

CaneConnection

Summer 2017



p6

Gayndah frost
tolerance work

p8

Making connections
from cane to creek

p18

Improving NUE of
sugarcane varieties

p28

Getting more profit
from nitrogen

Welcome to the Summer 2017 edition of *CaneConnection*

In this edition, we are looking at everything from the sky above sugarcane plants with research using unmanned aerial vehicles, to underground to better understanding soil health.

Industry sustainability is a key topic in this edition, with several articles looking at the important issues of water quality and nutrient management. We visit northern grower Len Parisi at Fishery Falls, who is working with SRA on the Cane to Creek project, and Tully grower Frank Vecchio, who is collaborating on the Protecting our Chemicals project. Both of these projects in the Wet Tropics are working collaboratively with growers to deliver productivity, profitability and sustainability outcomes for the Australian industry.

We also head to the Burdekin to see some of the enhanced efficiency fertiliser trials going in the ground at Joe Linton's property, as part of a major project with sixty trial sites across Queensland. While in the Burdekin, we also look at innovation in irrigation with Paul Villis with Jurgens Cane Farming.

A bit further south and we meet with the only current sugarcane growers in Bowen and learn about some of their on-farm practices and innovations. We also look at some of the research at Gayndah with frost assessments, and also interesting variety research looking at the nitrogen use efficiency within varieties.

We hope you find this magazine useful and informative. If you have any questions or comments please phone (07) 3331 3340 or email bpfeffer@sugarresearch.com.au

Brad Pfeffer

Executive Manager, Communications

Contents

- 03 By the numbers
- 04 Going solo – thanks to ingenuity and innovation
- 06 Heading west: Gayndah trials assess frost tolerance
- 08 Making the connections from Cane to Creek
- 10 SRA Ingham station delivering outcomes for growers and millers
- 12 Water quality work that works for us
- 14 Irrigation investment delivering on-farm benefits
- 16 Expansion and improvement to target long-term vision
- 18 Improving the nitrogen use efficiency of varieties
- 19 Broadening knowledge on downy mildew for Australian sugar industry
- 20 Working to improve RSD testing
- 21 RSD vigilance a piece in the productivity jigsaw puzzle
- 22 What lies beneath?
- 23 Making the good better
- 24 Taking the next step forward in biofuel technology
- 26 Enhanced efficiency fertiliser trials rolling out on a major scale
- 28 Novel laboratory approach uses robotics and micro-dialysis in nitrogen use efficiency research
- 30 Research alliance investigates proper blending of enhanced efficiency fertilisers
- 32 Total Research Investment



60

The number of trial sites to be undertaken to assess the role of enhanced efficiency fertilisers in the sugarcane farming system.

> *Page 26-27*



50%

The target for the US Navy's use of biofuel by the year 2020. Read how the sugar industry could capitalise.

> *Page 24-25*

By the numbers



4ha

The area of solid-set sprinklers being trialled in the Burdekin at Jurgens Cane Farming.

> *Page 14-15*



2%

The target for annual genetic gain in the SRA breeding program. Read more in our varieties newsletter.

> *Varieties and Plant Breeding Update*



4

The number of variety trials at Gayndah to assess frost tolerance and the region's potential to grow sugarcane.

> *Page 6-7*



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Going solo – thanks to ingenuity and innovation

He is 26 years old, but Bowen farmer David Richardson already has a decade of full time farming under his belt – something that is proving to be a valuable asset with the family being the only cane growers in the local region. By Brad Pfeiffer

Starting out sugarcane farming is not easy. And that job gets even harder when you are doing it at 16 years old. Then it gets harder again when you are in a district with very few other farmers and horticulture is the main game in town.

But that is exactly what Bowen farmer David Richardson did almost 10 years ago along with his father Hugh, who was an accountant by background.

Today, the Richardsons are the only farmers growing cane at Bowen, growing about 10,000 tonne each year that makes the 80km journey south to Proserpine mill.

Ten years ago, when David left school to start farming full time, there was a small number of farmers growing cane at Bowen, with the main proponent being Jamie Jurgens. While the district peaked at close to 30,000 tonne, Jamie and the other farmers have since stopped growing cane at Bowen, although Jamie continues to grow cane elsewhere.

"We started by taking over a block of cane that Jamie was growing on some of our land, and we kept going," David said.

"Small crops weren't an option, as when you are 16 years old no one wants to take any notice of you if you are telling them what to do, so the cane was a way to get started that was easier and needed less labour."

The foundation for the cane growing including the investment in a tractor and laser bucket, which David drove after school and on weekends to build dams for their farms.

David said that there were challenges being the only farmers now growing cane in the district. For example, they need to own all their own gear and also have the skills to fix it and modify it quickly.

An example of this challenge occurred earlier this year when their Cameco harvester burnt out while parked at the end of the day.

The images of the harvester and billowing smoke quickly did the rounds of the industry on Facebook, but for the Richardsons it presented a real challenge in finding help to finish the season.

In Bowen, there are no cane-growing neighbours down the road to call upon to ask for a hand.

This has meant a strong reliance on their own ingenuity and skills. It helps that David completed a certificate two in agriculture through the Burdekin Ag College, and also a cert three as a diesel mechanic.

"We build and fix all our own gear: slashers, sprayers, implements, even packing gear for the small crops," he said. "We have to, because it is expensive to go to the engineering works."

They have recently started growing some small crops as well, which David said "growing sugarcane has taught us how to do".

"We are self-taught, so have learnt as we have gone along, along with the help of agronomists," he said.

The horticultural crops can fluctuate wildly in their price in what he describes as "boom or bust", meaning that they carry much more risk.

This, year, for example, he said that their produce was not worth the cost of picking, packing and transport – let alone the growing costs that came before that.

"It has been excellent growing conditions in 2017, and after Cyclone Debbie everyone thought Bowen would take a lot longer to recover and bounce back, but we ended up with a large and high-quality crop, which depressed prices."

For the cane, they have two b-double side-tippers that move 34 tonne per load and make the round trip to Proserpine in about two hours and ten minutes if the traffic is okay.

Their preferred varieties are KQ228[®] and Q208[®], which David said handled the dry weather better than other varieties that they grow, with David feeling that KQ228[®] could be water stressed at harvest and still ratooning well on their farms.

Now using mostly flood irrigation, they have tried a few different methods of irrigation over the years, including drip tape and a travelling irrigator. They had some challenges with rats chewing holes in the tape, although did say that it produced some big cane in its first years.

He prefers growing sugarcane, but admits that it has a bit of an uncertain future locally unless there are more growers at Bowen.

The main barriers though are the high water and land prices, driven up by the small crops.

"Labour is also a challenge. We can easily find people with a car licence who want to work on the small crops, as they come to Bowen for that work. But finding someone with a truck licence to work part of the year is a big challenge."

Below: Small crops are now part of the business that has been built from sugarcane for David Richardson.

Below inset: Despite some impacts from Cyclone Debbie earlier this year, this year's crop has been reasonable, according to David Richardson.



SRA plant breeder Roy Parfitt showing frost damage in one of the varieties within the Gayndah FAT.

Heading west: Gayndah trials assess frost tolerance

Is there potential to push the boundaries of current sugarcane production further by expanding into frost-prone areas? The team at Isis Central Sugar Mill is keen to find out, with research support from SRA and implications for many areas of the industry.

It is a common challenge for many cane-growing regions: horticultural crops, tree-changers looking for a horse paddock, and timber plantations have reduced the area of sugarcane growing land.

In other regions, it is not crops or grass, but houses and industrial estates that are sprouting onto cane country.

The risk of declining cane supply and its long-term threat to mill viability is typified at Isis, where macadamias and avocados are common on the landscape.

SRA has already been working with industry on this challenge through research projects that are looking to maximise production from marginal soils, as sugarcane farming is pushed into these areas.

Separate work has also started establishing frost plots at Gayndah, in a region better known for its grazing and citrus industries.

The investigation is being driven and led by Isis Central Sugar Mill, and they see it as a potential long-term solution for ensuring a sustainable cane supply.

According to Chairman Peter Russo, while they consider that the investigation is still in the early stages, they are also excited by the opportunity that it presents.

"We are in the feasibility stage, but we are slowly ticking off key milestones," Mr Russo said. "We are working with the Federal Government to investigate water possibilities (from Paradise Dam), and we have secured a rail corridor for the freight.

