Buyers' Club that makes purchasing decisions based on Natural Capital Accounting.

Odonata Foundation is an Australian charity that empowers and enables all Australians to save wildlife and increase biodiversity. They have a particular focus of working alongside farmers. The Buyers Club, setup by Odonata in partnership with Bush Heritage and La Trobe University piloted in 2022, with the aim of helping buyers to preferentially purchase from farmers who are working alongside nature. Those in The Buyers' Club purchase raw food and fibre materials in bulk from farms that have been selected by Odonata due to commitment to Natural Capital Accounting.

With 12 companies involved in the pilot project, Odonata Foundation is now looking to expand the program in 2023. The Buyers' Club supports buyers to map their supply chain and understand how they can best purchase from farms who are working alongside nature and introducing natural capital in their accounts. Companies such as Will and Bear Hats use The Buyers' Club to support Tiverton Farm – producers of fine merino wool with an emphasis on biodiversity.

As consumers demand to know more about the source of their products, buyers of raw materials must understand the origin and integrity of the raw product. We know there are many more and we know that building an army of buyers, we can unlock more ways to financially benefit farmers. Anyone farming can start to measure their natural capital and introduce ways to increase and account for it. The methods developed through this initiative can be introduced to all farms at anytime. Taking a long-term approach to natural capital on farms will be increasingly important in the future.

Odonata Foundation is currently working with LaTrobe University on a project funded by Landcare Australia, to develop a standard series of metrics for Natural Capital Accounting including vegetation analysis, carbon capture, wildlife detection and soil health. These metrics will assist buyers everywhere to make informed choices on the natural capital of the farms from which they are buying.

You can read more about our story or get involved on our website https://odonata.org.au/

BETHANY DONKER

Zonal and variable rate application

Growers in the Lower Herbert are continually seeking to improve their productivity and protect the value of the landscapes around them. It is likely for these reasons Herbert growers have been part of Project Catalyst since its inception, exploring novel technologies and approaches and transforming them into practical realities through on-farm trials. While there have been a mix of successes and challenges in trialing the tools or techniques it is clear that exploring each new idea has not only built the confidence of growers in their own management but has also contributed to the wider body of knowledge that exists within the sugarcane industry; sometimes a step back has led to a jump forward.

In 2021-22, growers in the Herbert region have looked to existing and emerging practices, refining and adapting them for their conditions. The Catalyst Project's three Innovative growers have seen particular value in zonal and variable rate application for addressing a range of soil, weed, and system management challenges. In addition to testing the viability of these practices within their farming systems many of these growers continue to contribute to improving productivity and environmental outcomes within the region, supporting other growers in testing and adapting these same approaches for their own farms, establishing these tools, technologies, and approaches as best practice for adoption within the Herbert catchment.

PACE
Zonal Imidacloprid

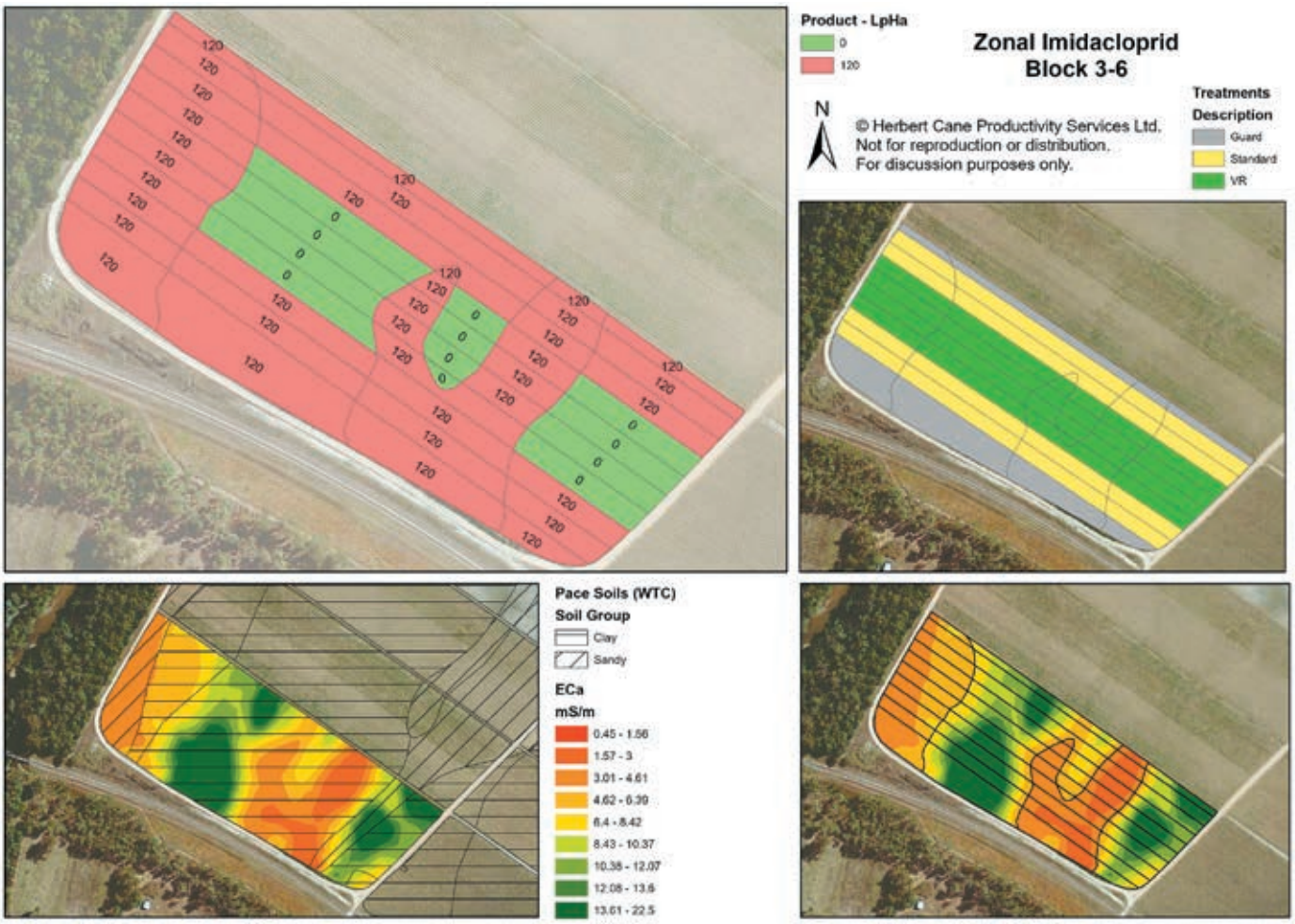
BACKGROUND

Canegrubs are the Australian sugarcane industry's most significant economic pest. Since 2001 control of canegrubs has relied heavily on the neonicotinoid insecticide Imidacloprid. However, a shift in the market for canegrub control products is currently underway as a result of concerns with the high concentrations and subsequent impact of neonicotinoids within local catchment waterways. This has led to growing interest in new control methods as well as cost-effective approaches for existing Imidacloprid products. Pace Farming are progressive Herbert growers with previous experience in trials around zonal applications for mill by-products. Increasing product costs as well as a strong awareness of where their farm had grub problems led them to consider exploring zonal application of Imidacloprid to maintain yield while reducing the quantity of applied Imidacloprid.

Figure 1 - Imidacloprid trial design with location of water monitors

Crystal Creek									
Headland									
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 3	Rep 4	Rep 3	Rep 4	
Guard	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Guard
18 rows Standard Rate	9 rows Standard Rate	9 rows Standard Rate	9 Rows Zonal Rate	9 Rows Zonal Rate	9 Rows Zonal Rate	9 Rows Zonal Rate	9 Rows Standard Rate	9 Rows Standard Rate	6 Rows Standard Rate
		Water monitor #1		Water monitor #2	Water monitor #3 (2021-22)	Water monitor #3 (2020-21)	Water monitor #4		
Headland									

Figure 2 - Zonal Imidacloprid Prescription



TRIAL DESIGN

Cane grubs are known to prefer lighter soils. Targeted zonal application of Imidacloprid at the recommended rate to sandy or vulnerable soils within a block reduces the total amount of product applied with potential water quality benefits from reduced run-off, leading to both a control and cost efficiency gain.

Using a combination of grower records, soil type and EM maps HCPSL generated a zonal prescription map for the Pace's to upload to their variable rate controller. Unfortunately, the block for the original trial established in 2019 flooded in early 2020, compromising the treatments and preventing samples from being collected. A new trial block was selected, and the trial redesigned with replicates for Imidacloprid prescription in September 2020 to reflect the different soil type patterns of the new block. Figures 1. & 2. show the trial design and prescription map for the Imidacloprid applied with the side dress of fertiliser on the 6th October 2020. First flush water samplers were installed shortly after to provide a comparison for Imidacloprid run-off between treatments.

RESULTS

First results from this trial came from ground-truthing grub counts in April of 2021. There was no presence of grubs and no observable grub damage which was confirmed by drone images prior to harvest. The block was cut late in the season on the 11th of November 2021. Results from the first cut of the trial indicated no significant difference between treatment yields. Run-off sampling results were also inconclusive. Table 1. and Figure 3. show that concentrations of Imidacloprid running off from both the zonal and standard treatment plots were highly variable. Previous studies have established that applying less pesticide to a paddock leads to a proportional reduction in loss from rainfall runoff so it is possible the unexpected variability in this case may have resulted from challenges with the sampling equipment and method.

On the 7th of December 2021 Imidacloprid was re-applied as per the trial design and water samplers installed soon after on the 9th of December. The trial was harvested early, on the 29th of June 2022. Similar to the previous year's yield data, there was minimal variation and no significant difference between treatments. Figure 4. presents the average cane yield and CCS results for each treatment in 2022.

An upcoming economic analysis will provide a further basis for confirming the value of zonal Imidacloprid over traditional blanket application in improving water quality and cane grub control long-term.

Based on these results and the savings generated from reduced quantities of product, the Paces are now implementing zonal Imidacloprid applications on all blocks with varied soil type needing grub control.

Table 1 - Concentrations of Imidacloprid in first-flush samplers following rainfall events

Sample Date	Rainfall (mm)	Sample Description	Sample ID	Imidacloprid (µg/L)
2020-21 Season				
29/12/2020	75	Standard Confidor	S-P2-R2	0.04
		Zonal Confidor	VR-P6-R2	0.05
12/1/2021	128	Standard Confidor	S-P2-R2	0.33
		Zonal Confidor	VR-P4-R1	0.15
		Zonal Confidor	VR-P6-R2	0.03
		Standard Confidor	S-P7-R2	1.02
19/1/2021	26	Standard Confidor	S-P2-R2	0.32
		Zonal Confidor	VR-P6-R2	0.49
		Zonal Confidor	VR-P4-R1	1.77
		Standard Confidor	S-P7-R2	0.38
2021-22 Season				
29/1/2022	125	Standard Confidor	S-P2-R2	0.38
		Zonal Confidor	VR-P4-R2	1.25
		Zonal Confidor	VR-P5-R3 *	0.86
		Standard Confidor	S-P7-R3	0.02
15/3/2022	67	Standard Confidor	S-P2-R2	0.18
		Zonal Confidor	VR-P5-R3*	0.05
		Standard Confidor	S-P7-R3	0.42

*Note change in sampling location from P6 to P5 in 2021-22 season.

WARING
Variable Rate Phosphorus

BACKGROUND

Soils in the wet tropics are highly variable, extending from heavy clays to terrace loams and red sands across farms and within blocks. As a result, growers implementing best practice seek to match their inputs of fertiliser and ameliorants with the needs and constraints of their soils at a block level. Nitrogen and phosphorus tend to be treated similarly across farms in terms of sampling and management despite the fact that these nutrients behave very differently in soils. Compared to nitrogen, which is highly mobile, phosphorus binds with soil particles which means phosphorus concentrations may vary widely as well as spatially depending on soil type. This places particular importance on soil sampling for determining phosphorus application rates as the current practice of randomized sampling may result in applications of phosphorus in plant that limit crop growth within the block from either excess or deficiency. Increasing uptake of variable rate boxes, GPS-guidance for tractors, and EM soil mapping presents an opportunity to target phosphorus applications at a finer scale. Grower Michael Waring has an interest in capturing the value of these technologies and approaches for managing phosphorus on his Lannercost Extension farm.

TRIAL DESIGN

This trial was established on a block in the Lannercost subdistrict with a soil profile typical of the region known for its clay and sand ridges over heavy clays. The trial was initially set out on the 5th of October 2021 and randomized soil samples were taken to provide a 'typical' recommendation for the standard treatment. Figure 5. shows the variable rate treatments as determined by a GPS grid of soil samples and phosphorus applied at 0, 10, 15, & 20kg P/ha across 50m strips using a GPS controller on the 8/11/21. The phosphorus rate for the control, based on the average recommendation for the block, remained at 0kg P/ha.

Normalised Difference Vegetation Index (NDVI) maps were used throughout the season to monitor plant health across the block. Due

to wet conditions over the harvest period of 2022 the trial was unable to be cut and was left as standover. Despite this, the trial clearly demonstrated the presence of variation in phosphorus demand within a block.

Growers considering precision application may benefit from specifically targeting their phosphorus application to improve not only plant germination rates, providing a yield benefit and reduced weed pressure from improved canopy closure, but ultimately better nitrogen use efficiency leading to a more even, profitable crop.

Figure 3 - Imidacloprid concentrations during the 2020-21 & 2021-22 Wet Seasons

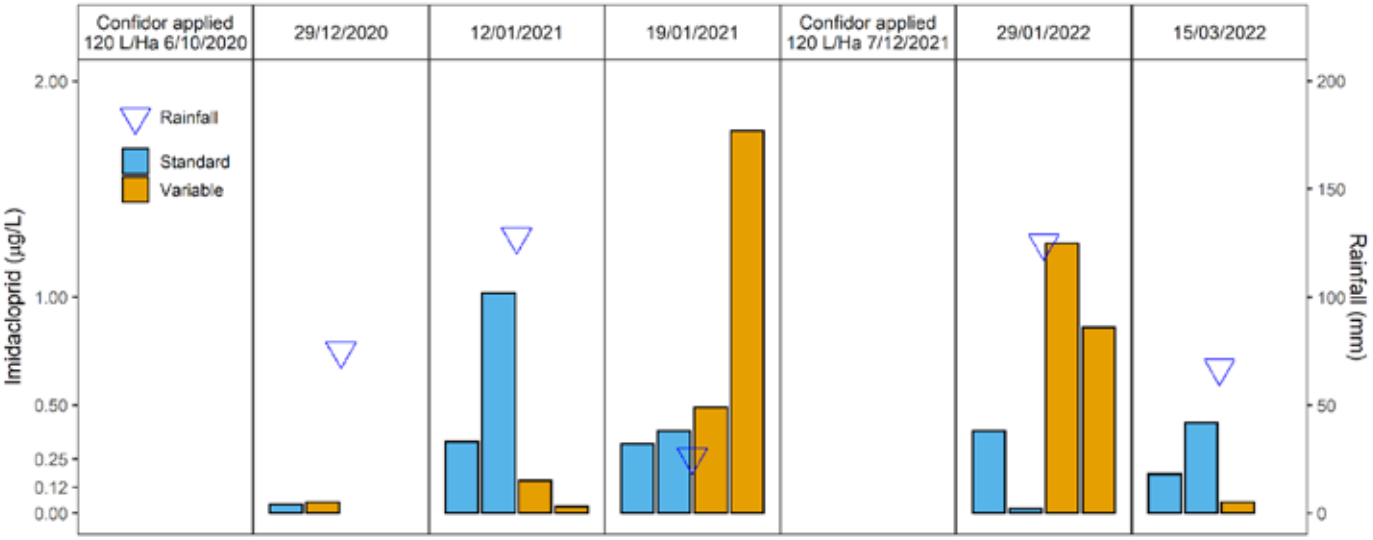


Figure 4 - 3R Harvest results for Zonally Applied Imidacloprid - 2022

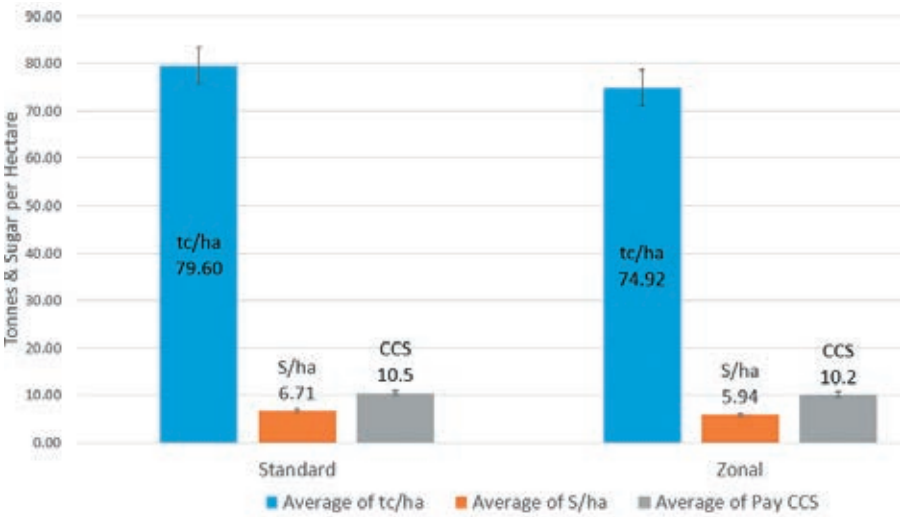


Figure 5 - Variable Phosphorus Trial Prescription Map

Figure 6 - Tracking variable phosphorus outputs

ABERGOWRIE SUGAR
Drone Weed Mapping

BACKGROUND

Herbert growers spend a significant proportion of time and resources early in the season managing weeds. A previous Project Catalyst trial in the Herbert, reported on in 2020, looked at using drones with high resolution aerial imagery to map and apply herbicide where there were weed infestations. While the project did not get the result hoped for in terms of control due to smaller weeds being missed by imagery and a lack of herbicide penetration into the canopy for controlling vines, the growers and HPCSL still saw potential for drones to improve the efficacy of weed control.

Building on the lessons from this initial work, the focus of a new trial was directed towards the using smaller, lighter drones for early surveillance and mapping of weeds in young cane blocks. This new trial with Abergowrie Sugar aimed at exploring drone mapping for precision herbicide spraying.

TRIAL DESIGN

The initial stages of the trial involved selecting a young ratoon block with weed pressure from Guinea grass (Megathyrsus maximus var maximus) as the visibility of broadleaf weeds and Guinea grass is higher in young cane when the interrow is clear. The HCPSL drone was flown over the block on the 11th of October 2022 at 65 metres above ground level to generate an image with a pixel size of 1.56cm. This was found to produce an image too coarse to confidently identify all the Guinea grass from sugarcane so from the 15th to the 19th of November a non-RTK GPS was used to ground truth Guinea grass stools in-field to compare against the drone map. The ground truthing showed that the image coarseness as well as the colour and reflection of the Guinea grass limited the usefulness of the drone imager for distinguishing the stools at this stage.

Figure 7 displays a map generated with grid cells set at 7 drills by 20m (12.81m x 20m). Plots were selected as 'infected' using weed GPS points plus a 2-metre buffer to account for horizontal GPS error. A total of 82/135 (61%) grid cells were considered infected with Guinea grass or broadleaf weeds. This map was then provided a guide for manual spot spraying on the 23 of November 2021.

The manual spot spraying involved three treatment combinations of paraquat, diuron, and hexazinone; paraquat and isoxaflutole; and MSMA, diruon, and hexazinone. This element of the trial was aimed at exploring alternatives to diuron in controlling Guinea grass.