"There is plenty of fertile land in the region, and there is already interest from land owners.

"But we are not rushing. We know that the Gayndah region has grown other crops in the past, and we need to be mindful of why people stopped growing those crops."

SRA is conducting four variety trials, including a Final Assessment Trial (FAT) near Gayndah and these are expected to run for two more years.

A FAT features about 175 different varieties – or potential new varieties – that have progressed through years of development through the SRA breeding program. FATs assess new varieties in the field and provide valuable data to help local Regional Variety Committees

(RVCs) make an informed decision on whether a new variety is suitable for release.

The plots at Gayndah, and one site in particular, were hit with some significant frost events in 2017, which has provided plant breeder Roy Parfitt and his team with valuable data to assess.

Mr Parfitt said there were two planting times for the trials – September/October, and another in March/April, as planting time was also a key question.

“Obviously one of our first priorities is assessing how varieties stand up to frost,” Roy explained. “But we also know that every variety will start deteriorating at a different rate. We know that the varieties that deteriorate more slowly have more value, as they could allow for more time to get the cane to the mill after it has been frosted.”

He said that frost would continue to be just one factor in variety selection. “We still need to assess the full range of characteristics such as tonnes, CCS, and other characteristics such as disease resistance.”

Isis Chief Field Officer, Paul Nicol, said that the Isis Board visited the sites in August, and they were surprised by how well the cane had grown.

“We’ve had a tough season with drought, then Cyclone Debbie, and then drought again, but some of this cane is comparable to cane closer to the coast at Isis,” he said. “We like the look of some of the response to frost, and we are hopeful that if we find a suitable variety with some frost tolerance then it would also be useful in other areas.

“We experience similar frosts at our growing areas near Wallaville and Gin Gin, so this has important lessons for other growers.

“It also has implications for a lot of sugar growing regions of Queensland and NSW.

“It is early days, but we are grateful that SRA had the foresight to bring trials here.”

For more information

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Below: Roy Parfitt and Isis Chief Field Officer, Paul Nicol, assessing information on the Gayndah FAT.

Below insert (left): Paul Nicol says that there were seven to eight frosts at this FAT site in 2017.

Below insert (right): A close-up of frost damage in one of the varieties.



Participation in the Cane to Creek project has given Len Parisi a new understanding of nutrient loss pathways.

Making the connections from *Cane to Creek*

Project details

Project name

Cane to Creek: Russell-Mulgrave Growers and the Nitrogen Story

Funding partner

Department of Environment and Heritage Protection, Queensland

End date

31/05/2019

Outline:

The Cane to Creek project is based in the Russell-Mulgrave catchments in the Wet Tropics. Growers involved are being assisted to achieve nutrient management best practice, with a focus on profitability and productivity while improving environmental stewardship.

The Cane to Creek project has three main goals:

1. Assist growers to use a balanced crop nutrition plan in accordance with SIX EASY STEPS and Smartcane BMP
2. Assist growers to identify and alleviate potential yield constraints
3. Demonstrate how best practice nutrient management can reduce nitrogen losses to the environment without negative impacts to the grower's bottom line.

SRA is working with Fishery Falls grower Len Parisi, and other growers, to improve nutrient management and increase understanding of water quality science in a new project based in the Russell-Mulgrave catchment in the Wet Tropics.
By Belinda Billing and Gavin Rodman

Len Parisi is a third generation cane farmer near Fishery Falls in the Mulgrave River catchment of the Wet Tropics. The Parisi family has been farming here since 1940, with the fourth generation now working on the family farms.

"We have to tackle the water quality issues plus any environmental matters that may impact our business," said Len. "We are trying to achieve a profitable business that can be maintained for future generations while also being sustainable in regards to the environment."

Len was involved in a project with a small group of growers that piloted the concept of Cane to Creek in 2016, farming between the towns of Deeral and Fishery Falls. "I wanted some real data from my own farm so that we could modify our practices if necessary, without economic impact, so we could do our bit to help improve water quality. By being involved in the pilot project and Cane to Creek so far, we have been able to make more informed decisions as to what we do operationally.

"Currently, I think water quality is our biggest issue. We are working hard to make things better, both as individuals and as an industry.

"Prior to being involved with this project, I felt comfortable with the concept of soil testing, but had some difficulty with putting the recommendations into practice. Being able to consult with SRA has assisted greatly.

"Now, having gone through the Whole of Farm Nutrient Management Planning process with SRA in this project, I understand it 100 percent better than before.

"I've been able to use the process to do plans for other farms. ***I now also understand nutrient loss pathways a lot better and have been able to apply that knowledge when questioning claims about the benefits of different fertiliser products.***

"Since joining the pilot project and now Cane to Creek, I have adjusted my rates to conform with SIX EASY STEPS guidelines and in some instances, I now apply slightly below. I am also now more strategic in the blocks where I am applying mill by-products and reducing my nutrient applications for the following crops.

"Of course; by applying less fertiliser than previously, I am saving money. In fact, this year, the average CCS for the farm is higher than it ever has been before. We will continue to monitor this trend to get a better idea of whether this is related to the practice change or seasonal influence.

"We are currently trialling where and how we place our fertilisers, and as a result we are planning to move to sub-surface applications soon across all of our farms.

"Aside from being involved in the Cane to Creek project, we are working closely with the Mulgrave Landcare group to install two wetlands and revegetating an area which will cover approximately seven hectares.

"This was previously cane land that we were not really growing good crops on. We were almost buying those crops and decided we were better off converting it to forest and wetlands to assist with drainage. Hopefully we can clean up some of the waters that leave our farm too.

"I think that projects like this revegetation and wetlands one tell a really positive story that growers are trying to do the right thing."

"If you are serious about staying in the industry, you should really consider how you can progress your farming practices to improve productivity and profitability while minimising any unfavourable impacts on the environment.

"I encourage any growers in the Russell-Mulgrave catchment who are interested in improving their nutrient management or even interested in some of the water quality stuff to get involved with the Cane to Creek project."

If you are a grower within the Russell-Mulgrave catchment area and are interested in being involved with this project, including information sessions, training or demonstrations – please contact Gavin Rodman on (07) 4056 4508.

This project has been funded by the Queensland Government Reef Water Quality Program.

In the Cane:

- SIX EASY STEPS rate demonstrations with end of paddock water sampling
- Fertiliser placement (surface banded vs sub-surface) demonstrations with end of paddock water sampling
- Rate deductions after mill by-product applications
- Rate deductions after legume fallow.

Selected sites have simple end of paddock water quality monitoring to compare current practice with recommended practices. Effort is being made to cover all of the above recommendations.

All sites will have yield, CCS and economic data collected.

In the Creek:

The Cane to Creek project works with growers to understand what is happening in their local creeks.

The Figtree Creek catchment, which also includes McDonnell Creek, will be monitored for nitrates before entering the Mulgrave River.

Changes in the system will be recorded through a Real Time Water Quality Monitoring Trailer continuously monitoring for nitrate at the bottom of Figtree Creek and grab samples taken at other strategic sites to measure water quality from the top to the bottom of the system.

The data from the both the creek and paddock scale monitoring will be shared with the project grower group.



Most of the permanent staff members at the SRA Ingham station.

SRA Ingham station delivering outcomes for growers and millers

The SRA Ingham Research Station is playing a key role in delivering productivity, profitability and sustainability outcomes for both the local region, and across the industry.

There is a buzz in the air at SRA's Ingham research station.

Farmers in the Herbert region will be familiar with the local SRA research station located near town on Fairford Road. For other farmers, though, while the site might not be familiar to you, it is an important piece of the overall investment from SRA in providing research outcomes for the Australian sugarcane industry.

Over the last two years, SRA has made a number of improvements and changes to the research station that are enhancing productivity, profitability, and sustainability outcomes for sugarcane growers and millers.

The first of these enhancements began two years ago after SRA commissioned a review of plant breeding activities in the Herbert. The review came in response to low productivity in the region as the local industry faced a long transition away from smut-susceptible varieties.

During that transition around 2006, average yields were 75 tonnes of cane per hectare – well below the costs of production and unsustainable for the local industry.

Seasonal conditions have improved since then, lifting yields as well, with a number of other enhancements to productivity also making a contribution.

The Herbert Breeding Review made several recommendations for change and improvement at the station, including additional staff within the breeding program and farming equipment.

Farm Manager, Vince Blanco, has been in this role for most of 2017 and he said that the farm continued to be improved upon, with work such as laser levelling and the investment in infrastructure such as sheds, farm machinery and specialist analytical equipment.

This includes the purchase of a near-infrared machine that allows for efficient and rapid analysis of samples and adds value to the breeding program.

This equipment is providing vital research support for local variety development and, over coming years, will continue to add value to variety development and other research activities.

Looking forward, there are further activities planned. The station is in the process of gaining Smartcane BMP accreditation and further farm renovation work will occur, building on work that has already occurred with the assistance of local farmer and contractor, Vince Russo.

As part of recent enhancements that have also been announced for the SRA breeding program, SRA is placing a greater emphasis on the use of introgression to introduce genetics from wild relatives of sugarcane to increase the productivity of new varieties.

As part of that, field evaluation will be centred around the Herbert, with the objective to supply varieties to benefit all regions as well as contributing increased genetic diversity.

On a broader scale, there has also been an expansion of other research activities that occur at Ingham.

New staff are working on projects including yellow canopy syndrome, soil health, and enhanced efficiency fertilisers. These include Technician Andrew Memory, Technician Linda DiMaggio, Technician Robert Verrall, and long-term Technician Glen Park.

The local plant breeding team consists of Variety Officer Melanie Adams, Plant Breeder Fengduo Hu and Technician Laura McIntosh.

They are all supported by the farm services team including Manager Vince Blanco, and Technician Sam Adams, with Casey Venables providing administrative support to the station and harvest losses work.

Vince also uses a pool of casual staff which are crucial to allow the large number of trial plots to be efficiently harvested and planted through the season.

There is a significant amount of planning and logistics that is required to plant and harvest research trial plots on the station. For plant breeding trials, for example, logistics include cutting plant material from propagation blocks, selections of cultivars to advance in the breeding program, labelling, field assessments and collection of stalks for CCS assessment.

Joe Bonassi joined SRA in 2016 as a mechanical engineer working on harvest losses, and he is working alongside Adoption Officer, Phil Patane, who is also based at Ingham, and technician, Jason Gunders.

The harvesting division have had a busy few months conducting trials as part of the major harvest losses Rural R&D for Profit project, as well as presenting the results to participating harvest groups. As well, they have also resurrected a research tool known as the 'chopper test rig', which had not been used for research activity for over a decade.

The machine is a stationary version of the feedtrain and chopper system of a harvester. Along with multiple sensors and a slow motion camera, it allows for another useful and visual means of understanding sucrose losses through mechanical harvesting.

Joe Bonassi and technician Jason Gunders said that the internal parts of the rig nearly had to be rebuilt from scratch, but it was now ready for operation.

"The losses from mechanical harvesting are increasingly understood and are gradually being minimised across the industry," Joe said. "But we know that the harvester remains very good at hiding the evidence. The chopper test rig is a valuable tool for providing another – and very clear – demonstrations of how the harvest may continue to be optimised."

During a recent SRA Board visit, local grower and Herbert CANEGROWERS Chairman Michael Pisano said the local industry appreciated the renewed energy and enthusiasm at SRA Ingham. He said it was clear that the SRA staff were keen to deliver for the local industry and were working well as a team.

There are also several other exciting R&D projects centred around the Herbert region. These include:

- The *Too Wet to Forget* project has field trials at Errol Cantamessa's farm. This project is looking to assess how different varieties may respond differently to water logging.
- EEF60 trials are occurring on eight farms in the region.
- Dr Jo Stringer with SRA recently completed a collaborative project that analysed mill data to deliver productivity enhancement programs, working with collaborators including Wilmar and Herbert Cane Productivity Services Limited (HCPSL).
- AgProfit and Coscer's accounting have completed a project on farm business management.
- Harvest loss trials have occurred across the region, as well as the collaborative Harvest Optimisation Week work.

Ingham farm manager, Vince Blanco.





Water quality work that works for us

The Protecting our Chemicals project is working collaboratively with growers and using practical demonstrations to create a positive impact in the Wet Tropics.

When Frank Vecchio attended a Tully Cane Productivity Services Shed meeting about SRA's Protecting Our Chemicals for the Future project, he was so happy to hear about it that he approached Project Leader Belinda Billing to offer his farm for demonstration work straight away.

"I'm just glad that our own research organisation is getting involved with water quality and sustainability. I can trust the information and if I have any questions I can speak to SRA directly," explained Frank.

The project Frank joined is helping growers to become more knowledgeable of how the herbicides they use interact with their local environment.

They are engaging in on-farm trials and demonstrations, and testing different herbicide strategies to those they might normally use. A key part of the project is directly involving growers in the science of the behaviour of pesticides in different situations.

For example, growers have the opportunity to participate in rainfall simulations and end-of-paddock monitoring to measure and compare the losses of pesticides from paddocks.

Participants also learn about the properties of pesticides that cause them to have environmental impacts.

For example, different herbicides exhibit differences in solubility, how tightly they bind to soil and organic particles, UV stability, biodegradation, and toxicity to aquatic ecosystems.

Additionally, different herbicides may have vastly different application rates, from 75 grams active/ha to more than 3 kg active/ha. Growers get to learn how all these characteristics combine to give each herbicide a "relative risk".

Frank was one of three growers in the Wet Tropics who hosted rainfall simulation demonstrations.

Objective

To help growers have information and support so they can make informed decisions, and to have confidence that alternative pesticide strategies can still give effective weed control and contribute to improved water quality.

He commented that he likes this work because he can see how it is done, how it works and, then, the results tell him which herbicides are more mobile than others. "I want to know if herbicides are leaving my paddock, and it helps me to understand how that research was done. It means that I can trust the information," he said.

Fellow Tully grower Gerry Borgna says it's not just knowing which chemicals are more mobile and toxic, he wants to know the good news.

"When I look at this data, I can see that some chemicals are barely being picked up in the monitoring. There is also information coming out that shows us that some chemicals are far more dangerous to the environment than others – I want to hear about this and understand the positive choices I can make. This work allows us to talk about good news and not just focus on the negative," Gerry said.

The project draws on research conducted by SRA weeds agronomist Emilie Fillols as well a range of research conducted through the Queensland Government's Paddock to Reef program.

Discussions with growers involved has revealed that they often feel that water quality research and monitoring is done in isolation from them, despite the fact that they are being asked to change.

With this in mind, the Protecting Our Chemicals team works to bring the latest relevant research to the grower groups and to connect them with researchers, such as the DSITI End-Of-Catchment Loads Monitoring team.

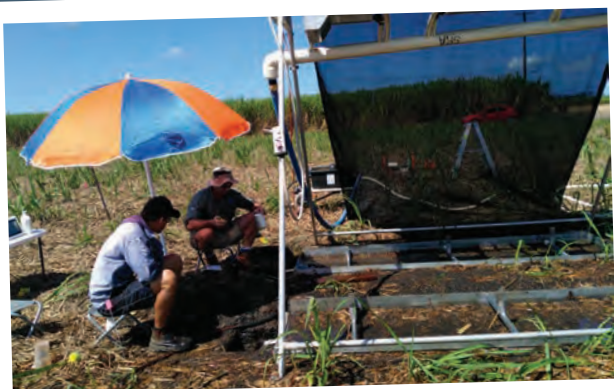
A great benefit of the project identified by all participants is having the water quality scientists and also Government policy makers on the farm. This allows for great two-way exchange of information, ideas and opinions.

Ryan Turner from the Department of Science, Information Technology and Innovation's Great Barrier Reef Catchment Loads Monitoring Program said that he and his team members are passionate about sharing their work with every stakeholder that is involved in improving water quality at the regional, local and state wide scales.

He said this is not only to provide access to the information, but to gain context and local knowledge that makes the information more useful for everyone.

"We have these great datasets that can inform changes to make the improvements needed together, but we only have part of the story," Ryan said. Coming to the regions provides us with the opportunity for open discussion with everyone involved. For us, spending time in the regions talking with growers, extension providers, industry representatives and everyone else gives us fantastic context and local knowledge on the waterways that we are monitoring. I learn from everyone I meet with and it gives greater value to the dataset meaning we can get better, more useful information for everyone."

Opposite: Tully grower Frank Vecchio has been a keen participant in the Protecting our Chemicals project.



Above: One of the rainfall simulations in action.