Herbicide efficacy assessments followed in early 2022 using part of the mapped grid as access through the trial block made a whole block assessment unfeasible. The assessment involved walking through the plots (20m by 7 rows) and reviewing Guinea grass stools as either dead, living but impacted or living and healthy. Adverse effects on the sugarcane from the herbicide sprays were also considered.

All but one of the assessed grids received an average efficacy rating of fair to excellent and there were no clear differences in the efficacy of the different products. The trial was harvested in late December 2022. Guinea grass stools emerging in early January were found to be unrelated spatially to previously marked stools.

DISCUSSION

A number of challenges for distinguishing Guinea grass in cane limit the current potential of drone-generated prescription maps. This trial looked at a process of weed mapping using drones at critical points to allow for rapid assessment and response to weed pressure in-paddock. This trial, harvested and sprayed late in the season, also demonstrated potential for variable rates to reduce the risk of herbicide loss in run-off from early rainfall. Further value arises from using the drones to spatially map block-specific weed pressure over time. With further exploration these tools have potential to provide growers with a functional, accurate way to approach their spray applications and track the effectiveness of their weed management.

Figure 7 - Drone trial map with guinea grass stool locations

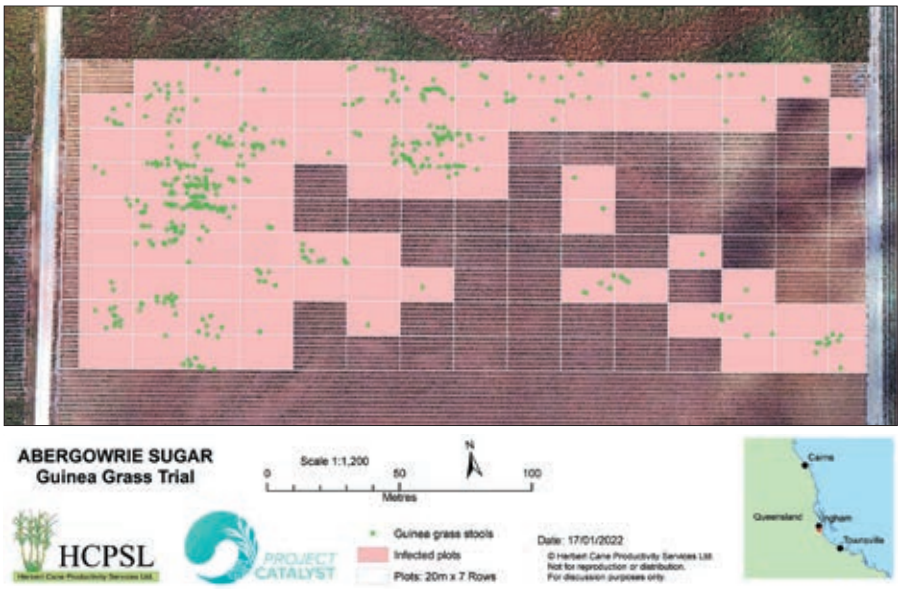
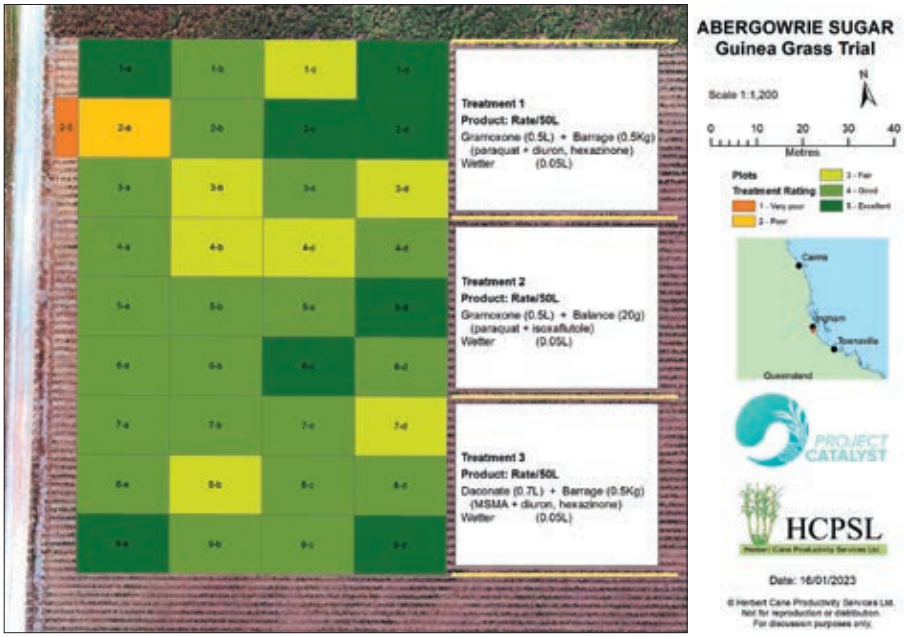


Figure 8 - Spray Prescription and Herbicide Efficacy Map



PETER BECKE

Supporting on farm innovation in the Johnstone

Over the past four years, Project Catalyst has supported 20 growers in the South Johnstone Basin to trial different ideas and farm management practices that they believe may lead to improvement in productivity and sustainability on their properties.

Project Catalyst provides advice and support to these growers through trial design and establishment, harvesting and the interpretation of results. This gives the growers involved confidence that the idea or management practice has made a difference on their farm.

One of the greatest strengths of Project Catalyst in the South Johnstone region is that it is part of an integrated local extension network. This provides the growers involved with consistent advice across their whole farming system and access to a broader support network which provides the best guidance and assistance possible to improve productivity and sustainability.

Growers involved in Project Catalyst in the South Johnstone Basin have run a total of 30 trials and projects covering reduced, zonal and zero tillage plant cane; banded and subsurface ameliorants; nutrient and pesticide management planning; fallow management and mixed species cover crops.

Banded Chicken Manure

A large proportion of the grower projects in this district has been focused on fallow management, with growers interested in a range of different management options from having a go at legume cover cropping to zero till mixed species cover crops.

The main defining factor with all fallow cropping in the South Johnstone area is ensuring cover crop establishment prior to the onset of the wet season. This has led to the establishment of several trials looking at zonal and zero till cover crops that allow the cover crops to be planted as early as possible after the final ratoon harvest.

Species selection is also a key factor in establishing a successful cover crop. It is important to consider individual block constraints when choosing what type of cover crop to plant. Examples of this include making sure grass species are not included in your cover crop mix if grass weeds are likely to be a problem in the fallow period, or whether a species can tolerate water logging or not.

In all situations it is important to consider what you are hoping to achieve from your fallow period before deciding what to do in each block.

Building on previous work from Project Catalyst and grower interest, a trial looking at pre-plant sub surface banded mill ash was carried out. This trial aimed at improving soil health and in turn increasing the longevity of ratoons and reducing the amount of synthetic nitrogen applied. Due to difficulty deep banding the mill ash there was no significant difference in cane yield between surface banded and sub-surface application in this trial. Another trial with the same aim involves banding chicken manure in the furrow prior to the filling in of plant cane.

Project Catalyst has become an integrated part of our local extension network and has supported growers to trial and assess different ideas and management practices on their own farms. This project also provides a support and advice network of growers, extension and industry bodies to further develop and share these ideas through the community.

Zero Till Cane Planting

Zero Till Planted Cane

Fertilising Ratoons

Direct Drilling Cover Crop

Marker Flag in Nutrient Trial

Mixed Species Fallow Crop

JASMINE GIRGENTRI

WITH GROWER ANDREW CROSS

Investigating the effect of various nitrogen rates in sugarcane following a harvested soybean crop

BACKGROUND

Andrew is a fourth-generation farmer originally from New South Wales. His farming experience includes dryland crops and irrigated cotton as well as sheep, cattle and pigs. Andrew has since moved to the Burdekin to work at MHP Farms and has grown a vast variety of crops including mungbean, soybean, kabuki pea, rice, sorghum, cotton, mango, macadamia, corn and sugarcane. Andrew has two young children who love the farming lifestyle of northern Queensland, however, whenever given the chance he loves to take the family travelling around Australia.

Andrew became interested in participating in the Project Catalyst innovation trials to better understand the effect a soybean crop had on the following sugarcane crop by way of nitrogen availability. He is particularly focussed on ensuring that nutrients and irrigation are used in the most efficient way possible to get maximum gain. Since soybeans fix atmospheric nitrogen to the soil, Andrew wanted to know if he could reduce his nitrogen fertiliser in the following cane crop without negatively affecting productivity, and how this would influence his profitability.

Image: **Biomass sampling crew - Cherrie, Rob, Jasmine, and Ellie Lea**

TRIAL DESIGN

A soil sample was taken prior to planting cane to determine the nutrient requirements. The control nitrogen rate (N170) was calculated using the Six Easy Steps methodology. The soybeans were biomass sampled prior to harvest to calculate the subsurface nitrogen supplied. Unfortunately, this crop had been severely affected by target spot a few weeks before harvest which drastically reduced the yield, however, we decided to continue the trial.

The cane was planted a week after harvesting soybeans and fertilised accordingly. Three rates of nitrogen were used: one at Six Easy Steps rate (minus the soybean N input), and two lower rates with 30kg/ha N difference between them. Each treatment was replicated three times randomly across the block. Fertiliser was applied in three split applications to ensure all macro nutrients were the same across treatments with only nitrogen varied.

Table 1 - Plant cane nutrient application

	N (kg/ha)	P (kg/ha)	K (kg/ha)	S (kg/ha)
Treatment 1 (60kg N reduction)	110	12.5	117	73.5
Treatment 2 (30kg N reduction)	140	12.5	117	73.5
Treatment 3 (control as per 6ES)	170	12.5	117	73.5
1st ratoon following year applied across all	200	0	71	38

Table 2 - Trial Plan

N110	N140	N170	N140	N170	N110	N140	N110	N170

RESULTS

Plant Cane

To determine if there was an effect from different nitrogen rates, the efficiency of nitrogen uptake was assessed by biomass sampling at nine months old. The cane was harvested at 15 months and tonnes of cane/hectare (TCH), CCS and tonnes of sugar/hectare (TSH) were calculated. This was also collected in first ratoon to see if there is any residual effect from reducing nitrogen rates in plant cane.

Nitrogen uptake from plant cane biomass at nine months showed that the cane was consistently more efficient at utilising nitrogen at the lower rate of N110 as seen in graph 1. This is based off samples taken in two rows of every replicate. Biomass sampling indicated that at the age of nine months, the cane was not deficient in nitrogen in any of the treatments.

When we analyse the 15-month harvest there was little difference in TCH between the N110 and N140 treatment, however the N170 treatment was on average 10T/ha greater, although this is not statistically significant, see graph 2. The N110 treatment still performed within the range of the N170 which indicates that there was surplus nitrogen within the system to supply the cane with adequate nitrogen for growth. To better understand how the nitrogen from the soybean crop interacted with the following cane crop, a zero nitrogen treatment would have been beneficial.

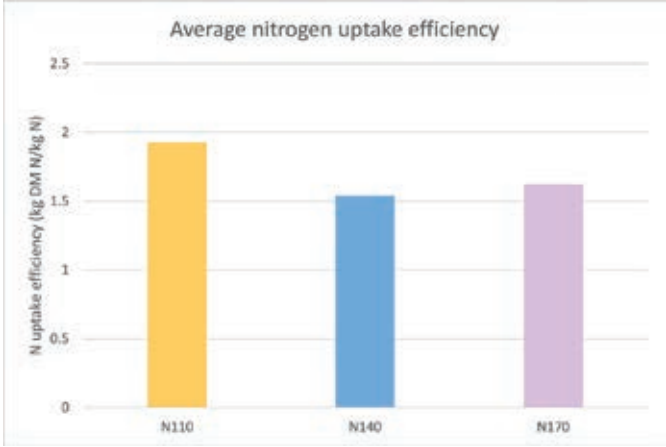
CCS showed that there was minimal variability between the treatments, the lower N rates had slightly higher CCS but it is not significant as seen in graph 3. It was noted that the CCS declined across the block with progression of harvesting, this may be due to burnt cane being left in the paddock for an extended period or even a block effect.

Tonnes of sugar per hectare (TSH) showed that there was no significant difference, however the higher N (170 6ES) was on average slightly higher, see graph 4.

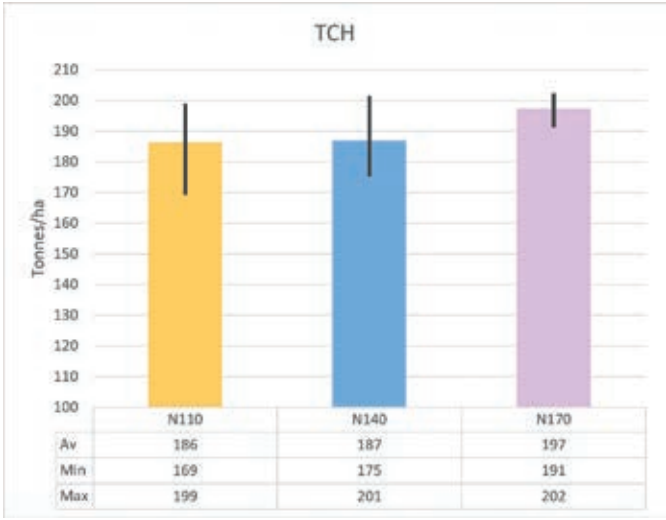
When the cost of applying nitrogen was calculated at different rates (110, 140, 170 kg/ha), the middle rate (140kg/ha) was better on average ($5163/Ha). The lower N110 rate showed the least return on average ($5046), however this is not significantly different to the other treatments. This was based on 2021 prices of sugar at $450/T, harvesting and levies at $7.50 and urea price of $1.43/kg of N. See graph 5.

Overall, there was no significant difference between the three nitrogen rates in relation to tonnes of cane produced in the plant cane crop. This indicates that a lower rate of nitrogen is sufficient to produce a similar tonnage to the recommended 6ES rate of nitrogen. The dollar return for the grower was marginally better in the N140 due to the lower cost of applying nitrogen while maintaining yield and CCS.

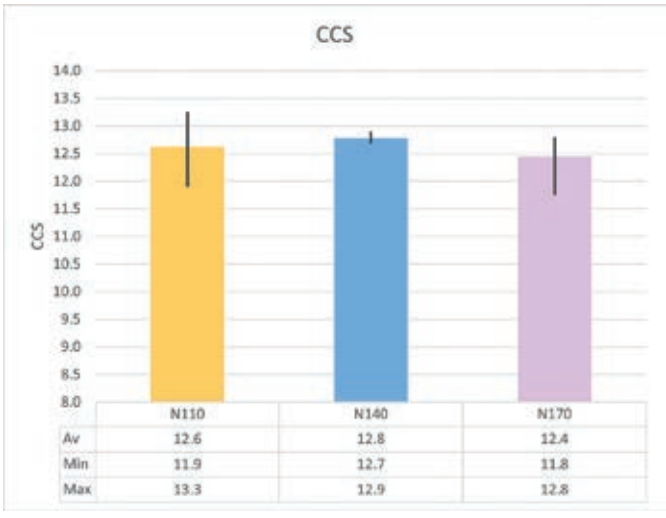
Graph 1 - Average nitrogen uptake efficiency



Graph 2 - TCH



Graph 3 - CCS



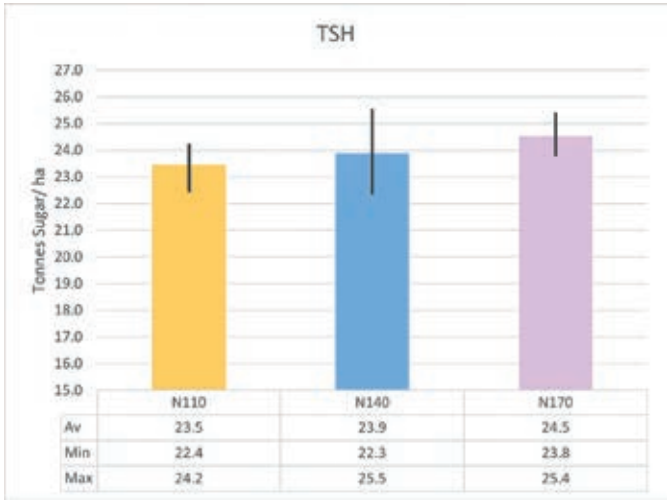
Ratoon Cane

Ratoon cane TCH, TSH and CCS were also analysed to find if there was a residual effect of reducing nitrogen in plant cane. The TCH, TSH and CCS showed that there was no difference across the trial and that all treatments yielded similarly as seen in graphs 6, 7 and 8. CCS showed a similar drop across the block as was seen again in the first ratoon harvest. This data shows that there was no effect on the first ratoon crop from reducing the nitrogen in the plant cane.

It is important to remember that each given year is different and excessive rain may affect the amount of nitrogen in the soil profile, particularly if soybeans are grown right before planting cane. Each crop of soybeans will sequester a different amount of nitrogen depending on the size and health of the crop, how much fertiliser nitrogen was applied when planting the crop and whether it is harvested.

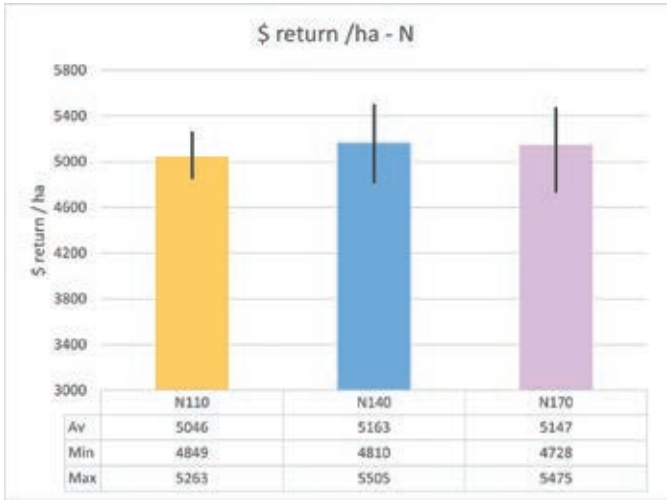
The results from this trial show that nitrogen can be reduced after a soybean cash crop without affecting sugarcane productivity and profitability.