Above: A shed meeting at Tully discussing the project.

What have growers been interested in?

Grower groups are working with the project team to compare different application techniques and chemicals. Demonstrations with low cost end-of-paddock water quality monitoring equipment are in place in Tully, Innisfail and Gordonvale. Some sites are comparing newer, non PSII chemicals, one is looking at a zonal application of residual herbicide in problem areas of the block with only knockdowns used elsewhere, while others are looking at the potential for only using knockdown herbicides in ratoons with lower weed pressure.

Growers were motivated to look at the newer, lower risk residuals after seeing that the potential for loss is lower than traditional herbicides used. While some in the groups were already using these, others had been unsure and wanted to see how they work. Growers were particularly interested in learning about a newly registered product flumioxazin (Valor® 500 WG) and demonstrations have been established in Tully, Innisfail and Mulgrave districts.

Reports will be written for all demonstrations and shared with grower groups and within each district. For more information contact Belinda Billing bbilling@sugarresearch.com.au or (07) 4056 4512.

Irrigation investment delivering on-farm benefits



The use of underground drip and solid set irrigation is delivering positive outcomes for Paul Villis in the Burdekin, including water use efficiency and a range of benefits as a result of green cane harvesting.
By Brad Pfeffer

It is something you would more likely expect to see on a small crops farm in the Lockyer Valley.

But Jurgens Cane Farming are experimenting with solid state sprinklers on a four hectare block in the Burdekin, and already have about 160ha at Proserpine, with some good results under their belt.

At Kalamia, the 400 hectares is managed by Paul Villis and he said that the solid state system had several similarities to their 17 hectares of trickle, which they were already familiar with over its use over the last decade.

While he said the drip was an excellent system, he added that in their situation they had faced some challenges with shallow soils and deep drainage.

With the sprinklers they are able to apply smaller amounts more often, which is working well with their shallow soils.

As is the case with the drip, they are also more easily able to automate the system compared to furrow, and can also irrigate at night to take advantage of electricity tariffs and maximise water use efficiency.

Every 10th row is removed to accommodate the sprinklers and they are set at a height to ensure the whole area is watered when the cane is fully grown.

Paul said that the recent cane grown from the block grew 130 tonnes of cane per hectare, which they considered a good result and was comparable to crops grown with underground drip, but somewhat less than furrow irrigated crops.

He estimated that costs of set-up for solid state to be less than high-quality tape.

A big advantage with both systems is that they have been able to harvest green, something that remains impractical on the surface irrigated fields.

"I've tried to trash blanket with furrow irrigation, but we use a lot of groundwater here with iron it, which chokes the trash and you end up using twice as much water as you should just trying to get it to the end," he said.

The trash blanket is creating other positive outcomes at the farm. In ratoon crops, it helps reduce evaporation when they are irrigating.



And the thick blanket from the big crops means that weed control is not a burden and they may only need one vine spray.

SRA Adoption Officer for Irrigation, Andres Jaramillo, said there were a range of factors to carefully consider when assessing different irrigation systems.

He said SRA encouraged innovation in irrigation, and added that important factors to consider were that sprinklers would have significantly higher evaporation compared to drip in burnt cane and plant cane, until the canopy closes.

"The loss of area under production can be significant, as both drip and furrow have about 11 percent more land under cane," Andres said.

"Wind losses are also a consideration, as well as the usual range of important factors such as water and energy

use, specific farm considerations, and management issues."

Long term, Jurgens Cane Farming is hoping to see some benefits to soil health. In that vein, they have built their own sub-surface dunder applicator, they use GPS guidance, they have trialled the use of compost and also changed to banded application of mill mud.

"We were told that banded mill mud wouldn't work and it would just sit there, but we are amazed by the response we are getting from it," he said.

Block specific nutrient plans are used with the rates determined through SIX EASY STEPS, their agronomist, and yield data.

They grow legumes such as mung beans at the end of each crop cycle, either ploughing out early to grow two crops of beans, or at the end of the crush to



grow one. "We try and do half our fallow early and half late so that it splits the workload at the end of the year."

Their main varieties are KQ228[®], Q208[®] and Q183[®], as well as an expanding area of Q240[®] and some SRA8.

360ha is owned by Jurgens Cane Farming, with the remaining 40ha owned by Paul.

Above (left): Cane grown on drip irrigation being green cane, trash blanket harvested this season.

Above (right): Paul Villis says Jurgens Cane Farming is getting some interesting results with the use of solid set irrigation in the Burdekin.

Below: The solid state irrigation irrigating this year's mungbeans, on the footsteps of the Kalamia mill.

Opposite: Paul Villis.





Expansion and improvement to target long-term vision

The Greensill family at Bundaberg is taking a long-term view of expansion and investment to ensure their agribusiness is set-up for long term profitability and sustainability. By Brad Pfeffer

The Greensill family is certainly not new to agriculture. They have been farming cane and other crops across Bundaberg and the wider region for three generations.

But what has changed has been a significant expansion of their operation and major investments in farming infrastructure across several properties in the Bundaberg region, to the point where they now farm close to 2000 hectares, which includes about 400ha that they farm for Bundaberg sugar.

The operation is bringing together sugarcane with watermelons and sweet potatoes, in an agribusiness that is seeking to extract maximum efficiency, sustainability and return on investment from their resources.

"The melons and sweet potato complement the cane from a risk point of view and also for ensuring a rotation

that reduces soil pathogens and insect pressure, while really delivering a decent rotation for all crops," Peter Greensill said. "Growing cane in the rotation allows us to bring scale and efficiency to the horticultural operation, where we are able to focus on aggregated fields with appropriate earthworks for drainage.

"We find that as we make a more efficient sugar business, we are also building a significantly more efficient horticultural business."

The cane is grown on 1.78m, the sweet potatoes on 1.5m and the watermelons on 3m. The rotation varies in length but Peter said ideally they were aiming to grow both the horticultural crops within 12 months so they don't miss cropping time with their cane.

Peter owns the business with his brothers Andrew and Lex. Peter is CEO of Greensill Farming Group, while

Andrew is part of the earthmoving and land development team in the family agribusiness. Lex is based in the UK and CEO and founder of international supply chain and finance provider, Greensill Capital.

They have been expanding notably since 2010, but 2017 has been a particularly busy year for the Greensill family. For example, as part of an expansion on a previously undeveloped farm at Wallaville, they have moved more than a million cubic metres of soil in preparing paddocks and modifying how water moves across the farm, as well as building dams and reticulation.

They have meticulously planned each development using aerial mapping technology to ensure maximum efficiency of layout and that the irrigation and drainage infrastructure is exactly how they want it.

"Part of our rationale for this development is that we weren't buying an existing farm and having to tear out infrastructure to develop it in the way we want," Peter said. "We can factor that into the purchase price and invest that capital at the start by doing it right and doing it once, which will set us up for long-term efficient farming."

Peter said they had approached each development this way, and also applied this philosophy to some of their existing farms.

For example, one farm that they purchased was only able to irrigate 2.8mm per day, which was far short of their summer requirements of 6-8mm per day.

"That 2.8mm was also costing us \$180/ML as we were lifting water directly from the river. So we had pumps and motors sized for other applications and pipes that hadn't been sized correctly. "That led us to the hard decision to rip that infrastructure out and resize it, where we can now apply 16mm per day.

"That allows us to look at the weather forecast and turn water off early if there is rain on the way, but also know that we can catch up if it doesn't rain. We can also use some off-peak power as opposed to 24 hour irrigating. Through that process we have reduced the power cost from \$180/ML, in that extreme situation, to \$42/ML as a blended average across the farm."

He said these investments were "multi-generational", which although have a big up-front cost, they pay off over the long term.

They use high-pressure irrigation for germination, if required, but use mostly furrow irrigation once the cane is established. As part of an approach of ensuring they are efficient and sustainable with their inputs, water is reticulated to capture any sediment and nutrient run-off. In that vein, soil tests are done every year and nutrients are applied accordingly. They use mill mud to augment existing fertiliser application, and have been particularly pleased with its results on country they have developed.

The Greensills have also been one of the first to invest in a CaneTec harvester, a locally designed machine with a gross weight of about 12 tonnes. Peter said he was happy with the uniformity of billets produced by the machine, that it helped to reduce compaction, and its reliability.

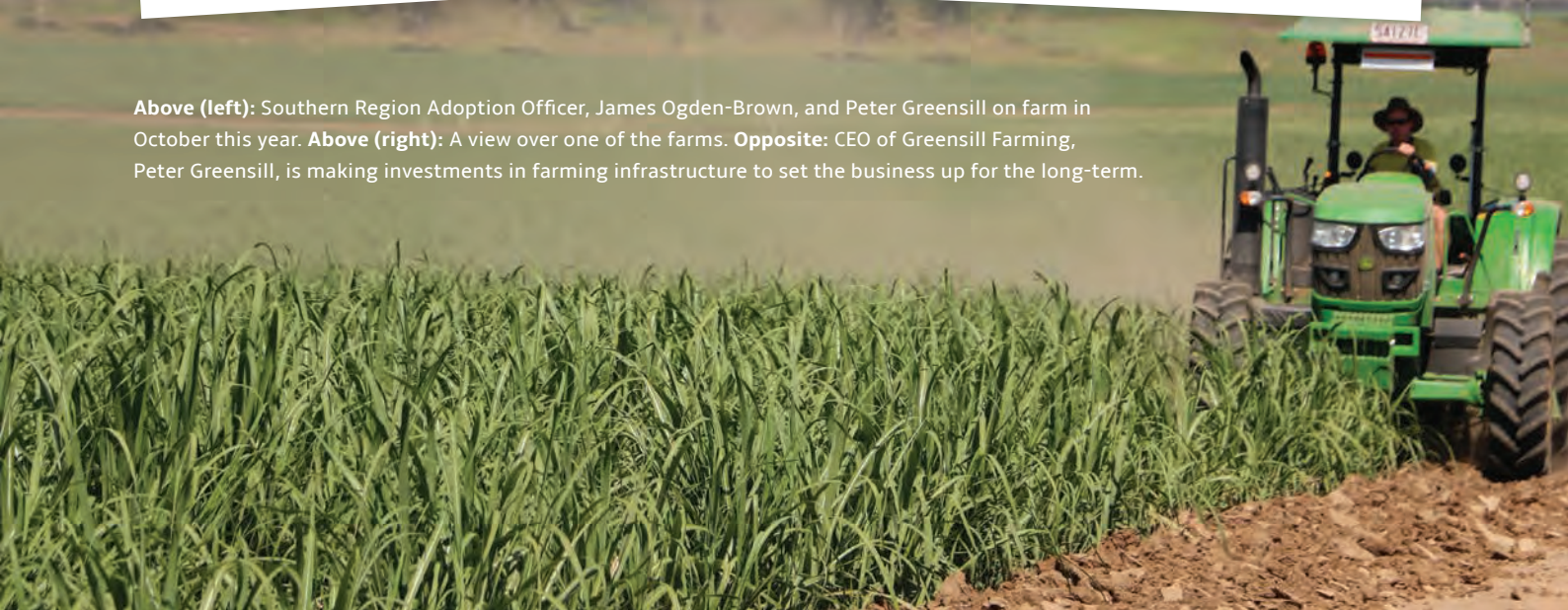
"We are keen to support local innovation and are excited to see how it goes in coming years," he said.

The cane alone, which includes their own planting and harvesting, is a massive undertaking. With the horticultural crops and earthmoving thrown in, the business now has a team of over 150 including seasonal workers. Peter said the key to keeping things running smoothly was to keep actively involved, lead by example, and having a great team.

"We are aware that big businesses can have inefficiencies as well as efficiencies, particularly such as being cumbersome or slow to react. So we've worked very hard to ensure our growth has embraced the efficiencies of large-scale agribusiness and sugar production."



Above (left): Southern Region Adoption Officer, James Ogden-Brown, and Peter Greensill on farm in October this year. **Above (right):** A view over one of the farms. **Opposite:** CEO of Greensill Farming, Peter Greensill, is making investments in farming infrastructure to set the business up for the long-term.





Improving the nitrogen use efficiency of varieties

A range of research activities are underway looking at nutrient inputs and efficiency, and this is being complemented by further research into varietal differences with nitrogen use.

Research is underway to better understand whether nitrogen use efficiency (NUE) can be used as a trait in the breeding program.

Growers already have observations from the field about different varieties being more efficient users of nitrogen, and this new research project is looking to capitalise on those observations with data and create useful outcomes for sugarcane growers and millers.

The project is called *Licence to farm: nitrogen use efficient varieties to meet the future environmental targets*, and is led by SRA Leader for Trait Development, Dr Prakash Lakshmanan.

The project has three main components. The first is testing a range of clones in glasshouses at the University of Queensland (UQ) for their NUE to see if there is genetic variability. This work is currently underway, with early indications that there is significant variability.

The second component of the project is to take those observations from the glasshouse and test them in the field.

"These two components of the project will allow us to identify potential elite clones and then take them further as breeding material to create better varieties, or deploy those clones as varieties to more nitrogen sensitive areas of the industry," Prakash said.

The third component of the project, which has not yet started, is to develop a system for screening potential varieties for their NUE by using unmanned aerial vehicles (UAVs).

These UAVs, also known as drones, use sophisticated cameras and processing software to assess potential varieties in an efficient and reliable way. This process is in development as part of other research activities at SRA.

All this could eventually lead to improved NUE information on new varieties, such as from the online variety decision tool, QCANSelect®.

Prakash said that NUE continued to be a critical topic for the Australian sugarcane industry, so this project had significant potential to add to the profitability, productivity and sustainability of the industry.

More information on this research will continue to be communicated to the industry through SRA publications and events.

Project details

Key Focus Area

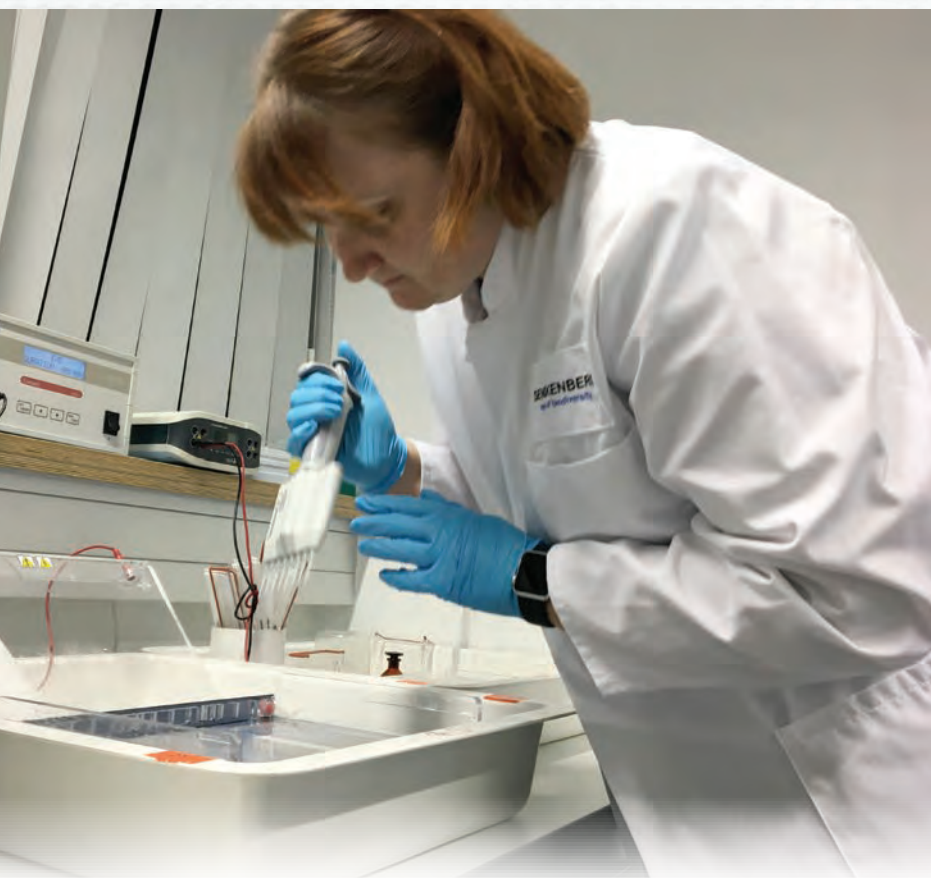
Optimally adapted varieties, plant breeding and release

Project name

Nitrogen use efficient varieties to meet the future environmental targets

Chief investigator

Dr Prakash Lakshmanan



Broadening knowledge on downy mildew for Australian sugar industry

Left: Dr Nicole Thompson in the lab in Frankfurt, Germany.