Graph 4 - TSH



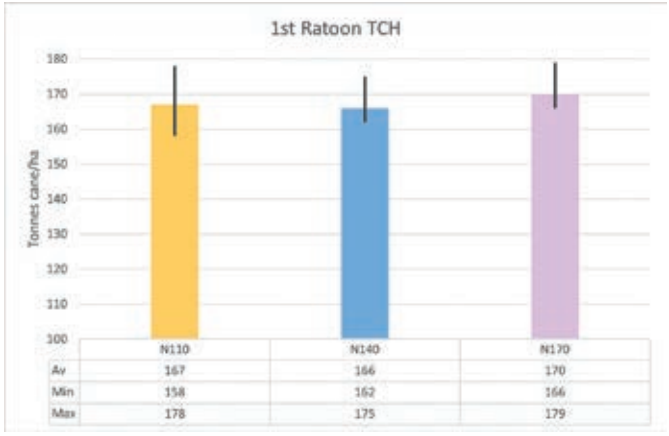
	N110	N140	N170
Av	23.5	23.9	24.5
Min	22.4	22.3	23.8
Max	24.2	25.5	25.4

Graph 5 - $ return/ha -N



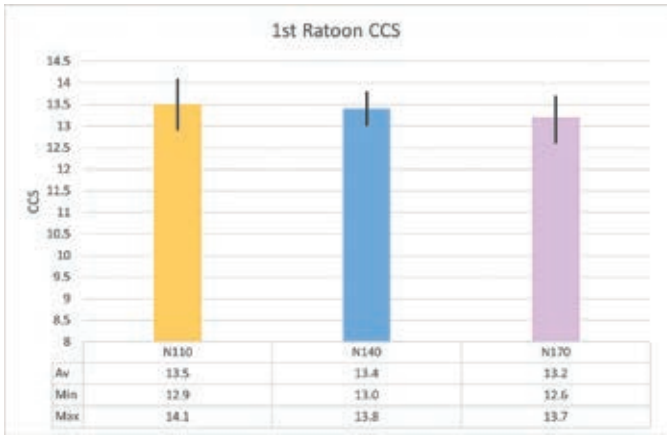
	N110	N140	N170
Av	5046	5163	5147
Min	4849	4810	4728
Max	5263	5505	5475

Graph 6 - 1st Ratoon TCH



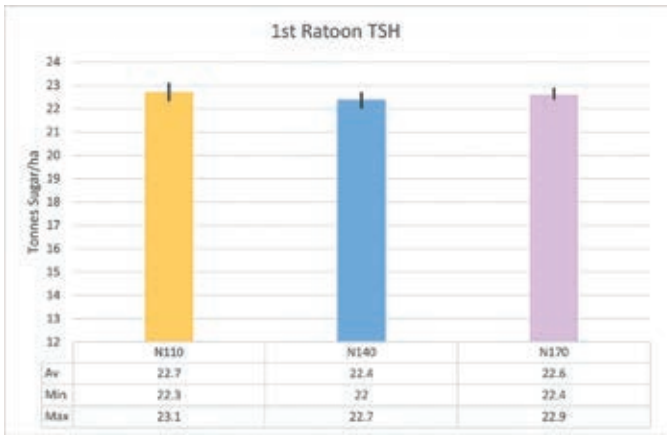
	N110	N140	N170
Av	167	166	170
Min	158	162	166
Max	178	175	179

Graph 7 - 1st Ratoon CCS



	N110	N140	N170
Av	13.5	13.4	13.2
Min	12.9	13.0	12.6
Max	14.1	13.8	13.7

Graph 8 - 1st Ratoon TSH



	N110	N140	N170
Av	22.7	22.4	22.6
Min	22.3	22	22.4
Max	23.1	22.7	22.9

Image: **Jasmine inspecting soybean crop**

BILLIE WHITE

WITH GROWER BRYAN LANGDON

Using real-time technology to monitor groundwater nitrates in the Burdekin

Through the 2020 Project Catalyst innovation grants, Farmacist Burdekin purchased a GW50 groundwater nitrate sensor to install at Bryan Langdon's farm. The focus of the trials at Bryan's farm for the last 5 years has been to monitor nitrate levels in the aquifer and conduct nitrogen-fertiliser-rate trials investigating how to utilize irrigation nitrates in a fertilizer budget. One of the hesitations that growers have when incorporating groundwater nitrates into fertilizer budgets is the unknown – what is the level today compared to tomorrow, or 6 months in the future? Farmacist staff conducted some preliminary monitoring at a number of bores around the Burdekin region in 2016-2019 and found that nitrate levels remain relatively steady throughout the year; however, they are influenced by rainfall events. When rainfall occurs during active fertilizer applications, the nitrate levels spike, before coming back down to their steady state level. However, collecting this data can be labour intensive (collecting samples from each irrigation, getting them analysed, and then analysing the data). The aim of this project was to implement a technology that would help growers collect this data themselves with minimal effort – enter the GW50 groundwater nitrate sensor!

Figure 1 - GW50 Sensor

WHAT IS THE GW50 SENSOR?

The GW50 sensor was developed by the Lincoln University, in New Zealand, to monitor groundwater nitrate-nitrogen levels in monitoring bores on the Canterbury Plains. The sensor uses a photometer to measure the nitrate-nitrogen level every 15 minutes (Figure 1). A data logger collects these readings before sending them to an online platform, where the data can be viewed in real time. Other nitrate sensors require regular calibration; however, the GW50 only requires occasional cleaning to ensure that the photometer remains clear for accurate readings.

Figure 2

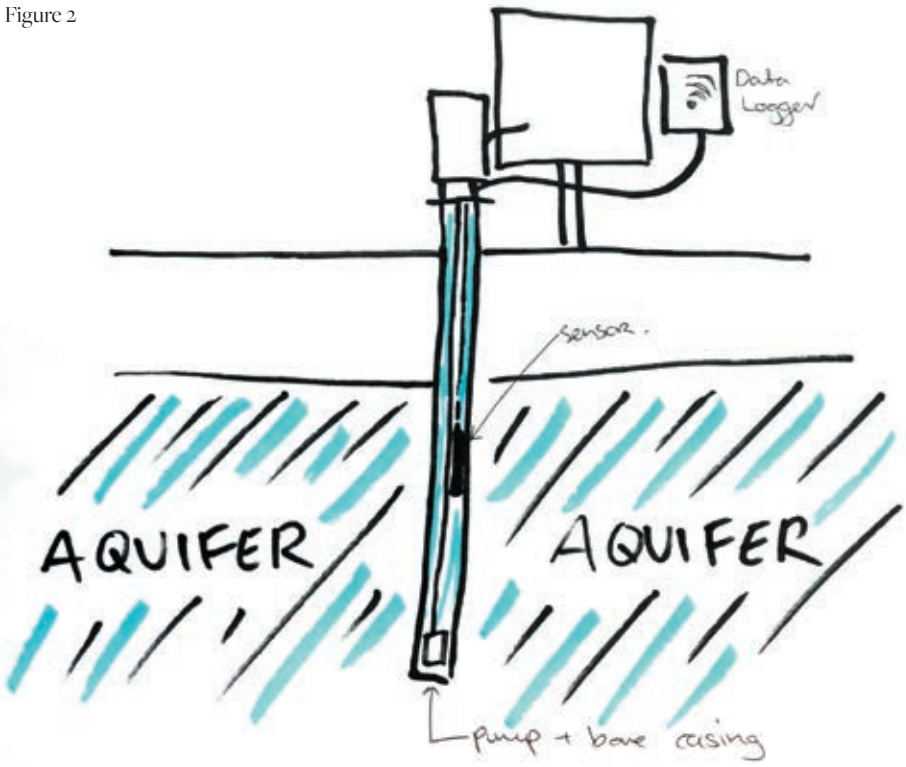
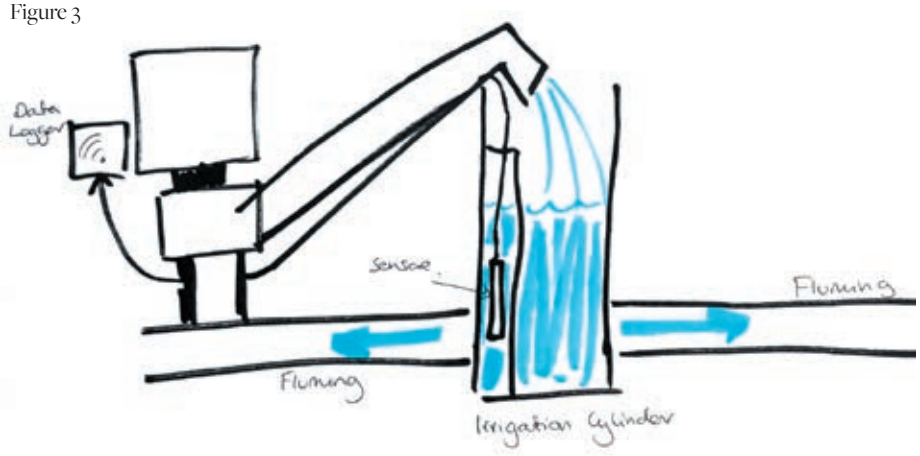


Figure 3



HOW IS IT INSTALLED?

Traditionally, the sensor is installed in 50mm monitoring bores/wells. The sensor (attached to a steel cable) is lowered into the bore until it is positioned in the aquifer. The sensor then remains in the monitoring bore, recording data, until it is removed for cleaning.

For this project, we had to make a few adjustments to suit the grower's system. Initially, our plan was to install the sensor in the house pump bore (Figure 2).

At this site, the shaft of the pump is offset, so there was room for the sensor to be installed next to the pump shaft, but above the pump; however, this idea was passed on due to concerns about the wire and cord that were attached to the sensor becoming entangled when the pump was in use.

The second installation plan involved utilizing an irrigation cylinder (Figure 3 and 4). When the grower irrigates some of his paddocks, water is pumped from the underground aquifer into a concrete cylinder. The water is then distributed to the paddock from the cylinder via plastic fluming. During an irrigation, the water level inside the cylinder is approximately 1-1.5m from the ground (the sensor is 455mm long). To minimize turbulence (from the water falling into the cylinder), the sensor is positioned in a piece of PVC pipe with holes to allow water to reach the photometer (Figure 5). It is also situated above the outlet but as far below the water surface as possible. This is not how the sensor is intended to be installed; however, as there were no monitoring bores on farm to install the sensor into, it was the next best solution! This installation also allows the data to be used for irrigation records, as when there is no water being pumped, the sensor reads 0mg NO_3-N/L – when the sensor is showing nitrate-nitrogen measurements, the pump is on, when there are no readings, the pump is off.

Figure 5

Figure 4

WHAT DOES THE DATA LOOK LIKE?

The sensor collects a measurement every 15minutes – a tremendous amount of data over a year of installation! This can make interpreting the data challenging – unless it is viewed on the online platform, Envault. The data in Figure 6 is an example of what the data looks like online. Due to how the sensor is installed, it looks a little different to how it would look normally. The data is presented in an easy-to-read graph form, that clearly shows what the nitrate-nitrogen level was for the irrigation, the date of irrigation and the hours of irrigation. This is great for short term, snapshots of the data.

Due to the huge number of readings that the sensor collects (every 15 minutes!) and the start stop nature of the sensor installation, long term monitoring and analysis is more difficult. If the sensor was installed in a monitoring bore, the readings would show a consistent line. Comparatively, the sensor currently shows a step-like pattern. This makes it difficult to view and assess the data online, unless it is imported into excel and converted into a more manageable data set. Figure 7 shows what the long-term data can look like in excel.

HOW CAN WE USE THIS DATA?

There are a few ways that we can use this data to benefit the grower. Firstly, this data shows the grower the nitrate-nitrogen level at each irrigation – providing him with the confidence that nitrogen is being applied with each irrigation. One of the major concerns that growers have with incorporating irrigation nitrates into their fertilizer budgets is not knowing how much nitrogen is being applied with each irrigation. Using this technology, the grower can be confident that nitrogen is being applied with each irrigation to supplement the fertilizer nitrogen that has been applied. It also shows the grower the nitrate levels over time (in this case, increasing nitrate levels), allowing them to make informed decisions about their nitrogen management strategy going into the next season.

The sensor data can also be used to record dates and hours of irrigation. By looking at the online platform, the grower can quickly see when he last irrigated and for how many hours (see Figure x). After measuring the pump flowrate, the volume of water applied per irrigation can also be calculated. When this data is combined with the nitrate-nitrogen level data, the amount of nitrogen applied per irrigation can also be calculated (see Table 1).

Figure 6

LIMITATIONS OF THE SENSOR

This sensor technology is not for everyone or every situation. Ideally, the sensor would be installed in its intended situation (in a monitoring well); however, not all growers have monitoring bores on their farms and those that do, the bores are often managed by outside organizations, such as the Department of Natural Resources. With the current installation, the sensor is limited to only collecting nitrate data when the paddock is being irrigated. As a result, there could be nitrate level fluctuations that are being missed (especially following rainfall events, as the grower may not irrigate for some time after rain). Furthermore, though the online data is great for a snapshot look at nitrate levels and irrigation records, looking at the data for long term trends requires a lot of manual data management to make it easier for analysis.

Though the sensor is relatively low cost when compared to other nitrate sensors on the market, the GW50 sensor is still an expensive piece of technology – especially as it cannot be easily moved around to other bores. It is also quite farm specific (even paddock specific, depending on the grower's irrigation system). Growers in a productivity area may benefit from looking at the sensor data (installed on an individual's farm) relative to periodic monitoring on their own farms.

GOING FORWARD

The sensor will remain installed in the current pump to help the grower and Farmacist monitor potential nitrate level changes in the future. This will not only help the grower through automated data collection, it also develops a robust nitrate-nitrogen level data set that can be used to inform nitrogen management decisions going forward. Though this data is situation specific, we can use the data trends to help build the confidence of other growers – in this case, the nitrate levels were increasing over time rather than fluctuating significantly. Though it is unlikely this technology will be adoptable by many people, there is potential for the sensor to be helpful to other growers. This may be through showing recent, real-time data on how nitrates behave throughout the year or using the sensor to increasing awareness of nitrates in irrigation water and how they may be impacting their sugar yields.

Figure 7

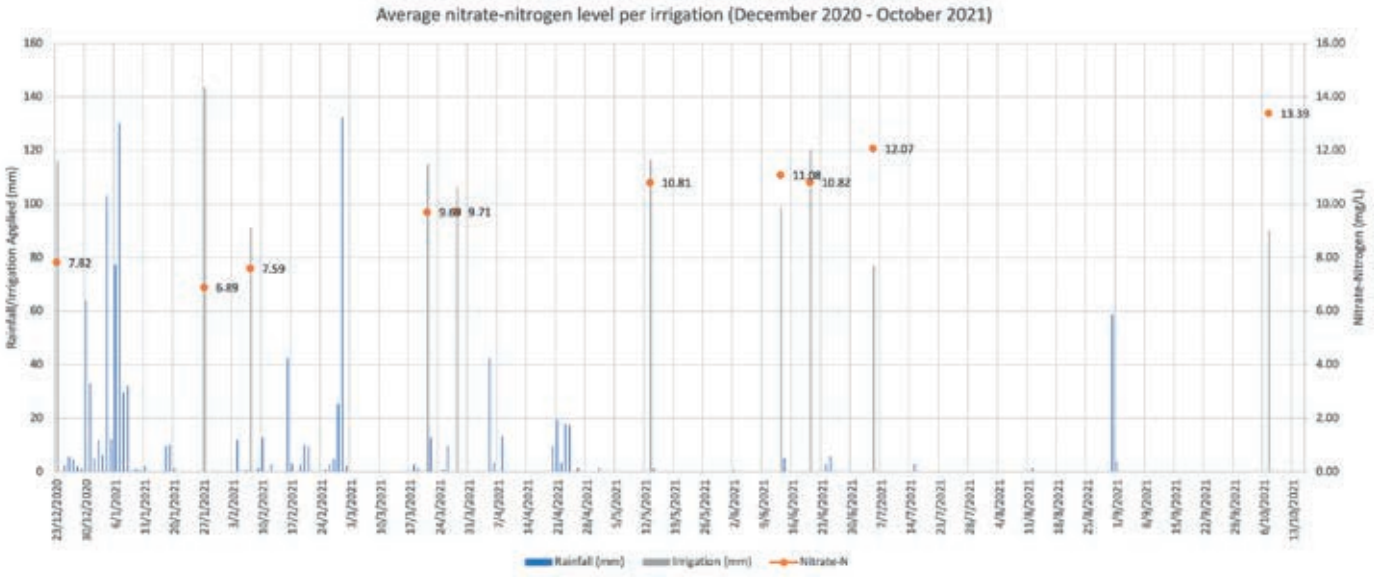


Table 1 - An example of the data that that can be calculated using sensor readings

Irrigation	Date	Average Nitrate-N (mgNO3-N/L)	Total Hours of Irrigation	Volume Applied (ML/ha)	Depth Applied (mm)	Nitrogen Applied (kgN/ha/ Irrigation)
1	23/12/2020	7.82	68	1.16	116.25	9.09
2	27/01/2021	6.89	84	1.44	143.60	9.89
3	7/02/2021	7.59	53.5	0.91	91.46	6.94
4	21/03/2021	9.69	67.25	1.15	114.96	11.14

Mackay Sugar
Member of Nordzucker Group

Productivity Awards well supported by local business and growers

For more than 140 years, the Mackay region has produced some of our countries largest sugar cane crops and has been the backdrop to several key farming and harvesting innovations.

Now, with the backing of its primary shareholder Nordzucker Group, Mackay Sugar is shining a spotlight on those in the region's sugar cane farming community who go above and beyond for the advancement of the industry.

In 2022, Mackay Sugar brought back its annual Productivity Awards with the aim of celebrating the new ideas, innovation and research that contributed to sustainable productivity excellence within the region. Spanning 11 categories and backed by more than 30 local industry sponsors, the Awards highlighted just some of the methods and advancements that are making a difference to growers and harvesters in the region.

"The Productivity Awards is a really positive step towards creating a community that works together for the betterment of the industry," said Brent Casey, Mackay Sugar General Manager Commercial and Agriculture.

"Not only did we create an opportunity to celebrate cane farming and harvesting excellence in the region, we created a platform where industry stakeholders could share ideas and achievements that we hope will be adopted and become mainstream over time," said Mr Casey.

Covering data-driven categories such as highest CCS and highest tonnes per hectare, as well as nomination-based awards that revealed success stories from right across the region, the 2022 Productivity Awards was a showcase of what can be achieved by coupling the growth of new ideas with the courage to try them out.

"The date for our 2023 Productivity Awards has been set and the nominations have begun flowing in. There are already some amazing tales of achievement despite a long and challenging season," said Mr Casey.

"We have made some changes to the Award categories this year, creating dedicated focus for sustainability, innovation, and research respectively, and we have acknowledged the difference in small and large harvesting groups," he explained.

"We have also introduced a new Promising Contributor category to recognise new and/or upcoming players in the industry," he said.

"These changes, along with the feedback and engagement seen during last year's awards, has seen an increase in the volume and value of sponsors, meaning that the 2023 Awards is set to be bigger and better than ever," said Mr Casey.

2022 Mackay Sugar Productivity Award Winners that rewarded sustainability, innovation, encouragement, as well as a lifetime achievement award, were as follows:

Canegrowers Sustainable Farming Practices Award - John, Dean and Tony Pastega

MAPS and SRA Research and Innovation Award - John Simpson

Mackay Sugar Encouragement Award - Ryan Soper

Mackay Sugar Lifetime Achievement Award - Andrew Dougan

FARMACIST

Improve productivity and profitability

Farmacist continues to proudly stand behind farmers in the Burdekin and Mackay as it has for the last decade, and now we are pleased to announce that we have extended our agronomic support even further. The Farmacist team has expanded to include a new branch in the Far North who work hard to provide advice and research from Tully to the Cairns region, and inland to the Tablelands, and even farther if required. This is in addition to an extension project being headed up in Northern NSW that focusses on Tea-Trees. Our far-reaching team has grown to include 32 qualified agronomists and dedicated field officers.

Farmacist values development and innovation in the agricultural industry, and works alongside farmers to find solutions, utilise technology and drive innovation in the field and beyond. We pride ourselves on being able to support the needs of farmers and their crops, while suitably improving production and profitability. To achieve these goals, we partner with some leading organisations to fund research and implement guidelines that provide valuable data to further protect the reef, the land, and the agricultural industry.

Currently, Farmacist is partnering with the Great Barrier Reef Foundation to implement Project Bluewater, assisting farmers to upgrade their spray equipment to minimise chemical loss and increase chemical effectiveness. Currently, the project is in its second year, and aims to provide tailored and one-on-one services across more than 40,000 hectares in total.

Farmacist is also spearheading projects that make precision agriculture more accessible to a broader spectrum of growers – Precision to Decision in both the Burdekin and FNQ, and Point of Difference in Mackay. These projects utilise the latest in EM mapping technology and soil analysis to identify areas of concern and customise a management plan for each farm, changing from a "one size fits all" approach in order to improve crop yields. Running over 3 years until 2024, this program aims to support nearly 30,000 hectares across Queensland.