SRA Researcher Dr Nicole Thompson has learnt valuable information for the Australian sugarcane industry on downy mildew as part of a scientific visit to Frankfurt, Germany, recently.

Downy mildew of sugarcane is a biosecurity pathogen of high risk to the Australian sugarcane industry. SRA research has shown that downy mildew in Papua New Guinea is likely to be caused by more than one species of *Peronosclerospora*, and that at least two species are likely to be new to science.

Professor Marco Thines of the Senckenberg Biodiversity and Climate Research Centre, in Frankfurt, Germany has published a DNA-based diagnostic and taxonomic tool for downy mildews, however this does not seem to be effective for characterisation of sugarcane-infecting downy mildews.

I recently undertook a Sugar Travel and Learning Award (STLA) to visit Prof Thines' laboratory to learn more about their methodology, to discuss the recent findings in PNG, examine the sugarcane downy mildew diagnostic test I have developed, and to produce a way forward for the taxonomic study of downy mildews.

The visit coincided with one by Dr Yu Pei Tan, of the Queensland Plant Pathology Herbarium (QDAF), who has been classifying downy mildews from the herbarium collection.

I took with me some samples from Papua New Guinea for analysis. Dr Sebastian Ploch taught me the Thines laboratory method of downy mildew extraction and PCR, and the samples were also used for DNA sequence analysis by Yu Pei.

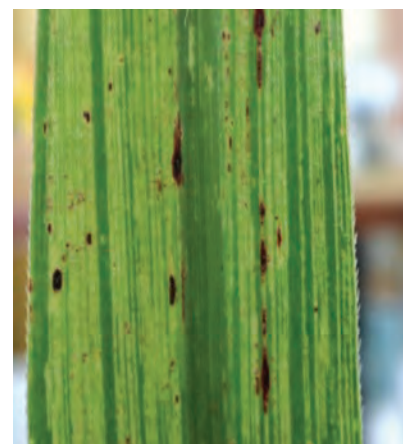
In discussion with Prof Thines we discovered that the methods we use are similar and target adjacent gene regions. This has led to the apparent difference in our results. Professor Thines' method was developed for genus-level discrimination, but the method I developed is better at species and sub-species-level discrimination of the sugarcane-infecting downy mildews.

We concluded that a more robust approach would be to sequence the whole of the Cox2/1 genomic region for complete taxonomic breakdown: the downy mildews of grasses could be a species complex, which would imply that the host range of these pathogens is broader than we thought.

The diagnostic test I developed is robust for the sugarcane downy mildew diagnostics, and is currently being prepared for publication.

The whole Cox2/1 genomic region is going to be used to study the taxonomy of downy mildews of sugarcane and related grasses into the future.

Thanks to Professor Marco Thines and Dr Sebastian Ploch of the Senckenberg Biodiversity and Climate Research Centre for their assistance, to Dr Yu Pei Tan of Queensland Plant Pathology Herbarium for sequence analysis and specimens. *Nicole's trip was funded by an SRA Travel and Learning Award.*



Above: Sugarcane downy mildew, leaf striping with down on R570.



Sampling for RSD testing using the ELISA method.

Working to improve RSD testing

A new sampling and testing process for RSD has been developed, with a research project underway to assess the potential for commercial and widespread use of this new technology for the Australian sugarcane industry.

Research is underway to advance new technology that could vastly improve the process and efficiency of sampling for ratoon stunting disease (RSD).

Currently, RSD samples are collected and diagnosed according to the ELISA method, which involves a labour-intensive process of collecting 16 to 20 stalk samples, and blowing compressed air through the stalk. In this test, antibodies specific to RSD are combined with other reagents to give a colour reaction when bacteria are present.

Each year, SRA tests about 30,000 samples this way. However, in recent years researchers have developed a new test that is currently used for research purposes. If it can be perfected for commercial use, it would allow for more efficient sampling and more accurate diagnosis of RSD in cane.

This project is building on the work of Dr Anthony Young (USQ) and Dr Kathy

Nock (SCU), who developed this new method of sampling for and diagnosing RSD.

This test, called LSB qPCR, involves the collection of leaf sheath samples and subsequent analysis using modern molecular techniques.

The new project involves SRA researchers Dr Rob Magarey and Dr Chuong Ngo as well as Dr Young and Dr Kathy Braithwaite. The project is also supported by a reference panel consisting of Dr Brendan Rodoni from the Victorian Department of Primary Industries and Mr John Agnew from MAPS, who bring diagnostic and end user perspectives to the project's design and implementation.

The project will assess the new test from a range of angles to ensure that it can provide a sensitive and reliable service for the Australian sugarcane industry and that it is practical to implement.

It is studying three varieties with different RSD ratings: Q208[®] (resistant rating), Q232[®] (intermediate rating) and Q242[®] (susceptible rating).

These will be used to assess different sampling times, as the LSB qPCR is able to be used much earlier in the growing season than the traditional ELISA test. The effects of variety on detection sensitivity will also be determined.

"We will be assessing the efficacy of the new test, as well as looking at its limitations. Then, further into the project, we will be looking at issues such as transport of samples and ensuring that contamination of samples does not occur," said SRA Researcher for Disease Management, Dr Chuong Ngo.

Dr Ngo said that diagnosis and management was critical for minimising RSD losses for the industry, so this project had significant potential for long-term benefit for the industry.



Field agronomist with Maryborough Cane Productivity Services, Barry Callow.

RSD vigilance a piece in the productivity jigsaw puzzle

The Australian sugarcane industry continues to work hard to minimise the impact of RSD, but it is an ongoing battle that must continue to be fought.

Sugarcane growers and millers are being reminded about the need for vigilance in monitoring and managing ratoon stunting disease (RSD).

With one of the major outcomes of RSD being yield loss, but with few other visible signs, field agronomist with Maryborough Cane Productivity Services at Maryborough, Barry Callow, said that the best way to reduce losses from RSD was to continue with the testing and most importantly the hygiene management practices widely adopted by industry.

RSD was first discovered in Mackay in 1944. Caused by a bacterium that lives in the vascular system of the cane plant, the disease restricts the plant's ability to carry nutrients and water and grow.

Due to improved diagnostics and management practices, this disease affects fewer than 5 percent of crops.

But when RSD does occur, it can cause losses as high as 60 percent. Losses are greatest when the cane is moisture stressed and even with good irrigation, losses can range from 10 to 30 percent (www.sugarresearch.com.au IS130007).

"It's an insidious disease that's very hard to spot, which is why testing and diagnosis is so important," Barry said. "It takes a lot of resources for the industry to find it, but it is crucial that the industry continues the effort to minimise it."

The impact of RSD can be minimised through good on farm hygiene and careful testing of planting material destined for use as a plant source.

He said that growers should work with their productivity services organisation to have plant sources tested to ensure that RSD was not able to be spread through a district via planting material.

Secondly, he said farm hygiene was crucial, particularly working with contractors to ensure machinery was disinfected when moving between farms and paddocks (especially planters and harvesters). Some varieties are more tolerant to RSD than others (for example, Q208[®]) and growers can plant these varieties to reduce pressure, however they **must** ensure they use a clean seed source. This is why purchasing tissue cultured plants is so important in the fight to minimise the spread of RSD. Information on the resistance ratings of different varieties is available from local productivity services, and the online variety selection tool, QCANSelect[®].

He said if growers believe they have paddocks that have RSD, they should contact their local productivity services for guidance. "RSD is of course one piece of the puzzle when it comes to productivity," Mr Callow said. "The list goes on when it comes to pests – nematodes, soldier fly, grubs – but it is a disease that we can manage and be vigilant about."



What lies beneath?

It sounds like the catchphrase of a B-Grade horror film, but in terms of sugarcane soil health, it is of the greatest importance. By Dr Anthony Young, Senior Research Fellow, USQ

For many years the sugar industry has been developing a good understanding of soil nutrition. This knowledge is well-known as the SIX EASY STEPS and has been widely adopted in Best Management Practice programs.

However, what many growers may not understand is that soil nutrition is underpinned by biological processes. As an industry we are only just becoming aware of them.