Our goal has always been to deliver precision agronomic solutions and, with our expanded team, Farmacist has now assisted in better farming practices related to not only sugar cane and alternative crops, but also grazing and cattle, bananas, tea-tree production, soybeans, sesame, peanuts, sunflowers and nearly anything else ag-related.

The Precision to Decision project, Point of Difference project, and Project Bluewater 2 is funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation, and Farmacist Pty Ltd.

Australian Government

REEF TRUST

Great Barrier Reef Foundation

MIKA ROWLSTON

WITH GROWER DENIS POZZEBON

Mixed species fallow cropping

BACKGROUND

It is widely accepted that breaking the monoculture of sugarcane with a fallow crop has many advantages, this has now become common practice in the Burdekin region with legumes such as mungbeans and soybeans. The ability of these cover crops to fix nitrogen means reduced inputs and potentially higher yields for subsequent sugarcane crops, but these fallow crops are still a monoculture and therefore still have many of the issues associated with monocultures (i.e. pests and disease build up and resilience, organic matter (OM) levels, water usage and soil compaction). It is proposed that some of these issues can be alleviated by planting a mixed species fallow crop, with benefits associated with reducing tillage and soil compaction, increasing soil OM, greatly improving soil biology (e.g. increasing beneficial nematode numbers) and increasing the available nutrients.

There has been documented success of mixed species fallow crops in the other regions, but a Project Catalyst trial of this nature has never been conducted in the Burdekin region. Delta grower Denis Pozzebon has been planting alternate fallow cover crops such as cowpea and sunn hemp for several years and approached Farmacist in 2019 to investigate the potential benefit of other mixed species cover crops on his farm.

Denis in Mixed Species

TRIAL DETAILS

The trial was run over two years on two separate paddocks, mixes were refined in year two based on learnings from the initial planting.

Table 1 - Trial One (Dec 2019 – Mar 2020)

Irrigation	Date
Area	5.6ha
Treatments	5
Replicates	3
	Treatments
Control	Bare/Weedy Fallow
Soybean	Leichhardt variety (very poor germination)
Mix 1 (Biomass)	Ebony cowpea, Leichhardt soybean, Jumbo sorghum (forage)
Mix 2 (Nitrogen Building)	Ebony cowpea, Leichhardt soybean, Jade mungbeans
Mix 3 (Soil Health)	Tillage radish, A6785 Soybean, Sunflower, Shirohie millet, Jumbo sorghum (forage)

Table 2 - Trial Two (Jan 2021 – Apr 2021)

Irrigation	Date
Area	6.7ha
Treatments	4
Replicates	4
	Treatments
Control	Bare/Weedy Fallow
Soybean	Hayman variety
Mix 1 (Biomass)	Ebony cowpea, Jade mungbeans, Sunn hemp
Mix 1 (Biomass/Nitrogen)	Lablab, Linseed, Vetch, Soybean, Triticale, Ryecorn, Tillage radish, Sunflower, Cowpea, Buckwheat, Sunn hemp
Mix 2 (Variety)	Tillage radish, A6785 Soybean, Sunflower, Shirohie millet, Jumbo sorghum (forage)

The fallows were planted using the grower's existing bean planting equipment, a three row John Deere Max-Emerge XP planter. Seeds were pre-mixed and inoculated using a cement mixer and direct drilled into preformed beds (2 bean rows per 1.55m sugarcane beds). The fallow crops grew for 3 months (First trial: Dec 2019 – March 2020, Second trial: Jan 2021 – Apr 2021). Ground preparation activities were as follows: Ploughed out cane, disced twice, bed-formed, 2 pre-plant irrigations, sprayed, plant mix species, 2-3 in-crop irrigations, sprayed out, mulched and incorporated, wavy coultered, planted cane. Preparation was the same for both blocks with the only difference being that in the first fallow, treatments with forage sorghum planted were slashed half-way through the fallow to prevent seed set.

Comprehensive sampling was undertaken in each plot prior to planting of fallow crops and post spray-out/incorporation of the fallow crop. Some additional sampling also occurred in the subsequent plant cane crop to determine if any potential changes were lasting. Sampling included: full chemical soil analysis, labile (active) carbon analysis, nematode population counts, microbial respiration (Solvita© Burst testing), weed population counts, nitrate N analysis and drone NDVI (normalized difference vegetation index) analysis.

CHALLENGES AND LEARNINGS

- Each species has a different planting depth, refining this to an average depth proved difficult, especially with small seeds that potentially have poor vigour (i.e tillage radish, millet). The planting depth that worked well was 20-30mm.
- Some species included in commercially sold mixed species seed may not grow well in the region at a particular time of year.
- Depending on the source, mixed species seed can be of a much poorer grade compared to crops grown for commercial harvest, so germination rate and vigour may be compromised. Planting rate should compensate for this. We typically halved the recommended planting rate for the mixes we created, with a planting rate between 20-30kg/ha.
- When creating your own mixes, ensure planting ratios are considered. 1kg of cowpea contains approximately 15,000 seeds, where as 1kg of linseed contains approximately 150,000 seeds. So, adding 1:1 ratios of seeds could lead to an over population of one species.
- When purchasing seed, ensure it has not been treated with a fungicide, one of the goals for implementing a mixed species


Planting

fallow is to increase mycorrhizal fungal activity in the soil, fungicides can inhibit this.

- Including grasses in mixes can create problems for volunteer cane management, applying grass specific herbicides to control volunteer cane is not possible when grasses are included in mixes unless you intend kill the beneficial grasses as well.
- Including grasses in mixes can create problems for weed control in the subsequent plant cane crop if the mixed species grasses are allowed to seed.
- Mixed species fallow crops create a "green bridge" for beneficial and pest insects. A crop grown for commercial harvest will have insecticides and fungicides applied to control pests, a mixed species fallow will not. This provides opportunities for pest species to flourish and potentially re-infest surrounding commercial fallow crops faster than they normally would.
- Mixed species fallow crops can produce large amounts of biomass, dealing with this biomass can be a challenge for subsequent planting of cane. If the biomass is not largely broken down prior to planting, this can impact the plant cane strike and disrupt fertiliser use efficiency. Consequently, cane planting may be delayed, which could impact plant cane yields.

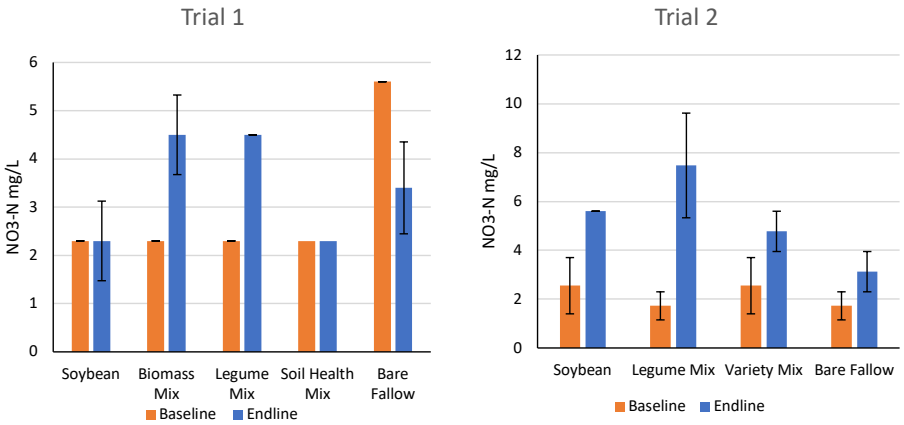
RESULTS

Nitrate Nitrogen Levels

The results presented below are based on nitrate strip testing, before and after the treatments were installed. Nitrate N increased in most treatments across both sites, except for the soybean and soil health mix in trial 1. The low level of nitrate N leftover from the soybean treatment is attributed to the poor germination after planting, the soybean only treatment would have been considered a failure in a commercial cropping sense and would have not gone to harvest, plants were small and spread out, almost emulating a bare fallow. The issues with this variety of soybean seed were anecdotally poor throughout the district in 2020. Other treatments that were majority legumes saw substantial increases in nitrate N.

The discrepancy between the bare fallow treatments could be attributed to the plot size and location. In trial 1 the control bare fallow treatments were paddock long strips the same size as the other treatments. In trial 2, as a result of flood risk, we could not have such large sections of the paddock left bare, consequently we installed four 47sq metre sections in the guard rows of the paddock to simulate bare fallow areas. As these treatments were surrounded by legume species, irrigation could have lead to nitrate N accumulating in the treatments.

Figure 1

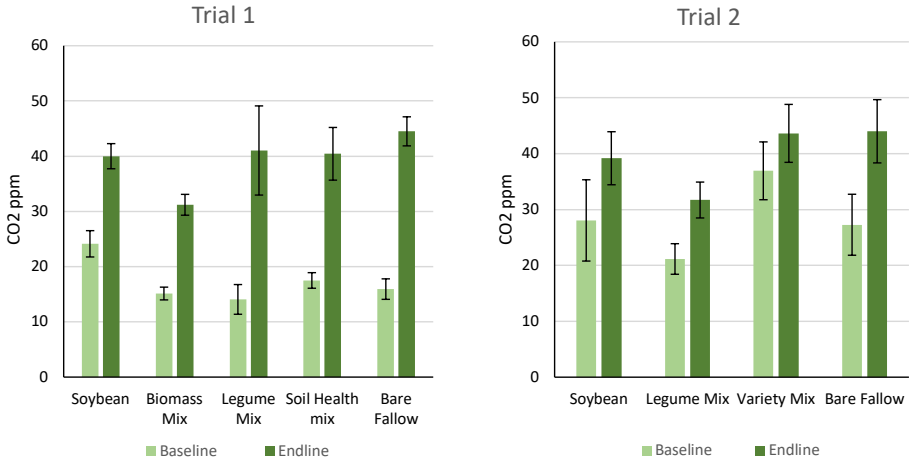


Microbial Respiration

Microbial respiration can be used as an indicator for soil health, as the more CO_2 that is produced by the soil, the more live organisms, and the greater the detritus food web. This food web plays a vital role in nutrient cycling and the water holding capacity of the soil. Microbial respiration was measured using the 24hr Solvita© Burst method.

The above results show that bacterial respiration has increased over the fallow period for all treatments, including substantially in the bare fallow. Indicating that any kind of fallow is beneficial for microbial growth, with no treatment necessarily having an advantage over another. The limitation of this method is its ambiguity, the test does not allow us to identify which organisms are producing the CO_2. Being able to identify specific microbial communities may present differences in the results above, i.e will a greater diversity of plants and root systems lead to a greater diversity in micro-organisms?

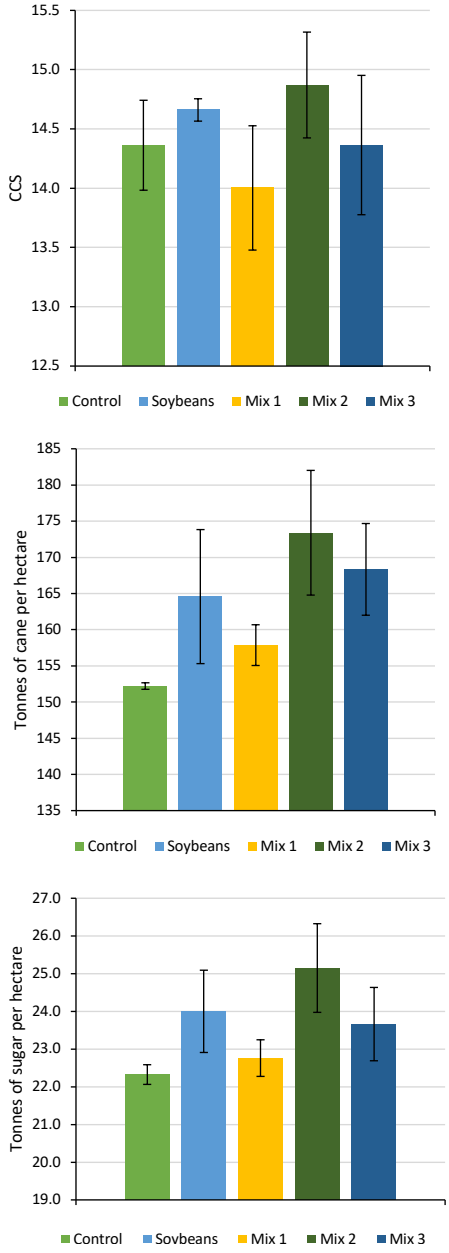
Figure 2



Nematode Populations

Populations of nematodes were very low in each block during all sampling events (six events). Overall, we did see a decrease in parasitic nematodes and an increase in free-living nematodes, but results were highly variable, and it was difficult to draw quantifiable conclusions from the data collected. Parasitic populations in all samples were well below economic thresholds. Quantitatively monitoring changes in nematode populations can be extremely difficult in a commercial cropping scenario, nematode populations can vary greatly within a few metres. Their presence or absence in the soil profile is also heavily influenced by moisture levels and other environmental factors, so conclusive repeated temporal sampling proved to be very difficult in this trial.

Figure 3

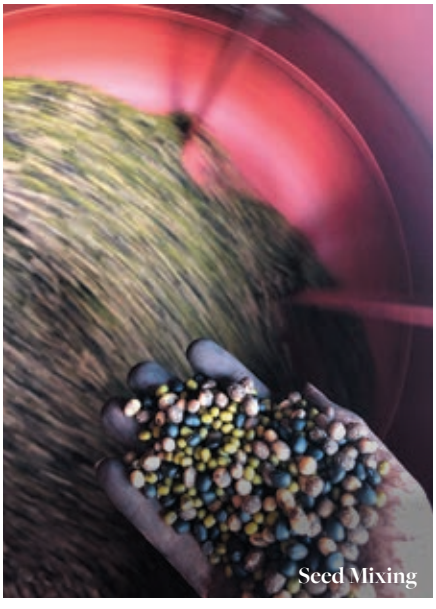


Yield Results (First Trial Block)

Commercial plant cane yields were recorded for each treatment for the first trial block (second trial is yet to be harvested). The variety is KQ228 and the six easy steps soil test recommendation was used to calculate fertiliser inputs. Nitrogen fertiliser rates were not adjusted for sources of nitrogen provided by any of the fallow crops, to limit variability. Statistical analysis was undertaken for CCS, tonnes of cane per hectare and tonnes of sugar per hectare, but no significant difference is present between any of the variables. We believe this to be a result of the variation in yield across the paddock, this trial block has a substantial cross-slope and is very sandy, the change in yield could be driven by the water holding capacity of the soil and slope can affect this dramatically.

Consistently, Mix 2 (Ebony cowpea, Leichhardt soybean, Jade mungbeans) appears to outperform all treatments, although we cannot conclusively state that any mix is better than the monoculture soybean fallow. It can be said that, overall, planting some sort of cover crop during the fallow period is beneficial to subsequent yields compared to a bare or weedy fallow. We would however expect to see a potential CCS penalty in the legume dominated treatments, but results don't reflect this, potentially this is a result of the light and sandy nature of the soil. The soil has a reduced capacity to store nutrients and therefore any excess N is unavailable to the plant during its maturing phase, allowing it to maintain reasonable CCS.


Trial Harvest - Break Pushed


Seed Mixing

SUMMARY

There have been several important learnings developed over the course of these trials. Before developing a plan to implement a mixed species fallow, it is important to step back and determine why we fallow ground to begin with. One major advantage of fallowing ground is the unselective control of weeds and reducing the weed seed bank in the paddock to reduce the pressure in the subsequent cane crop. In addition, to control volunteer cane to decrease the carry-over risk of diseases. Consequently, based on the results from these trials we believe that a diverse mix of broadleaf species will provide the greatest benefit to the overall cane rotation, 2-3 species responsible for fixing nitrogen (such and mungbean), sprawling groundcover (such as cowpea), large biomass producer (such as sunn hemp), biofumigant (such as sunflower) and possibly a species of brassica (such as tillage radish) to increase diversity.

Given this conclusion, the underlying idea behind the success of a mixed species cover crop is developing ecosystem and biological synergies between the different species (this includes many groups of plants: brassicas, legumes, grasses and many others). If these relationships do not develop because we have selectively chosen to remove grasses from the mix, then perhaps we may not see all the potential benefits a mix species cover crop can offer. In addition, when working with ecosystems, changes can take an incredibly long time, and often whole-system approaches are needed to achieve substantial improvements. We cannot expect to see lasting benefits from implementing a three-month mixed species fallow without also modifying other activities and inputs. Consider, ground preparation and tillage, pesticide applications, nutrition inputs, irrigation management, other cropping, and external environmental factors. Farm systems change does not occur in isolation.

In summary, this trial has allowed Denis to determine what fallow strategy is most easily managed in the cane rotation on his farm, so we can maximise yield without compromising soil health and the sustainability of the system.

For more information on the outcomes of these trials please contact Mika Rowston – Farmacist (Extension Agronomist)

Supporting change through shared knowledge

Sugarcane Ratoons following Reduced Nitrogen Application

The timing was perfect when our agronomist met with a sugarcane grower interested in engaging with the Project Catalyst – Practice Change Adoption Project.

From the initial interview introducing him to Project Catalyst, and while completing the Paddock to Reef (P2R) Questionnaire, practice change adoption resonated strongly with him.

Recently purchasing his farm, newly married, and starting a family, he was bursting with ideas, enthusiasm, and motivation to advance traditional farming practices. Finding support and reassurance from Nutrien Ag Solutions in adopting improved farming practices, he's eager to be savvier with available farming technology, whilst improving the quality of water leaving the paddock, reducing potential environmental effects on the Great Barrier Reef. His focus - to provide a more productive future for his family's farming business.

A snapshot of his farming practice changes implemented to date reveal his commitment:

Transitioning to controlled traffic farming by changing row spacing from 1.6m to 1.8m to match machines and implements; including harvesters and haul-outs wheel tracks, and to farm zonal tillage reducing the number of cultivation passes.

The benefit of these changes is to reduce soil compaction by only working the uncompacted soil in the stool area. Additional on and off-farm benefits are that more trash remains on the soil surface and the wheel track area remains firm. This results in less soil and nutrient run-off from the paddock, and therefore, water entering streams and rivers is less likely to be carrying high loads of sediment and nutrients.

- A reduction to Nitrogen application on old ratoons by more than 10kg/ha.
- Mill mud/ash application rate reduction including application method changing from Broadcast to Zonal.

Fallow block under Sunn Hemp

Fallow block under Mixed Species

The benefit to the grower in being able to reduce Nitrogen application to old sugarcane ratoon blocks without impacting crop yield created immediate cost savings and reduced risk of nitrogen loss.

A selection of cover crops planted across fallow blocks included Cowpea and Millet were which were harvested and bailed. One block also produced a second cover crop which was direct drilled with Soybean and Sunn Hemp.

Mixed Species 7ways was also planted to other fallow blocks across the farm. The cover crops were sprayed out using a suitable herbicide allowing the bio-mass residue to compost. Tillage of the blocks was required to remove compaction and stubble and convert to the new improved farming system for the next sugarcane plant crop cycle to 1.8m row spacing and for zonal tillage to occur. Single rows of sugarcane were established on the newly formed 1.8m zonal beds.

Soil samples were taken from fallow blocks after ratoon harvest. With the support from Nutrien Ag Solutions - AAA Accredited Agronomists Team, the grower was provided with a compliant Nutrient Management Plan (NMP) which enabled him to efficiently manage nutrients in accordance with soil conditions, crop requirements and farming practices.

The grower received nutrient recommendations based on 6EasySteps taking into account successful legume crops. This allowed the grower to reduce nitrogen application to the subsequent sugarcane plant crops without compromising yield.