Dr Graham Stirling has spent over forty years investigating soils, particularly in relation to the Sugar Yield Decline Joint Venture. "Soils represent the most biologically complex ecosystems on Earth. A lot of focus has been on the damaging organisms such as plant parasitic nematodes and fungi, but harnessing the beneficial organisms will be a key driver of sustainability over the next hundred years."

Soil Health Masterclasses will be held in February/March 2018 in the Far North, Burdekin and Southern regions. Visit www.sugarresearch.com.au for more information.

While Graham claims only to know 5 percent of what he needs to know about soils, some of what he does know has been translated into the SRA-funded Soil Health Masterclasses.

With a team comprising Andrea Evers (SRA), Sebastien Garcia-Cuenca (SRA), Dr Jay Anderson (University of Queensland) and Dr Anthony Young (University of Southern Queensland), Graham presents material essential to the understanding of soil health.

"Soil carbon is the essential driver of biological diversity within the soil ecosystem," says Graham.

"It is the foundation for the nutrition of the bacteria and fungi that mineralise nutrients for plant use. Although we have depleted significant amounts of the available carbon, by adopting elements of the improved farming system we can help raise it to healthier levels."

Key to the success of the Masterclasses are the personal stories of different growers who have enjoyed significant economic and production benefits by attending to the health of their soils.

These include Ashley Peterson (Hervey Bay), Simon Mattsson (Mackay) and Tony Chapman (Bundaberg). While everything is good in theory, these growers have made practice changes that have boosted their profitability and soil health.

So far, eight Sugarcane Soil Health Masterclasses have been held in Ballina, Ingham, Gordonvale, Tully and Mackay. There are at least six more sessions planned for early in 2018 in the Burdekin, Southern and Northern regions. The Masterclasses are available for all growers and consultants, and have even been attended by people in other industries.

Graham hopes that by presenting information on sugarcane soil health, he can open the door for the Australian sugar industry to improve its sustainability and profitability. After the Masterclasses, participants will be able to better answer the question: What lies beneath?

Above (left): Dr Graham Stirling explains what makes your soil tick.

Above (right): Participants getting down and dirty at the Soil Health Masterclasses.



Making the good better

SRA's Soil Health Project team. (Back from left): Richard Brackin (UQ), Darren Oliveri (Wilmar), Peter Larson (Wilmar), Paul Marbelli (Herbert grower), Richard Hobbs (HCPST), Willy Lucas (Burdekin grower), Armin Wessel (Burdekin grower), Terry Granshaw (BPS), Davey Olsen (SRA), Rob Milla (BPS), Andrew Dougall (MSF), Mark Poggio (DAF), Alan Lynn (Herbert grower), Felice Driver (SRA), Vince Russo (Herbert grower), Bernard Schroeder (USQ). (Front from left): Seb Garcia-Cuenca (SRA), Andrea Evers (SRA), Lawrence Di Bella (HCPST), Caleb Connolly (DAF) and Cy Kovacich (Burdekin grower). Absent: Michael Carey.

*When it comes to putting in place a new farming system in order to improve soil health and gain the associated benefits, it can seem a long and arduous journey. But for those who have implemented the learnings of the Sugar Yield Decline Joint Venture, it's been a journey worth taking. **By Andrea Evers***

Growers, researchers, adoption officers and extension providers met in Townsville recently for the launch meeting of the SRA-funded Soil Health Project. They shared their views on soil health, what they will bring to the project and what they hope to gain from participating in the project.

It was clear that this project is unique, with each member of the project team playing an equally important role in its direction and outcomes, which is exactly what Davey Olsen, project leader, had in mind.

"The Soil Health Project brings people with different skill sets together to form a cohesive team that will work as peers to develop knowledge, materials and tools that will improve the way in which improved farming systems practices can be implemented on farm. The potential benefits to the industry are huge."

The project is currently working in the Burdekin and Herbert regions with six demonstration growers who will test improved farming system practices, suited to their farm and conditions, alongside their current farming practices.

The central aim of the project is to enable growers and millers to grow more cane and increase profits by working with them to adopt farming practices that lead to improved soil health.

The project will also test and analyse soils collected from long term paired site farms.

These are farms located close to each other where one farmer has implemented an improved farming system for the past 10+ years, while the other has maintained a conventional farming system.

The project team will measure the long term changes on soil health and farm economics arising from these contrasting farming systems.

The data collected will also provide baselines from which soil health monitoring tools and methodologies will be developed, that can be adapted to the rest of the industry.

Speaking at the meeting were two growers who had implemented an improved farming system and reported the benefits that their businesses had gained.

While both experienced some anxiety when first taking the journey, after seeing the advantages, the new farming system has become their 'new normal' and neither have looked back.

These growers will also lend their support to the project by sharing their experiences with the demonstration growers.

For further information about this project

Sebastien Garcia-Cuenca

0421 349 995

Anthony Curro

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Taking the next step forward in biofuel technology

New research is looking at the potential to turn bagasse into biofuel, and then take a step further by transforming it into products such as jet fuel. By Brad Pfeffer

The production of ethanol from sugarcane juice and molasses is well understood.

But it is the potential to create advanced biofuels – such as aviation fuel – from bagasse that could be the next step forward for the Australian cane industry.

This is the focus of a major research project that is looking at adding value to the sugar industry by providing the research foundation to create biorefineries alongside the existing sugar industry.

The project is funded by the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program, along with SRA and the Queensland University of Technology (QUT).

One aspect of the project is looking at the conversion of bagasse into products called microbial oils, which can then be used as a feedstock to create advanced biofuels.

Dr Jan Zhang and his team have studied different ways of converting bagasse into microbial oils and ensuring maximum yield.

"These oils created from bagasse have very similar properties to algae oil and vegetable oil, and can be used to create biodiesel," Dr Zhang said. "However, we know that we can generate greater value by targeting the production of advanced fuels."

Why aviation fuel?

Fuel for aviation, whether it be consumed by major commercial airlines or other users such as defence departments, has much higher quality requirements than traditional fuel.

It needs to be able to withstand the risks of icing and explosion and comply with other safety and regulatory requirements.

This means it is a higher value product than traditional fuel.

In addition, there is a growing appetite for the production of sustainable aviation biofuels. Australian airlines have previously signalled their intent to increasingly use biofuels in their fleets.

Defence forces have also expressed their desire to increase their consumption of biofuel. The US Navy has made a commitment to source 50 percent of its fuel from renewable sources by 2020.

Bagasse

Mill

Cane

What is needed

End-users are looking for biofuels to be drop-in products to replace fossil fuels, so they can avoid any changes or redesign to aircraft and systems.

They also need these fuels continue to meet the high safety standards already in place, while looking for a solution that reduces carbon emissions.

The cane industry

Biofuel – and high value biofuel – can potentially be produced from a wide range of sources and feedstocks. But this research is helping the Australian sugarcane industry into a position to assess the viability of this fuel production, prove the concept, and then be ready to capitalise on future opportunities.



Fermentation



*Hydrothermal
liquefaction*



"Currently we can achieve more than 20 grams (gm) per litre of microbial oils from fermentation of molasses. When we started the project in 2016, the concentration was less than 5 gm per litre, and we are still working on improving the concentration further, and replacing molasses with lower-cost substrate – bagasse," Dr Zhang said.

The second process, using yeast, does not present the same control problems as the fungi, meaning it may produce more biomass. However, the oil content may be lower. One current strain of yeast accumulated up to 45 percent of its biomass as oil, based on preliminary screenings.

The research

The first part of the process is converting molasses and bagasse into microbial oils, with the research teams using micro-organisms for this process. They have worked on two different approaches: one using a type of fungi and another using yeast.

To be successful, a process would need to deliver a high oil content (50 percent to 70 percent), as well as a high biomass. This means ensuring a high yield of oil from the bagasse.

Dr Zhang said that there were challenges with both, as well as opportunities. Using the fungi creates a risk of quality control because it can grow in various morphological forms, as well as posing cultivation problems that mean not enough biomass is created.

However, he said that they had developed a morphological control method and used one strain of the fungi that could accumulate up to 70 percent of its dry biomass as oil, which is very high.

The next step

A process called hydrothermal liquefaction (HTL) is used to convert the oleaginous microbial biomass into bio-oils, from which advanced fuel is produced through catalytic cracking processes. QUT researchers are working on the HTL process and will collaborate with Southern Oil Refining to test and demonstrate the oil-upgrading process for advanced biofuels.