With the support of Project Catalyst and Nutrien Ag Solutions the grower has adopted several beneficial and sustainable farming practice changes across his farm which are over and above the project practice change pathway goal of two new practice changes adopted in 2 years. The practice changes this farmer has permanently implemented will go a long way to improving the quality of water leaving the paddock and ultimately the Great Barrier Reef.

Fallow block under Mixed Species

Plant sugarcane following legume cover crops


SAM
dh

ZOE EAGGER

WITH GROWERS SAM, GERRY AND JOE DEGUARA

Quantifying the effects of an extended legume fallow

BACKGROUND

Long-term breaks from sugar cane monoculture were required to maximise soil health benefits and sugar cane productivity according to the findings of the sugar industry's "Yield Decline Joint Venture" (1999-2006). While the benefits of a soybean cover crop over the conventional fallow period (6 months) have been extensively trialled in the Central district, the benefits over an extended period (>12 months) have not been as well substantiated.

The benefits of an extended fallow period for water quality include a decrease in potential runoff of nutrients and sediment due to improved soil health and higher ground cover over an extended period, as well as improved productivity for the grower. Planting winter crops in a sugarcane rotation system enables the use of alternative herbicide chemistry that can help control weeds that would otherwise need to be controlled with PSII herbicides. As a result, by using fewer PSII herbicides, there is less risk of these ecotoxic compounds infiltrating local aquatic systems.

On their 1000-hectare cane farming enterprise at North Eton near Mackay, Gerry Deguara and his sons Sam and Joe are no strangers to implementing innovative farming techniques. They have used legume fallow crops for both green manure and grain for a number of years, and they have observed the advantages this method offers to both soil health and crop productivity. In recent years, they have been undertaking several trials with Farmacist to determine if a longer fallow cropping cycle can provide additional long-term effects not seen with a conventional single fallow crop.

> ***"We'll keep looking for winter crops that fit into our rotation, have a decent gross margin and are compatible with our management system and machinery"***
> **- Sam Deguara**

TRIAL DESIGN

In November 2019, a trial was established by their Farmacist agronomist at the time Natalie Fiocco to further investigate the impacts of an extended fallow season on soil health and the productivity of the subsequent sugar cane crop rotation. Two fallow management options were used as treatments across two adjacent blocks. The first block was planted to a conventional single fallow crop treatment, whereas the second block was a longer, multiple fallow crop treatment. Both blocks had their fallow crops grown for grain production.

Treatment 1 (Grower standard practice): Plough out à soybean à plant cane

Treatment 2 (Extended 2-year fallow option): Plough out à soybean à safflower à soybean à plant cane

The sample locations and trial area were chosen based on an Electromagnetic (EM) soil map to reduce the impact of soil variability on yield. The soil texture category in both treatment plots was the same even though the test in Treatment 1 revealed that it was a slightly heavier soil type based on a higher organic carbon content and pH level. This is a frequent occurrence since some heterogeneity still exists within soils of the same texture classification.

A Kuranda soybean crop was sown in the block to be used at Treatment 2 (2-year fallow) for the trial in December 2019, and the crop was desiccated in preparation for harvest in May 2020. Across the 5 ha block, the Kuranda variety averaged 4t/ha. In June 2020, a Safflower crop was planted into this same block and it was harvested on November 5th, 2020. The average yield of safflower was 1.1 t/ha, which was below expectation. The adjacent block which was designated as Treatment 1 block (standard fallow period) had its final sugarcane crop harvested in November 2020. Both treatment blocks had 50t/ha of mill mud applied and were then planted to the final Kuranda soybean crop in the first week of December 2020.

This soybean crop was harvested in May 2021, yielding 3t/ha on average. The growing circumstances were not as favourable as they had been the previous season. The sugarcane variety Q240 was planted into both blocks in mid-July 2021, since both plots' Pachymetra spore counts were below the 30,000-spore threshold for low probable disease severity.

The activities undertaken in each treatment are outlined in the following table.

Figure 1 - Project Activities

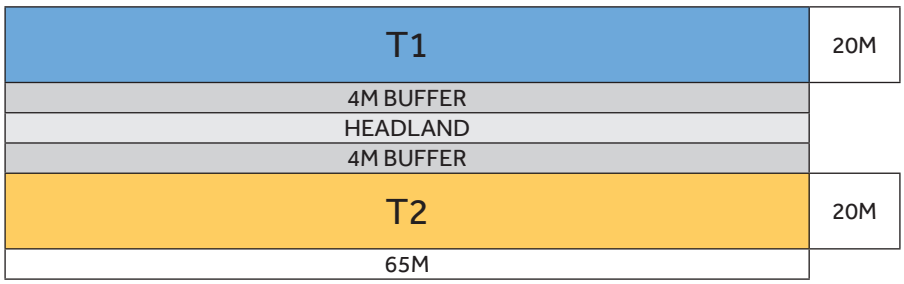


Table 1 - Project Activities

Stage	Date	Activities
Stage 1	November 2019	Sugarcane crop harvested T2*
Stage 2	December 2019	Soybean crop planted T2
Stage 3	May 2020	Harvest soybean crop T2
Stage 4	June 2020	Plant safflower T2
Stage 5	November 2020	Harvest sugarcane off T1*
Stage 6	November 2020	Harvest Safflower T2
Stage 7	December 2020	Apply 50 t/ ha mill mud to T1 and T2 Plant soybean in both T1 and T2
Stage 8	January 2021	Collect base-line soil nutrient levels
Stage 9	May 2021	Harvest Soybean in both T1 and T2 Undertake nitrate test strips to determine residual N levels
Stage 10	August 2021	Plant Sugarcane in both T1 and T2
Stage 11	November 2022	Take soil samples for soil health testing

RESULTS

Grain Gross Margin

Both treatments were subjected to a basic gross margin analysis. For the first soybean crop in T2 grown in 2019-2020, the Deguara family secured a soybean contract worth $930 per tonne, with a crop yield of 4 tonnes per hectare which, when costs of production were factored in, equated to a gross margin of $2624/ha.

With a gross margin of $49/ha, the following safflower crop grown in T2 was not considered a success by the grower. Input expenditures for fertiliser and herbicide applications contributed to the low gross margin, which was further exacerbated by the low yield of 1.1 t/ha in 2020.

For the 2020-2021 season, the family received a reduced soybean price of $750/tonne due to a strong market supply. The crop yielded 3t/ha due to less favourable growing conditions compared to the crop planted in 2019. Herbicides, particularly glyphosate, and soybean insecticides had increased in price in 2021 resulting in a smaller profit margin. Despite these factors, the crop was still profitable, with a gross margin of $1072/ha. This figure does not take into the account the savings made by the Deguara family by reducing their plant cane nitrogen top dress rate due to the contribution to soil nitrogen by the legume crop.

The family has their Farmacist agronomist do a nitrate test trip, which is an inexpensive, quick test that provides an indication of organic nitrogen levels so that top-dress rates can be adjusted. Based on the results of this test strip, instead of applying 140 kg/ha of nitrogen, 90 kg/ ha of nitrogen was applied to the plant cane crop saving the business $141/ ha in fertiliser expenses.

Unfortunately due to the nature of 2022 crush in the Mackay region , sugar cane harvest data between treatments was not obtainable.

> ***"With the break crops sold, it's a great cash injection into the business and if sugar prices are low, a two-year fallow could be more profitable than the standard fallow break"*** - **Sam Deguara**

Pachymetra And Nematode Testing

Treatment 2 (extended fallow) had lower pachymetra spore count than T1 (conventional fallow) after 12 months of cane production (42,539 spores/ kg soil vs 65,378 spores/ kg soil).

Treatment 2 (extended fallow) had higher levels of plant-parasitic nematodes (Pratylenchus and Helicotylenchus) than treatment 1, however high parasitic nematodes do not necessarily mean that soil health is declining, parasitic nematodes are opportunistic feeders and their presence maybe due to an increase in organic matter or other events such as the planting of a mungbean crop. Nematodes counts only indicate a snapshot in time, as numbers fluctuate often due to soil moisture, food source availability and soil temperatures.

Soil Health Testing

Baseline levels for soil health indicators such as microbial respiration (CO_2 burst), dispersion and slaking, active carbon, total carbon and nitrogen, and C:N ratio have been determined through laboratory testing from samples taken in 2022.

According to the results of the soil health testing, the longer fallow had higher labile carbon (treatment 2). Labile carbon is a part of organic carbon that soil bacteria may readily break down and use as food. Overall, there were no significant differences between treatments in terms of the soil health results. The findings might just be a reflection of microbes living in a monoculture since the paddock had been planted with plantcane at the time of the study and microbial populations fluctuate often depending on soil conditions.

CONCLUSION

The Deguara's will continue to work with Farmacist and implement fallow legume crops in their cane growing cycle but will undertake further trials of the longer fallow period before they make the decision to incorporate it fully in their operations. The biggest limiting factor from their point of view has been the lack of suitable winter cropping alternatives that can provide similar gross margins to a summer soybean crop and isn't a legume. While corn and sorghum fit well into that timing, they are unattractive options due to the Fall army worm problem in the area. There is also the added challenge of harvesting winter crops in November and December which is high risk due to potential wet weather.

Sam, Gerry, and Joe Deguara

Table 2

Crop	Yield (t/ ha)	Price received ($/ t)	Return/ ha ($/ ha)*
Treatment 1 (conventional fallow) - soybean	3	750.00	1,072.00
		TOTAL	1,072.00
Treatment 2: - soybea - safflower - soybean	 4 1.1 3	 930.00 - 750.00	 2,624.00 49.00 1,072.00
		TOTAL	3,745.00

Table 3

Treatment	Dispersion Index (Loveday/ Pyle)	Slaking (2 hours)	Microbial Respiration (CO_2 burst) mg/ L CO_2	Total Carbon (Combustion) %	Active (labile) Carbon mg/ kg	Total Nitrogen (Combustion) %	C:N Ratio
T1	1	partial	33.1	1.7	374	0.1	17:1
T2	1	partial	24.2	1.9	419	0.12	16:1


LRM

Manuel, Maggie, Patrick, and Joe Muscat

ROB SLUGGETT
WITH GROWER MANUEL MUSCAT

Further Exploring the Potential Benefits of Mixed Sugarcane Variety Planting

BACKGROUND

Sugarcane growers have long recognised the improved growth and yield of some varieties on certain soil types – particularly on tougher country such as sodic soils. Q138 is a great example of a variety that outperformed all others for yield and ratoonability on sodic soils. However, the downside was it tended to have lower CCS than other varieties. As growers create larger fields to improve farming efficiencies, more diverse soils are needing to be managed together. This creates a challenge for how to choose the optimum variety to maximise profit. Choose the variety most suited to the better soils and accept a loss of return on the poorer soils, or choose the best variety for the poor soils and suffer CCS losses on the good soils?

Mixed variety planting has the potential to provide the best of both worlds!

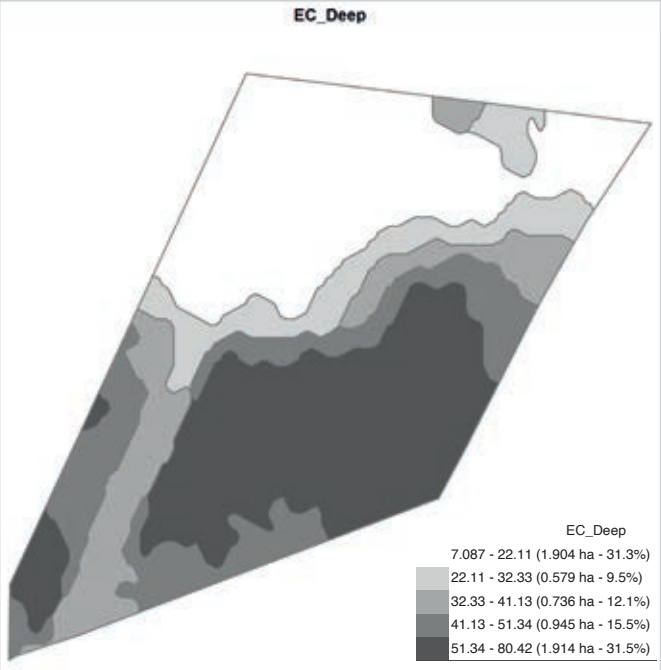
Manuel Muscat and his Farmacist Senior Agronomist Rob Sluggett have been trying different options to improve soil structure, water infiltration and crop yield for many years. While improvements have been made, the sodic soils consistently yield less or fail earlier and need to be ploughed out creating a loss of income. The idea to match the best variety to different soil types within the field was an option the pair debated for a while, before giving it a go.

Manuel's first Project Catalyst mixed variety trial was planted in 2016 into a field with good quality loams as well as an area of poor, sodic soil. Farmacist EM mapped the field, soil sampled and designed the layout of this trial – Q138, Q183 versus a mixture of the two. Over the four harvests of that trial, the mixed variety treatment gave the highest average yield every year, a cumulative yield increase of 24t/ha over the 4 harvests. A good result worth pursuing further!

THE NEW TRIAL DESIGN

Several new mixed variety combinations were planted into observation strips in 2019 and 2020. These included Q183+Q253, SRA9+Q208, Q208+Q253, Q183+SRA9 and Q208+Q240. The most promising of these – Q183+SRA9 was chosen to plant into a new Project Catalyst trial site in 2021. The block is a Sunnyside sodosol soil type - a silty, alkaline, bleached, mottled, grey duplex soil. Slope is below 1%, irrigation water infiltration is slow and part of the field is sodic. The field was EC Mapped using Farmacist's Top Soil Mapper®. The EC map is presented in Figure 1. The darker higher EC zone across the top of the field has an ESP of 11% in the top 20cm. The low EC zone at the bottom of the field has an ESP of 3%.

Figure 1 - Electrical conductivity map for the trial site field



The trial area is 3.5ha, has three treatments (T1 Q183+SRA9, T2 SRA9, T3 Q183), 6 rows per treatment, randomised and replicated 4 times (Figure 2).

The trial was planted with a dual row double disc opener planter on 1.8m row spacing on August 21st 2021.

Figure 2 - A google earth image of the trial layout

2022 TRIAL HARVEST

The 2022 trial harvest occurred later than originally planned due to wet weather interruptions. Replicate 1 of Treatment 1 (SRA9) was lost due to rain stopping harvesting part way through the treatment and harvesting being abandoned in that field for eight days. The balance of the trial was harvested green on 17th October 2022. Unfortunately, CCS of individual treatments was not collected for this harvest – insufficient cane from each treatment for a mill ccs and a 3am harvest prevented manual sample collection.

Figure 3 - Plant cane trial harvest mean tonnes cane per hectare for each treatment

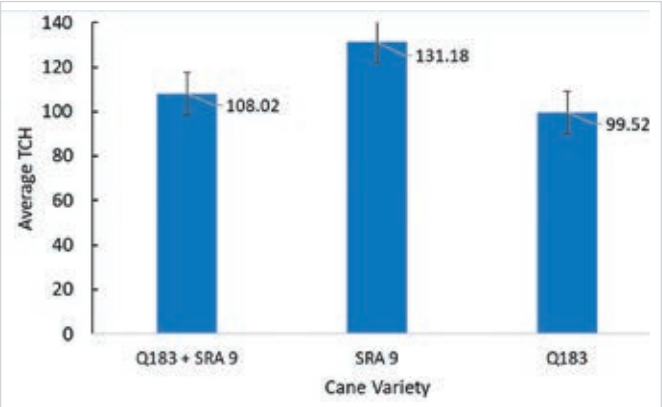


Table 1 - Muscat Mixed variety trial - 2022 Harvest Data Summary

Treatment Number	Variety	Yield - tonnes cane per hectare
1	Q183 + SRA 9	108.02
2	SRA 9	131.18
3	Q183	99.52

DISCUSSION

There was a statistically significant yield difference measured between the three variety treatments in the plant cane harvest. Treatment 2, SRA9 averaged 131.18 t/ha, or over 23t/ha higher than Treatment 1 Q183+SRA9. Treatment 3, Q183 was 31.6t/ha lower yielding than SRA9. Based on the plant cane harvest results, there has been a disadvantage to mixing SRA9 with Q183 at this site.

This is a very promising result for the performance of SRA 9 on poorer sodic soils. The trial site has been ratooned and will be harvested again in 2023.

CONCLUSION

While this trial has several years to run, the plant cane harvest results highlight the importance of sugarcane variety selection and the matching of varieties to soil types has important implications for crop yield and potential grower returns.

Pesticide Analysis in the Laboratory

When released into the environment, pesticides can be harmful to native flora and fauna and pose a risk to human health. Some pesticides are also highly persistent in the environment and may bioaccumulate and magnify through the food chain. It is important to note that degradation of the original pesticide does not always eliminate the risk. In some instances, the original compound can degrade or metabolise to toxic products. For example, triazine pesticides can give rise to carcinogenic nitrosamines.

Some example groups of pesticides of interest, based on chemical composition, include:

Organochlorine Pesticides (aldrin, dieldrin, DDT, lindane), Organophosphates (chlorpyrifos, dimethoate, phorate), Carbamates (fenoxycarb, carcofuran, carbaryl), Pyrethroids (cypermethrin, bifenthrin, deltamethrin), Phenoxyalkanoic Pesticides (2, 4-D, MCPA, MCPB, 4-CPP), Urea Pesticides (diuron, isoproturon, chloroturon), Diazine and Triazine Pesticides (atrazine, cyanazine, terbuthylazine), Quaternary Ammonium Salts (diquat, paraquat), Metal Based Pesticides (phenyl mercury, tributyl tin), Glyphosate Based Pesticides (glyphosate, gluphosinate).

A challenge in the analysis of some pesticides is the stability, or lack thereof, of the target compound. Some pesticides are highly reactive and breakdown in a matter of hours or days. Analysis of the degradant(s) may therefore be more informative than targeting the parent compound. For example, Isoxaflutole has a half-life of 1-4 days in the field and aquatic environments. It transforms via rapid hydrolysis to its more biologically active and stable diketonitrile product, DKN. Hence, it is frequently pertinent to include DKN in target analyses as a means of assessing the health risk from Isoxaflutole.

Other challenges encountered when targeting certain compounds include sample matrix interferences which can occur due to unknown or high concentration components generating "background noise". Sometimes dilution of the sample may be required which can impede the laboratory's capability to report the desired target compound to a low enough concentration.

Laboratories will often employ a combination of gas chromatography (GC) and liquid chromatography (LC) methods to provide analytical capabilities for a wide coverage of pesticide compounds. Tandem mass spectrometry (MS/MS) is becoming the detection method of choice for pesticide analysis. The power of MS/MS is the ability to filter ion transitions that are highly specific to the compounds of interest. This significantly reduces 'noise' and therefore provides a higher degree of sensitivity than single stage mass spectrometers and allows for more confident identification of the target pesticides. As the scope of pesticides of interest expands, so does the technology for detection and quantification of these chemicals in environmental matrices.

For information on ALS's Environmental testing capabilities please contact our Queensland Business Development Team:

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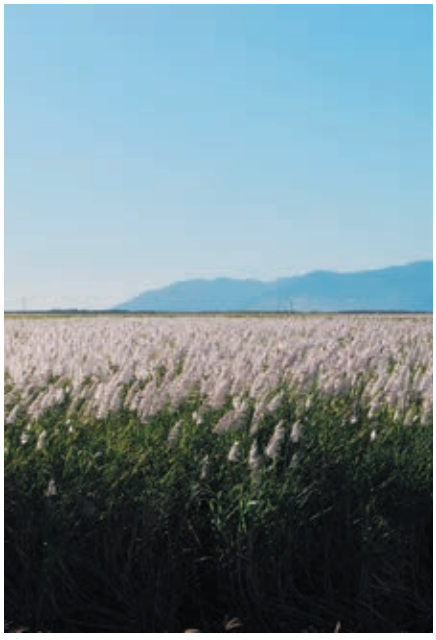


Rabobank Sugar returns to surplus in 2023

Rabobank expects the global sugar market to return to surplus in 2022/23 (October-September). A recovery in Brazilian sugar production is underpinning our weaker sugar price outlook, with Rabobank's forecast for ICE#11 prices to average between USc 16.3/lb and USc 17/lb in 2023.

This seasons rainfall in Brazil has been greater than 2021, however much of the crucial period of rainfall (October-March) is still to come. If weather conditions remain positive, this should see recovery in cane volumes. While our base case assumption is that there will be a high sugar mix, there remains uncertainty as ethanol prices are contingent on taxes, fuel price policy and oil prices. On January 1, 2023 the new Brazilian government issued a 60-day extension on federal fuel tax suspension. Possibilities of the return to fuel taxes as well as adjustments to fuel price policy create uncertainty for ethanol pricing that may not be resolved before milling begins in late March.

In other growing regions, production gains and losses should offset each other. Favourable weather in Thailand will likely lead to production recovery, while competition for acreage and dry conditions in Europe is expected to result in lower production. In India above average monsoon rainfall will be supportive for this season's crop, if not eroded by increasing ethanol production. The Indian government is also expected to review the provisional export quota for this season, dependent on harvest progress, which could improve export availability in 2023.

Rabobank's economic outlook forecasts the Australian dollar will remain weak into 2023, in the mid-to-high USc 60s range, helping keep local sugar prices favourable. With the global price outlook and ongoing weak dollar, local sugar pricing is expected to be down 6% year on year in 2023, but still 24% above the 2016-2021 average. While local prices will remain significantly above the five year average, costs of production remain elevated, keeping pressure on margins.

Pia Piggott
Associate Analyst
Rabobank


FARMACIST

CAMERON TURNBULL

Dynamic Nutrient Planning - Getting Nitrogen Right in Time and Place

AIM

1. To evaluate the 1622WhatIf?™ tool as a robust scientific method for determining crop nitrogen (N) fertiliser requirements within field.
2. To determine potential N fertiliser input reductions by better understanding soil/crop/seasonal dynamics in application decision making.

BACKGROUND

WWhen it comes to altering fertiliser rates on sugarcane crops, there is no single decision-making support tool. A team at CSIRO has developed the 1622WhatIf?™ App that is promoted as allowing farmers to evaluate the risks and benefits of changing N fertiliser applications. The App takes a scenario approach, for example a grower may ask "What if I change my fertiliser rate, harvest date and/or fertilising date? How would that affect my crop yield and N losses?'

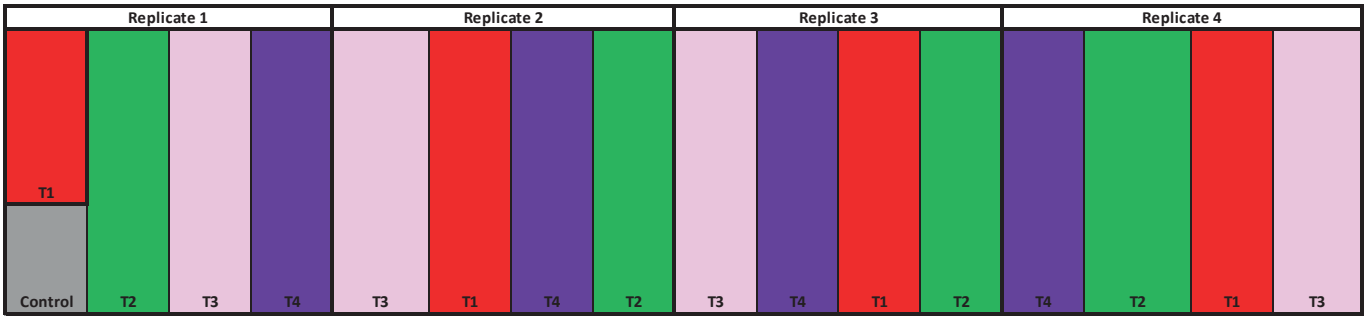
The trial uses the CSIRO 1622WhatIf?™ App to model crop N fertiliser requirements for a large sugarcane block at Dawlish. Soil cores, field productivity history, irrigation practices and soil type were collected and provided as

inputs to the 1622WhatIf?™ App. Based on the outputs of the model, a replicated field trial was established where N fertiliser inputs were varied annually according to the App's predicted requirements.

Crop N uptake, yield and sugar content measurements were collected in 2019 from four baseline N rates. Based upon crop performance data generated, 1622WhatIf?™ parameter inputs were refined, and new targeted treatments were applied.

Catchment Solutions is collecting water samples from each treatment to measure potential nutrient run off for the life of the trial.

Figure 1 - Trial layout of treatments and replicates



POTENTIAL WATER QUALITY BENEFIT

A more robust decision support methodology is required to assist growers and their advisers in making more informed decisions about N fertiliser applications in sugarcane, particularly identifying scenarios (soil type constraints, seasonal constraints) which may result in reduced yield and determining an appropriate N rate reduction to support that yield potential. The trial supports N rate determination that responds to seasonal conditions and N loss risk potential. This approach mitigates against losses to the environment through increased N use efficiency (NUE) and maximising crop yield potential.

EXPECTED OUTCOME

Validation of the 1622WhatIf?™ model by evaluating the yield and water quality outcomes of adopting the model's recommended annual N fertiliser application rates. A decision support tool that provides greater confidence to growers and advisors that N application rate recommendations are reflective of potential crop yield and seasonal conditions.

TRIAL LAYOUT

The trial was located in Dawlish, QLD. The soil type at this site is a Sunnyside soil which is a grey duplex soil, characterised by often acidic topsoils that have a high cation exchange capacity, low organic carbon values, and grey well drained clay with many yellow mottles at depth.

The trial was established with four treatments, each with four 0.7ha replicates, and a control (Figure 1). The initial treatment rates were determined by using the industry's nutrient guidelines, the SIX EASY STEPS (6ES), and +/- the recommended rates.

The application rates of N were varied annually for each treatment dependent on the 1622WhatIf?™ recommended rate.

The N application rates applied are outlined in Figure 2. These rates where determined as the baseline and 2021 applacations are replicated rates from 2020 season;

- Treatment 1 - -30% 6ES rate
- Treatment 2 - -15% 6ES rate
- Treatment 3 - 6ES rate
- Treatment 4 - Typical grower practice

The 1622WhatIf? ™ App was used to alter the rates applied after the 2019 season. The new 2020 fertilsers rates were replicated for the 2021 season. Two dunder brews where used in order to maintain the same phosphorus, potassium and sulfur quantity across the four treatments, with N being the only variable.

Table 1 outlines the 2020 applications determined by the 1622WhatIf? ™ App model, with consideration for forecasted local climate conditions and crop performance.

Catchment Solutions Water Quality Sampling

KP samplers, developed by BBIFMAC, were used to collect end of furrow run-off. The KP sampler is considered cheaper and simpler to run, as well as provide data more accepted as representing farm paddock run-off from rainfall events. The water quality assessment involved the use of KP samplers to collect end of paddock run-off following extensive rainfall events.

Figure 2 - Treatments of 2020 and 2021 season

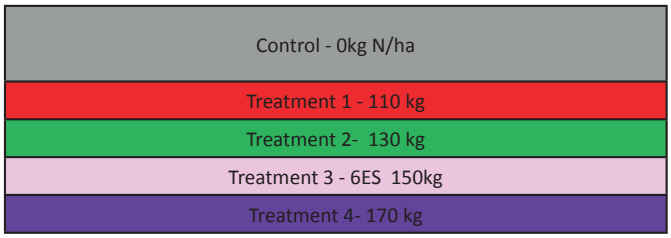


Table 1 - Rationale for 2020 post-harvest N application rate

Treatment	N rate (kgN/ha)	Rational
1	110	WhatIf?™ App determined minimal yield risk between 80 kg/ha and 110 kg/ha
2	80	No yield impact previous season between lowest and highest treatment. Given the crop was cut late, fertilised late and low yielding (60 t/ha average) the rate was reduced to 80 kg/ha
3	150	150 kg/ha is the Six Easy Steps rates, this will stay constant throughout the trial
4	180	Annual forecast predicts higher than average rainfall. Typical grower practice is to increase N rates to mitigate against potential N losses (denitrification & run-off) and increased potential yield.

Figure 3 - KP water sampler on the trial site

Figure 8 - 20 trial harvest

Figure 4 - Cane Yield (tC/ha) of 2020 treatments

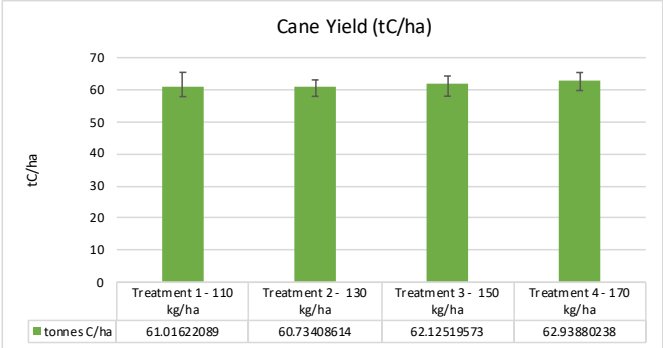
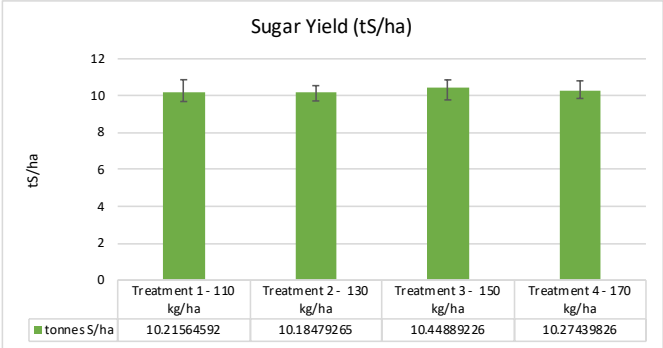


Figure 5 - Sugar Yield (tS/ha) of 2020 treatment



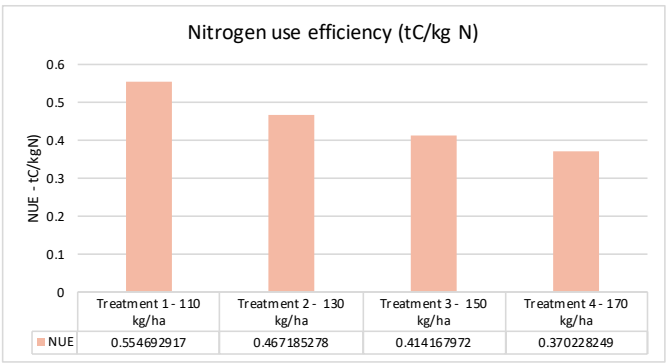
RESULTS

Yield Results 2020

2020 yield results indicated no significant difference in tonnes of cane or tonnes of sugar per hectare (tC/ha, tS/ha) between the four treatments (Figures 4 &5). The paddock was cut and fertilised late in 2019, restricting the crop's potential growth.

NUE results indicated that Treatment 1 (110 kgN/ha) resulted in the highest efficiency (Figure 6). The grower saved 60 kgN/ha but yielded 1.9 tC/ha and 0.1 tS/ha higher than Treatment 4 (170kgN/ha), equating to 67% improvement in NUE by using the lower N rate. However, the extent of this result must be considered with some caution because the reduced growing period. The significance of this result cannot be determined until the 2021 harvest results are collected and can be statistically compared on a daily growth rate in a determined period.

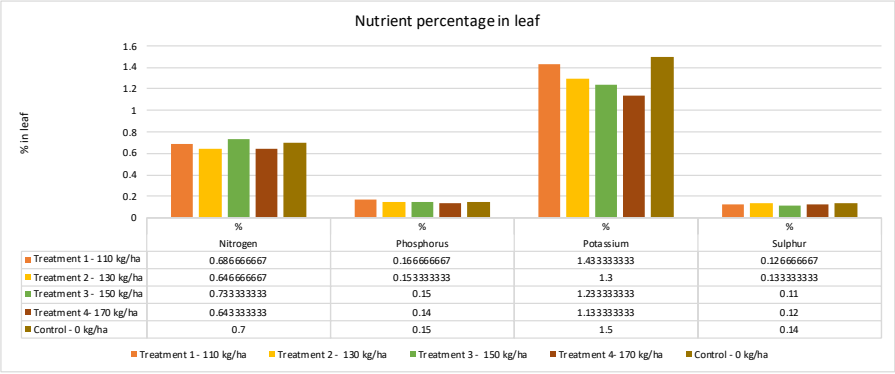
Figure 6 - Nitrogen use efficiency (tC/kg N) for 2020 harvest



Leaf Samples 2020

Leaf sampling results show little difference between N, phosphorus, and sulphur percentage in the leaf, however, potassium levels increased as N levels decreased (Figure 7). The control had similar, if not higher, nutrient content compared to the fertilised treatments.

Figure 7 - Leaf sample nutrient results 2020



2020 Catchment Solutions Water Sample Results

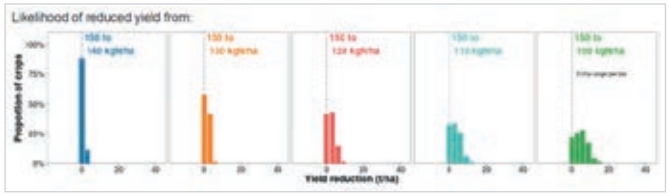
The initial assessment determined that the Dissolved Inorganic Nitrogen (DIN) estimate run-off loads increased in line with the increasing N Treatments, with Treatment 4 (170 kgN/ha) having the highest paddock run-off at 0.228 kg N/ha). There were no changes in mass loads for the paddock run-off for both the DIN and Particulate N. There were no changes in mass loads for the paddock run-off for Total Phosphorous, while Particulate Phosphorous had a more elevated mass load in the replicates of Treatment 3 (150kgN/ha), although this may be associated with factors outside of the trial assessment.

Figure 9 - Day of 2020 trial harvest

2020 1622WhatIf?™ Analysis

The results of the 1622WhatIf?TM better informed the N application decisions of 2020. The low risk of yield loss between nitrogen rates was consistent with the minimal yield differences between harvested treatments.

Figure 10 - 2020 1622whatIF? Yield reduction graph



Yield Results 2021

2021 yield results indicated no significant difference in tonnes of cane or tonnes of sugar per hectare (tC/ha, tS/ha) between the four treatments (Figures 11 & 12). The paddock was cut and fertilised late in 2020, restricting the crop's potential growth. The control expresses a significant reduction in cane and subsequent sugar yield. This was as expected as control was unfertilised (0 kg N/ha).

Similarly to the 2020 season, NUE results indicated that Treatment 1 (110 kg N/ha) resulted in the highest NUE (Figure 13). In treatment 1 the grower saved 60 kg N/ha however, on average, treatment 4 yielded 9.5 tC/ha and 1.4 tS/ha lower (170 kg N/ha). Treatment 2 and 3 express the same NUE. The control was not added to Figure 13 as it is insignificant to data interpretation.

Figure 11 - Cane Yield (tC/ha) of 2021 treatments

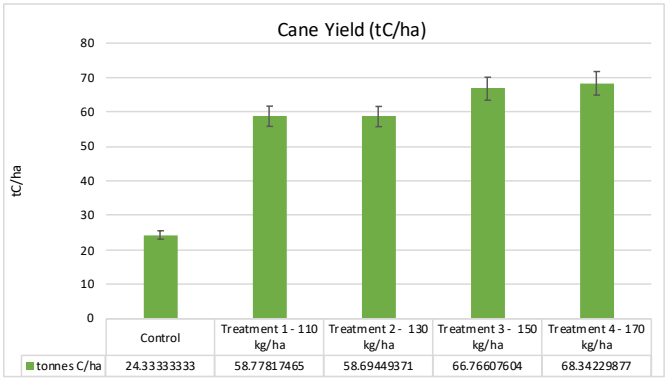


Figure 12 - Sugar Yield (tS/ha) of 2021 treatments

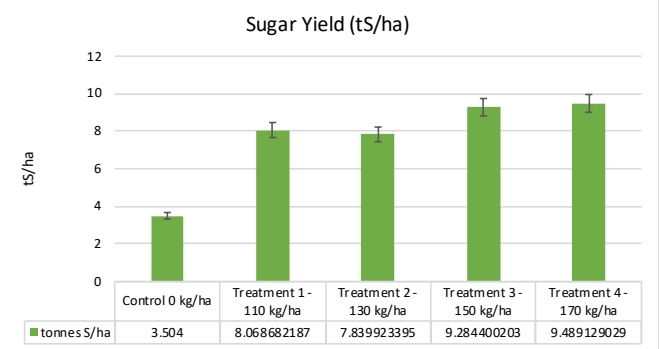
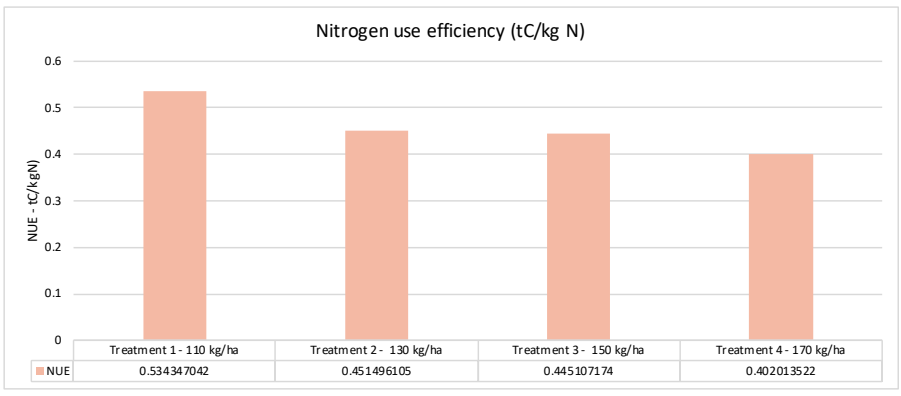


Figure 13 - Nitrogen use efficiency (tC/kg N) for 2021 harvest



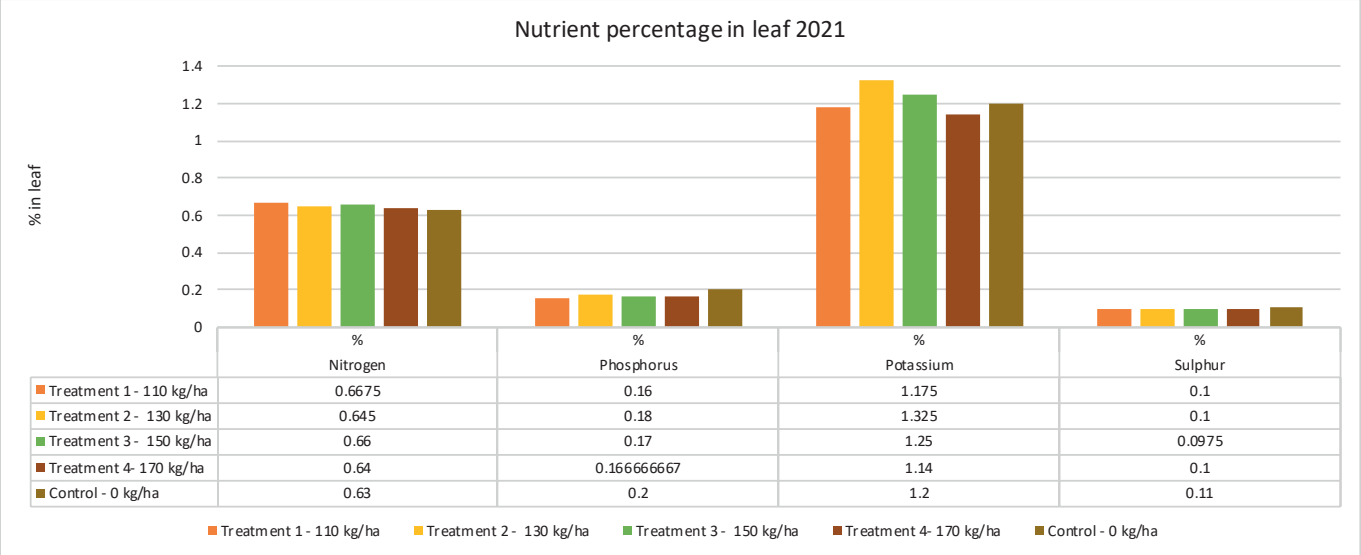
Leaf Samples 2021

Leaf sampling results show little difference between N, phosphorus, and sulphur percentage in the leaf, however, potassium levels increased as N levels decreased (Figure 14). The control had similar, if not higher, nutrient content compared to the fertilised treatments.

2020 And 2021 Catchment Solutions Water Sample Results (Combined)

Results show Total Nitrogen (TN) and Dissolved Inorganic Nitrogen (DIN) run-off load rates increase as a response to the increased rates to Urea in the different treatments. However,

Figure 14 - Leaf sample nutrient results 2021



	% Nitrogen	% Phosphorus	% Potassium	% Sulphur
Treatment 1 - 110 kg/ha	0.6675	0.16	1.175	0.1
Treatment 2 - 130 kg/ha	0.645	0.18	1.325	0.1
Treatment 3 - 150 kg/ha	0.66	0.17	1.25	0.0975
Treatment 4- 170 kg/ha	0.64	0.166666667	1.14	0.1
Control - 0 kg/ha	0.63	0.2	1.2	0.11

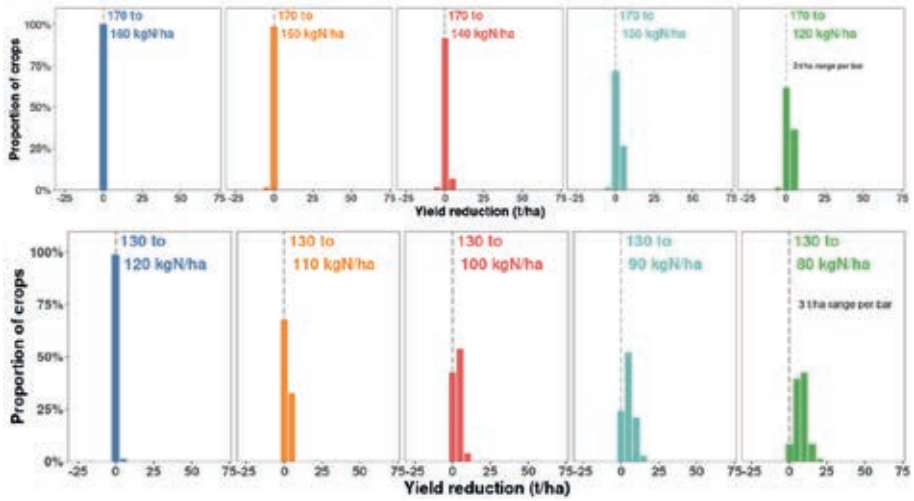
Treatment 2 (130 kg N/ha) showed the highest run-off load rate average of DIN at 0.46 kg N/ha over 2020 and 2021 seasons. Comparably Treatment 4 (170 kg N/ha) DIN average expressed a lower rate of 0.34 kg N/ha. Total Nitrogen of Treatment 2 was 1.83 kg N/ha, which is higher than Treatment 4 at 1.67 kg N/ha. Treatment 2 Dissolved Organic Nitrogen (DON) and Particulate Nitrogen (PN) rates expressed DON of 0.99 kg N/ha and a PN of 0.46 kg N/kg. Comparably treatment 4 expressed slightly lower rates of DON at 0.84 kg N/ha and PN at 0.27 kg N/ha. According to Catchment solutions, the elevated run-off concentration may have been influenced by factors outside the trial assessment.

2021 1622WhatIf? ™ Analysis

The results of the 1622WhatIf? better informed the N application decisions of 2020. 2021 replicated the treatment application rates of the 2020 season. The low risk of yield loss between nitrogen rates was consistent with the minimal yield differences between harvested treatments.

Figure 15 - 2021 Biomass sampling – Farmacist team

Figure 16 - 2021 1622whatIF? yield reduction graph



CONCLUSION

This project in now complete under this round of funding, however the trial will be continued pending additional funding.

Farmacist is driven to continue the work to promote the new tool. This will assist us to continue the work of extension and increase data set for further investigation.

Advantages of this Practice Change

Overall, the trial showed the NUE was greatest at 110 kg N/ha compared to the higher rates of treatment. This is an advantage to the grower by reducing cost of fertiliser without diminishing yield significantly. Another advantage is the reduction of environment contamination of the unutilised Nitrogen fertiliser products used in typical application rates.

Disadvantages of this Practice Change

A small chance of yield reduction over several seasons even though insignificant, can provide uncertainty within grower community. The Adoption rate of growers is likely to be slow. Barriers of adoption include lack of confidence surrounding the reduction N. The use of a technical tool that may not be easily understood and is in an early stage of adoption.

Will you be using this practice in the future

Overall, yes Farmacist will be promoting confidence in the use of the 1622whatIF app and the data that it represents. The reduction of fertiliser application and NUE show clear evidence that yields are not determined by standard, high N application rates.

% of farm you would be confident to use this practice

20% of total farm for initial practice change per individual grower. This is a good start for both grower and advisor as the current trial was on 1 soil type, over a few seasons. The increased use of the WhatIF tool will increase in line with clear outcomes, cost benefit achievements and larger farm yield data sets.

Launch of Ageing on Farm Guide inspired by Herbert region farmers

Sam Marwood, Co-Founder of Cultivate Farms, in Ingham

Cultivate Farms has wrapped up its Great Barrier Reefinance Project with the publication of the Ageing on Farm Guide. The Great Barrier Reefinance Project, made possible through the Great Barrier Reef Foundation, aimed to match aspiring farm owners with retiring farmers and orchestrate shared ownership or a transition of farm ownership over a period of time.

Sam Marwood is the Managing Director of Cultivate Farms, and Project Manager for Great Barrier Reefinance. While researching and recruiting for the Great Barrier Reefinance Project, Sam re-confirmed that in the Herbert region, like most regions in Australia, there is a lack of knowledge about the options available for farmers to age on their farm.

"Most farmers think that the only option is to sell and walk away from their farm," explains Sam, "however you can stay on your farm, keep involved in the farming and be a key player in the local community."

The Ageing on Farm Guide encourages farmers to think about and plan for their retirement and future. Taking a proactive approach to Ageing on Farm can support farmers to continue their legacy and connection to their land, while supported aspiring young farmers toward their goal of farm ownership.

"The cane farmers in the Herbert region showed us how important transitioning farms can be to the quality of life of retiring farmers," continues Sam, "This guide is inspired by them, and we hope that the guide inspires conversations with retiring farmers and their families all across Australia."

Transitioning farm ownership leads to thriving farming communities, and typically shows higher farm productivity and environmental outcomes. The incoming, young farmer supports the retiring farmer to age on the property, while the young farmer benefits from the years of accumulated local knowledge.

The Ageing on Farm Guide is available to download for free from the Cultivate Farms website www.cultivatefarms.com/retiringfarmer

BBPrint
QUALITY PRINT & DESIGN

Continuing to lead the way in environmental printing

As Central Queensland's leading printing and design business, BB Print continues to strive to be at the forefront of Australia's environmental initiatives.

The printing industry has improved in leaps and bounds when it comes to environmental responsibility and this is an area Office Coordinator Nicola Kaye is passionate about, having led the charge to make BB Print a sustainable green printing business.

Sustainable Green Print (SGP) is the Australian Printing Industry's own recognized certification program which ensures the industry meets its environmental responsibilities.

Having maintained a 'Level 2 accreditation for Sustainable Green Print' for 9 years, BB Print's commitment to the environment remains unwavering.

BB Print is the only SGP accredited business north of the Sunshine Coast and each year exceeds the strictly monitored environmental audit they are required to undertake.

Every aspect of waste is weighed and calculated with the SGP system allowing accredited companies to continually improve and reduce their impact on the environment.

"BB Print has made significant changes to reduce our impact on the environment with every waste stream we have. We strive every day to better our procedures to reduce the impact on our surroundings," Nicola said.

"This became particularly challenging in 2020 when China stopped accepting waste to recycle from Australia. We had to come up with a solution to allow us to recycle our paper waste, such as trimmings, and this is when we discovered beneficial recycling to help compress the waste."

"This new procedure has reduced our general waste from 600kg to 150kg per week."

This 'out-of-the-box' solution led to BB Print being a finalist in the 2022 Resource Industry Network awards.

BB Print had also previously scooped Environmental Management Awards in 2013 and 2015 from the Printing Industries Association of Australia.

BB Print Partner, Gary Bye said, "We care about the environment and so do many of our customers."

"Another benefit is that by taking responsibility for the impact we have on the environment we can also focus on improving efficiency. We recycle everything possible, even down to the rags we use, utilising greener chemicals and soy-based inks."

It's a great source of pride for us that we are an environmentally responsible company.

Mackay REGIONAL COUNCIL

Nutrient offset scheme a win-win

LOCAL cane farmers have led the way in an innovative trial project to reduce nutrient runoff into local waters.

The Nutrient Offset project was inspired by Mackay Regional Council's need to undertake future upgrades of the Mackay North Water Recycling Facility (MNWRF), due to significant population growth in the Northern Beaches area.

As the technology required to undertake these upgrades is expensive for what they deliver, council sought an alternative catchment-based solution for limiting nutrient load increases resulting from wastewater management.

The impetus for this project was the Cleaner Wastewater Initiative, linked to LGAQ's Reef Councils' Reef Rescue Plan, and funded by the Queensland Government through the Queensland Reef Water Quality Program. This program is designed to trial and share knowledge about low-cost, alternative wastewater management approaches that are more appropriate for smaller regional councils.

The trial project encompassed farms surrounding Tin Pot Creek, at Balnagown, with the intent of assisting local cane farmers to develop on-farm management plans that would reduce runoff while potentially reducing operating costs and increasing farm yields.

Council engaged local agronomic solution provider, Farmacist, to engage with the farmers, working with them to review their current practices, including their farming equipment, chemical and nutrient use and nutrient retention, and align these practices with the Paddock to Reef Water Quality Risk Framework.

The nutrient plans were seen as a "win-win" for both council and growers by provident a more affordable scheme for managing expected wastewater-associated nutrient load increases.

Growers see retaining nutrients on their farms as the better outcome to reduce nutrient load in waterways, rather than the reduction of nutrient inputs. By improving fertiliser management practices, they can make savings on fertiliser application, making them more profitable.

Lowering nutrient input into waterways also reduces the likelihood of harmful algal blooms occurring.

AUDRA ALLAN
WITH GROWER RICK GARNHAM

Adopting multi-species as fallow break crop and addressing high Aluminium levels in soils

BACKGROUND

In mid-December 2020, Rick joined the Project Catalyst Broader Adoption Program with the plan to adopt multi-species legume break crops. At the end of 2020 and start of 2021 the weather presented extremely dry followed by extremely wet conditions. Despite this Rick managed to plant a soybean crop while the multi-species seed was not an option between the weather extremities.

The soybean germinated well, then struggled once it had reached three to fourth leaf stage and went backwards from there and subsequently the crop failed. In early 2021, I started compiling historical farms soil tests in preparation for the development of Rick's Nutrient Management Plan and noticed the number of soil tests identified low pH(water), low Calcium, low Zinc levels, in addition high levels of Aluminium which is closely associated with low pH levels. Aluminium is highly toxic to legumes which could explain the disappointing outcome that his legume crop then failed. A later soil test confirmed my suspicions. (Figure 1)

I arranged a meeting with Rick and his Nutrien agronomist John De Costa to discuss the issues of high Aluminium levels and the toxicity impact on legumes and that lime could alleviate the issue.

Figure 1 - Soil Test Results

Nutrient	Result	Low	Marginal	Sufficient	High	Excess	Sufficiency Range
pH (1:5 H2O)	5.4						5.5 - 8.5
pH (1:5 CaCl2)	4.3						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) %	0.76						1.20 - 2.00
Phosphorus (Colwell) mg/kg	24						41 - 50
Phosphorus (BSES) mg/kg	14						41 - 50
Phosphorus Buffer Index (Colwell) (PBIc)	130						15 - 420
Potassium (Amm-Acet.) cmol+/kg	0.17						0.40 - 2.00
Potassium (Nitric K) cmol+/kg	1.2						0.70 - 2.00
Potassium % of CEC	4.4						3.0 - 10.0
Sulfate-S (MCP) mg/kg	11						15.0 - 25.0
Calcium (Amm-Acet) cmol+/kg	1.6						2.0 - 20.0
Calcium % of CEC	41.8						55.0 - 90.0
Magnesium (Amm-Acet.) cmol+/kg	0.8						0.3 - 10.0
Magnesium % cations	20.7						0.0 - 25.0
Sodium (Amm-Acet.) cmol+/kg	0.06						0.00 - 1.00
Exch. sodium %	1.7						0.0 - 6.0
Electrochemical Stability Index	0.018						0.050 - 10.000
Aluminium (KCl) (prewash) cmol+/kg	1.2						0.00 - 0.50
Aluminium Saturation %	31.4						0.0 - 10.0
eCEC cmol+/kg	3.8						2.0 - 40.0
Copper (DTPA) mg/kg	1.8						0.20 - 1.00
Zinc (DTPA) mg/kg	0.37						0.30 - 1.00
Zinc (BSES-HCl) mg/kg	0.4						0.6 - 1.0
Manganese (DTPA) mg/kg	50						2.0 - 200.0
Iron (DTPA) mg/kg	140						4.0 - 400.0
Silicon (CaCl2) mg/kg	37						10.0 - 2,000.0
Silicon (BSES) mg/kg	150						70.0 - 2,000.0

LEARNING AND ADOPTION PROCESS

Due to the farm topography and traffic controlled 1.8m row spacing Rick was not in favour of broadcasting lime prior to sowing any break crop. This is due to the truck spreader running over the mounds as they turned at the end of the rows and the possibility of floodwaters inundating paddocks during the wet season and having to perform paddock maintenance after the wet. As an alternative Rick has opted to use OzCal @ 450kg/ha after planting his sugarcane crop to assist with his pH and calcium issues. OzCal is ultra-fine granulated Calcium Carbonate with 95% of particular under 45 microns making the Calcium more readily available compared to other forms of lime.

Practice change in 2021 was needed for growing legumes/breakcrops however, the constraints of low pH, low Calcium and low Zinc and very high Aluminium levels required new approach as part of the overall fallow management. We discussed conducting earlier soil testing prior to planting any fallow crops to identify any soil constraints well before purchasing seed. This also allows consideration on how to address any issues and what is best suited to plant into the fallow blocks. To assist Rick for a clearer picture, I created a map of his farm with the soil constraints associated with his soil tests, fortunately Rick has extensive soil testing program for many years. (Figure 2)

We also discussed alternative cropping species that could tolerate the issues and decided that we would look at some pasture grasses for biomass and trying some Sun Hemp for nitrogen fixing in the 2021-2022 break crop. Unfortunately, these crops didn't get planted due to late crush and rainfall events but are still planned as a breakcrop for next season 2022.

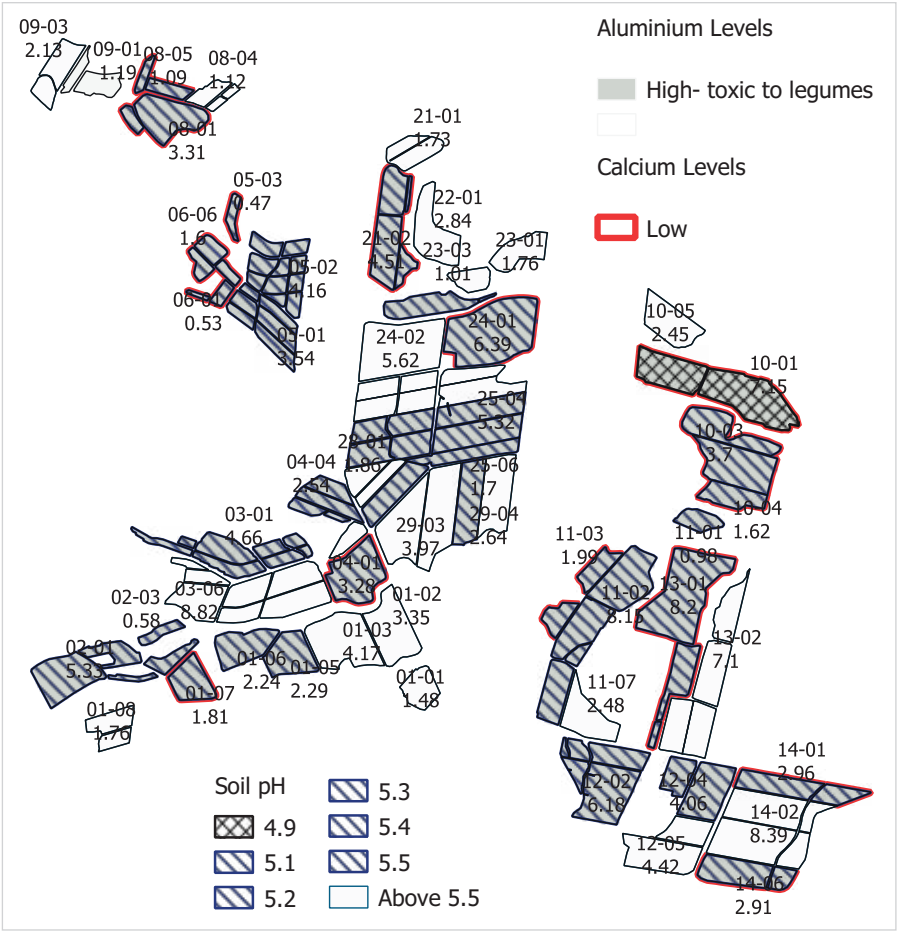
Block 24 which was planted into sugarcane in 2021 had high Aluminium Saturation levels reading three times above the acceptable range. Aluminium toxicity in sugarcane is uncommon however high levels can cause yield reductions. Since the 1990's the varieties have changed, and no actual updated information is available on the effects of Aluminium levels on current varieties. These studies are referenced in Sugarcane Nutrition by D.L Anderson and J.E Bowen and published by Potash & Phosphorous Institute (PPI) Atlanta, GA 1990 Copyright (pages 6 & 7).

Also noted in the Sugarcane Nutrition publication that high levels of Aluminium toxicity can cause Phosphorous deficiency symptoms of alumino-phosphate complexes within the plant and in the soil. D.L Anderson also referenced that Aluminium root damage resembles similarities caused by nematodes (abnormally thickened root tips). Plants become highly susceptible to moisture stress and by adding lime and higher Phosphorous fertilisation often alleviates toxicity effects. The latter is no longer an option due to the Reef regulations unless captured in a current soil test. (Figure 3)

Figure 3 - Aluminium root damage resembles nematode damage. Affected plants are highly susceptible to water stress.

(Photo: Anderson and Bowen 1990 Copyright. Sugarcane Nutrition. Potash and Phosphate Institute, Atlanta, GA)

Figure 2 - Farm Map



ADOPTING AND IMPLEMENTING THE NEW PRACTICE CHANGE

Focusing on all the above and addressing the constraints, we identified a Loveland product called "Structure" with the potential to assist with the issues which generated a practice change trial in the fallow block. The trial compares using Rick's usual Liquaforce Plant Starter @ 100 L/ha at planting verses Liquaforce Plant Starter @ 100 L/ha product and adding 10 L/ha Structure into his fungicide at planting. The entire plant block was top-dressed using the same granular product and rates at fill in.

Loveland Structure is relatively new to sugarcane in Australia and is truly a unique product that no other technology offers. The "Reacted Carbon Technology" is a formulation of Nitrogen, Phosphate and Zinc, which are reacted in a proprietary process with very high-quality organic acids. These organic acids form a single bond with the Phosphate (P) and Zinc (Zn) complexing these ions, this means that complex P & Zn don't bind near as readily with other ions in the soil, meaning you can expect much greater P and Zn availability in the plant/ sugarcane. With long chain and short chain organic acids this product has many beneficial properties that stay in the soil and act as a "buffer" for the roots taking up undesirable ions like salt (Na), chloride (Cl) and aluminium (Al) and the undesirables will stick to these organic acids and not enter the roots.

The other mode of action in these organic acids, is they contain an amount of transmembrane proteins (TMPs), these TMPs give the plant the ability to decipher between two ions of similar molecular weight, say Potassium (K) and Sodium (Na), so the plant will be able to take up more K.

By applying Structure, the crops will be able to deal with heat stress much better as they will be able to take up more K to regulate the stomata and create a healthy moisture gradient in the plant and be able to retain internal moisture and transpire when necessary. This has led to a healthier crop in high temperature or dry conditions.

Hence, we decided to trial this product to observe the following:

a. Observe if it visually works in the field and crop
b. In conjunction with lime application, alleviate and assist with a healthier sugarcane crop.
c. Be cost effective

OUTCOMES

The program has confirmed the importance of conducting soil tests early to identify any issues prior to sowing any crop. Soil test can assist with making informed financial decisions when considering what crop to grow and where.

Figure 4 - Ground Level

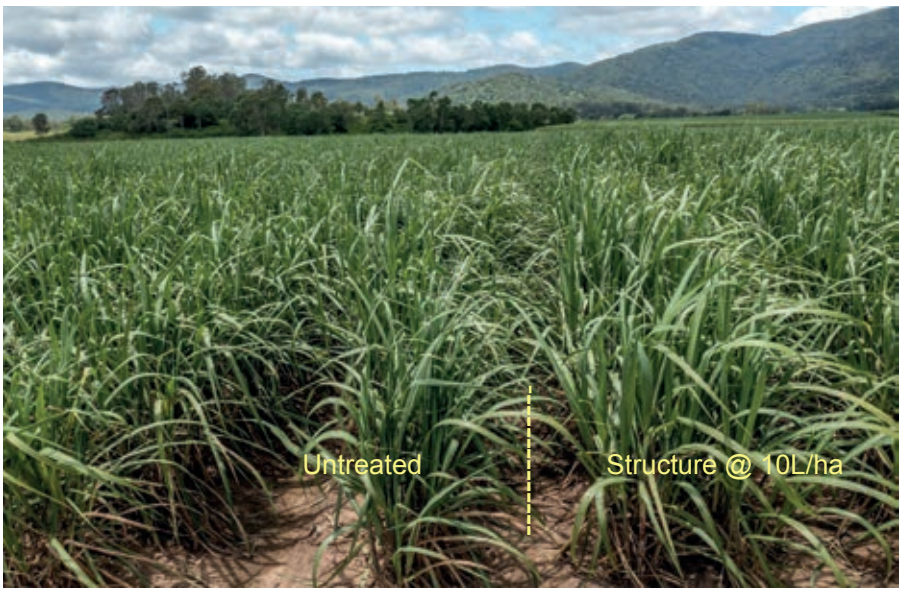


Figure 5 - Aerial View Rick's Structure Trial

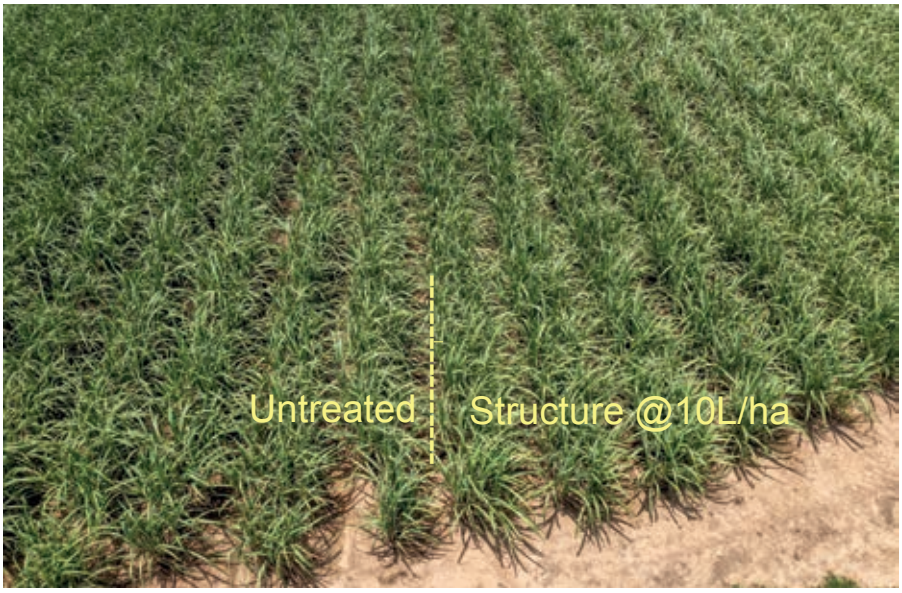
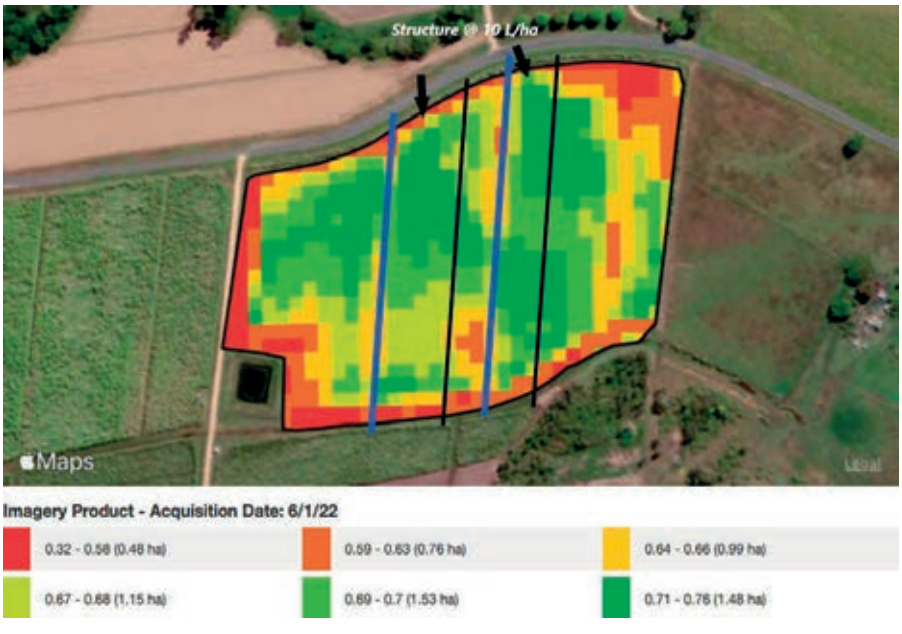


Figure 6 - NDVI Image or Block



Although broadcasting of crushed Ag lime would be beneficial this was not an option for Rick, however, he is still addressing the low Ca levels with OzCal @ 450 kg/ha.

Using both OzCal in conjunction with Loveland Structure the visual outcome is becoming more evident as the crop continues to grow throughout 2021-2022 season.

During the heat wave on the 6th January 2022 where temperatures soared to 35 0C with 67% humidity, we could identify the Structure treated strips on right handling heat stress far better than the untreated areas which were showing a lot of leaf curling around 11:30am. (Figures 4-6)

Structure treated areas also showed considerably more biomass which should also increase transpiration of chlorophyll with better leaf surfaces, plant growth and yield which should reflect at harvest time in 2022. This has also been observed in another Structure trial at Pinnacle on Krasnozem soils which tends to tie up available phosphorous due to high iron content in soil. (Figures 7 & 8)

RESULTS

Rick has managed to plant some Sun Hemp into his 2022 fallow to further support his sediment control, nitrogen fixing and robust nature of Sun Hemp ability to tolerate his soil Aluminium levels with a breakcrop. (Figure 9)

Unfortunately, with the 2022 crush Rick's Structure block wasn't harvested due to wet weather and is currently standover.

The Pinnacle Structure block was harvested, (Figure 10) however, the mill mis-sampled some of the structure bins which has interfered with the results and the overall bin weighs for both treated and untreated area averaged out the same.

Figure 9

Figure 7 - Pinnacle Structure trial

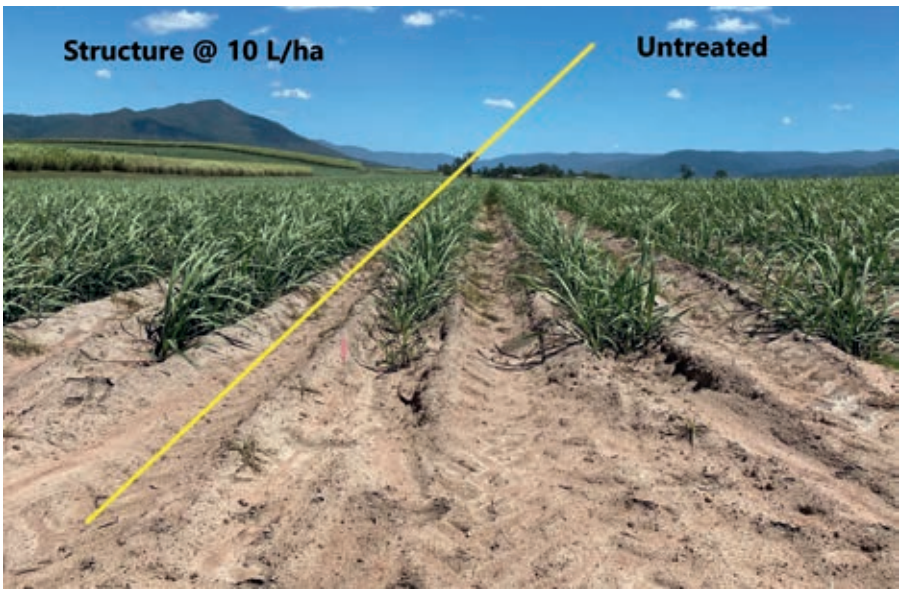


Figure 8 - Pinnacle Structure trial

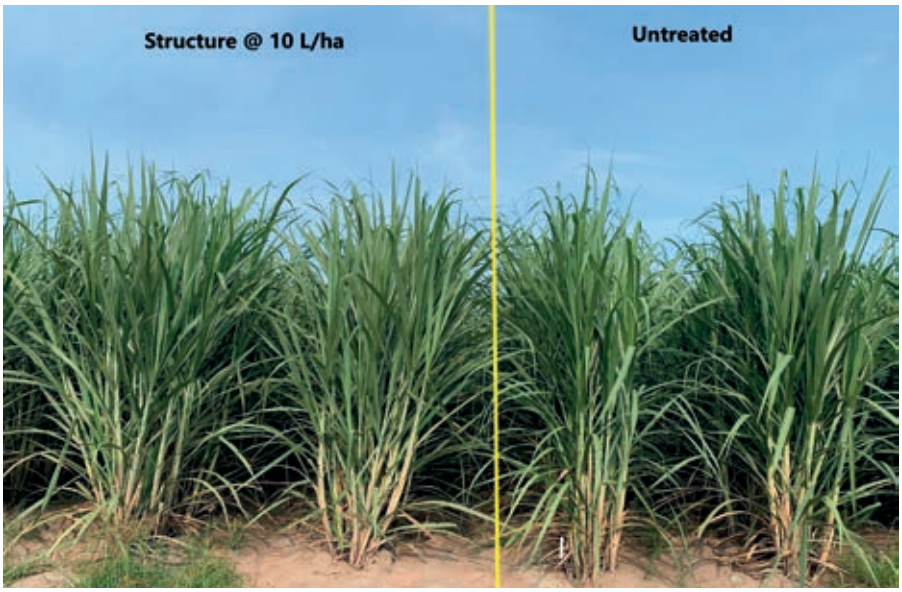


Figure 10

REEF CATCHMENTS

Partnering with you to deliver Sustainable Agriculture

We're working alongside farmers and landholders on their properties to achieve practice change that not only increases on-farm productivity and profitability, but also supports a reduction on impacts including sediment loss, erosion, and chemical runoff into the Mackay Whitsunday region catchment areas.

Over the past year, it has been incredible to see the increasing willingness of landholders to take part in initiatives and share innovative ideas – many with positive results leading to the adoption of these practices on a broader scale.

Several local growers involved in water quality programs have focused on more efficient application of pesticides. Through the fabrication of a high clearance spray tractor and GPS rate controller, one grower has reported reduced pesticide usage by 15 percent.

Others have adopted precision agriculture technology to identify and address soil constraints, such as pH to reduce their costs and the amount of fertiliser required. Adopting practices such as planting soy or mung beans has allowed some growers to reduce the amount of synthetic nitrogen being applied, which can result in big cost savings.

One local farmer has earned recognition as a Reef Conservation Champion at the 2022 Queensland Farmers Federation Awards by working to improve wetlands on his grazing and cane property.

Through funding from the Australian Government's Reef Trust, he was able to remove invasive weeds and construct fishways to improve connectivity between the freshwater and marine environment. Other changes, such as fencing, and off-stream watering points have had dramatic results and benefited both the landscape and his farming operation.

We recognise new challenges as well as the opportunities facing landholders today and are excited to support Project Catalyst and continue our involvement in the outstanding work that is being undertaken across our catchments to support sustainable and productive farming.

We look forward to continuing our work with local growers to improve production, resilience, and sustainability beyond 2030, through our funded programs and events.

For more information on how we may be able to help you please contact Reef Catchments.
E: info@reefcatchments.com
T: (07) 4968 4200.

AGLANTIS
SMART FARMING MADE SIMPLE

Making GPS Work For You

In recent years, increased regulatory compliance has required farmers to keep more records of their day-to-day operations. GPS systems can be challenging at the best of times.

We can help make record-keeping easy, by setting up your GPS to record operations while they are being performed.

Not only does this provide you with accurate records to assist with meeting regulatory compliance, but it also sets a solid foundation for progression in precision farming.

AGLANTIS rises to respond to a need in farming operations. An Australian-owned smart farming company based in the Burdekin – working with farmers across Queensland to provide innovative, practical, reliable solutions. Empowering you with knowledge and reliable service.

Reliability is a core value, and we achieve it by ensuring you have easy access to local on-ground support and specialist advice from our leading smart farming experts.

Managing director Luke Malan has worked with and provided tailored agricultural extension services to over one-hundred farmers in the Burdekin region, with a key focus on farming solutions that improve business sustainability and profitability.

We can help you understand GPS systems whether they're blue, green, red, or yellow. Offering one-on-one tailored smart farming services to all farmers from the Wet Tropics to Mackay Whitsundays Regions.

Luke and Barry bring decades of combined sugarcane industry experience, to share knowledge and provide local support in Ayr and Townsville.

Innovation is crucial to make farming easier, more intuitive, and more profitable.

Being involved with Project Catalyst over the past 8 years, we are proud to support growers attending the 2023 Project Catalyst Forum and our team looks forward to connecting with both growers and project partners in Cairns.

To see other ways we are making smart farming simple, visit us at aglantis.com.au

NOTES

Thank You

We could not accomplish our goals
without the support, involvement and enthusiasm
of our committed supporters.

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FULLHAMMER

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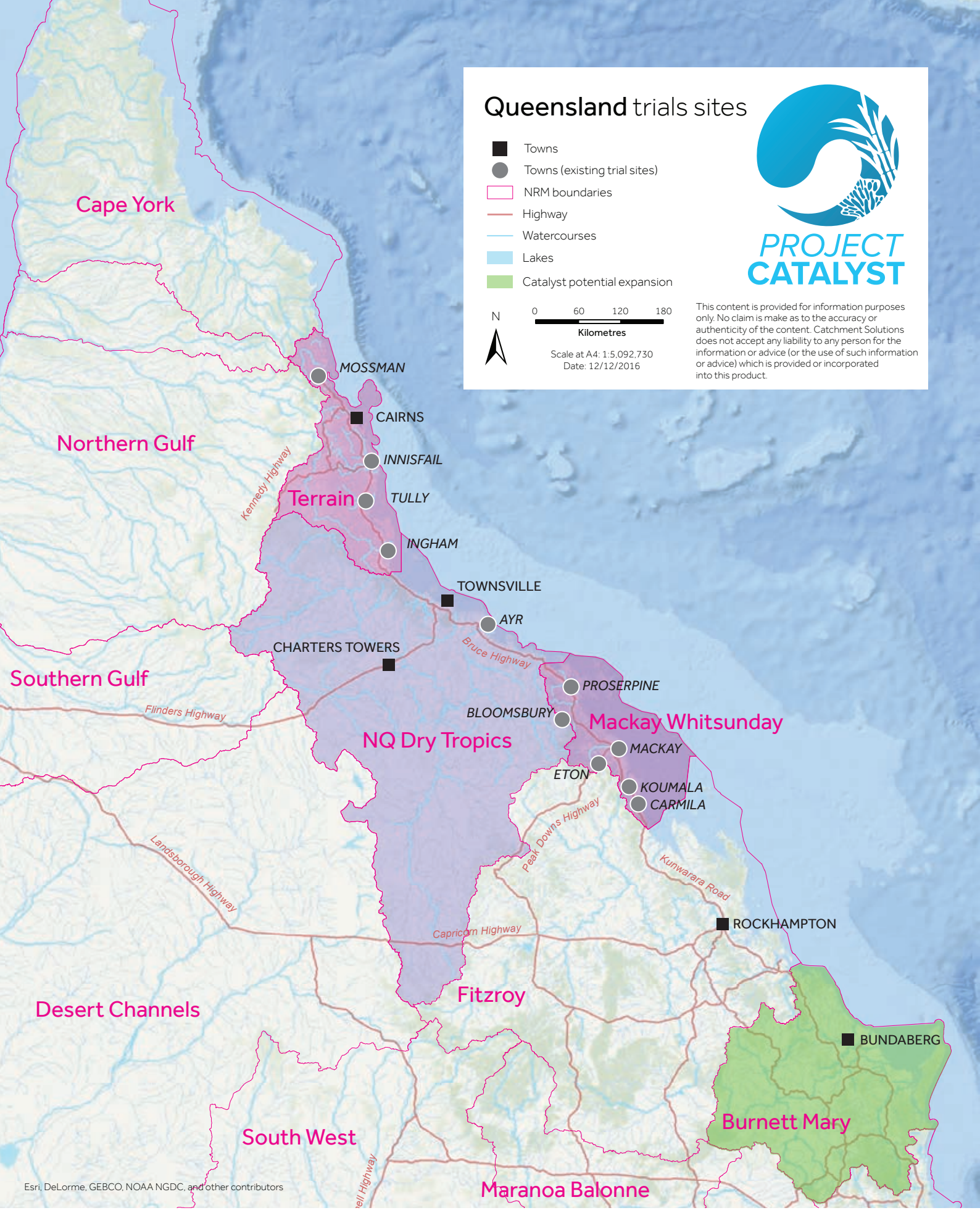

Australian Government | Reef Trust | Great Barrier Reef Foundation | The Coca-Cola Foundation | WWF