The Biorefineries for Profit project is funded by SRA and QUT and the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program. It is also supported by funding from the Queensland Department of Agriculture and Fisheries.



Australian Government
Department of Agriculture
and Water Resources



Enhanced efficiency fertiliser trials rolling out on a major scale

A major collaborative project is underway assessing the role of enhanced efficiency fertilisers in the sugarcane farming system. By Nick Hill, SRA, Mackay

Enhanced efficiency fertilisers (EEFs) consist of two main types: nitrification inhibitors and coated products.

Nitrification inhibitors maintain nitrogen (N) in the ammonium form which is available to the crop but is less likely to be lost than nitrate. Coated products delay N release based on the properties of the coating and, ideally, the timing of N release from the product is matched with the timing of N uptake by the crop.

EEF products potentially improve nitrogen use efficiency (NUE) which may result in increased yield or the ability to reduce fertiliser rates.

However, further validation and demonstration is required to determine where and when they are likely to work and the benefits that they offer to the sugarcane industry.

The EEF60 project is looking to assess the benefit of EEFs at 60 sites within Queensland's major cane growing districts. Funding for this project is provided by the Commonwealth Department of the Environment and Energy (Reef Trust 4), and the Queensland Department of Environment and Heritage Protection. This project was awarded to Queensland CANEGROWERS with trial activities to be managed by SRA. A range of agencies, including productivity services organisations, are providing extension support.

SRA, in conjunction with local extension providers and collaborators, has identified, and is in the process of establishing paddock scale strip trial sites across Queensland to identify the benefits of EEFs over a three-year period with trial site activities concluding in 2020.

At each trial site, four N treatments are being applied:

1. SIX EASY STEPS N rate using urea;
2. 80 percent of the SIX EASY STEPS N rate using urea;
3. 80 percent of the SIX EASY STEPS N rate using a 1/3 nitrification inhibitor and 2/3 polymer coated urea; and
4. A wildcard treatment, which is any EEF at 80 percent of the SIX EASY STEPS N rate. Thus far these have included: Entec® and Entrench® and Urea and polymer coated blends.

Sites also include small zones with no N fertiliser to determine the amount of N available from the soil.

Activities at each site include: soil coring to one metre to identify current nutrient status and characterise the site; development of trial site and whole of farm nutrient plans; fertiliser application; in-crop monitoring of N uptake; and, assessment of the impact of the treatments on cane yield, CCS and sugar yield through commercial harvesting.

Economic analyses and an assessment of NUE will also be performed.

Industry will be kept informed of trial outcomes at project events and via general extension materials, as well as from CANEGROWERS and SRA.

Burdekin grower, Joe Linton, has one of the 60 trials on his property at Home Hill and is looking forward to learning more about EEF technology and how it could deliver efficiencies for his business.

He already uses the SRA SIX EASY STEPS nutrient management guidelines and added that he had a focus on finding the most efficient way possible to grow the crop.

"EEF products have been identified as one way to do that," Mr Linton said. "I have also looked at a number of alternative fertiliser options, but at this stage this technology sits well within the current thinking of cane growing."

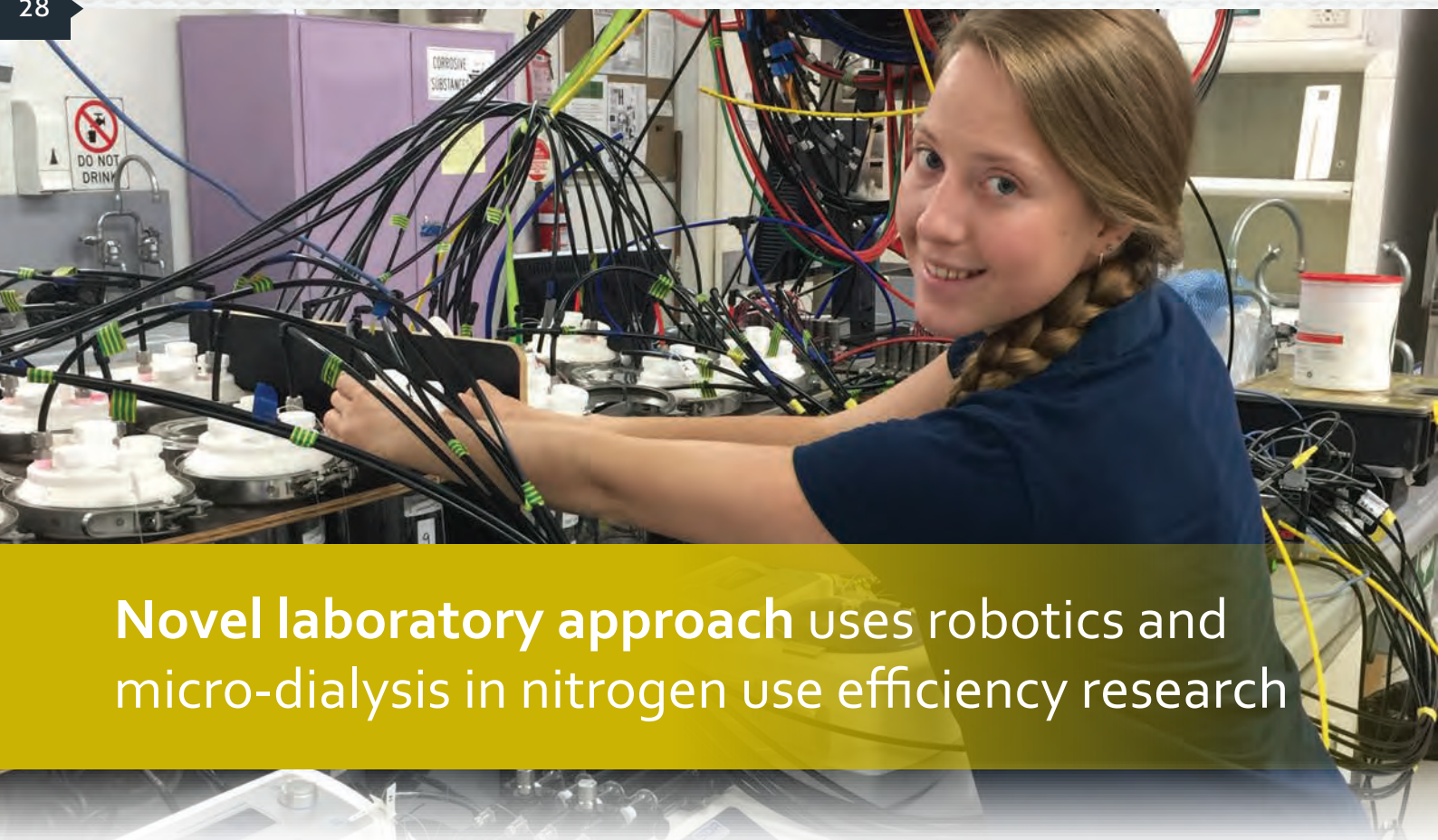
Below (left inset): SRA Research and Adoption Officer, Nick Hill, at the establishment of Joe Linton's trial site in September. It has been a busy few months for the research team as the 60 sites are established across Queensland.

Below (right inset): SRA Technician Prakash Adhikari establishing the trial with Joe Linton, who is keen to learn more about EEFs and how they fit into his farming system.

Opposite: Burdekin Extension Officer on the project Jasmine Connolly, BPS, with Nick Hill, SRA, and Prakash Adhikari, SRA.

This project is funded by the Australian Government Reef Trust and Queensland Government Great Barrier Reef Innovation Fund.





Novel laboratory approach uses robotics and micro-dialysis in nitrogen use efficiency research

The Queensland Government's Department of Agriculture and Fisheries (DAF) project, New technologies and management: transforming nitrogen use efficiency (NUE) in cane production is one of three sugar research projects into NUE being conducted under the umbrella of the four year cross-industry More Profit from Nitrogen Program. By Marguerite White

The QDAF team is taking a novel approach to their research, with laboratory studies that are cutting-edge for the sugar industry. The team has devised a process for testing the characteristics of a range of nitrogen (N) fertiliser formulations under different management and environmental conditions within the laboratory.

The aim is to develop more targeted N formulations to better match N release to cane crop uptake demands, throughout seasons, by controlling N transformations and solubility, and combating N "leakiness" to the environment.

To do so, the team has designed equipment to rapidly test characteristics influencing optimal N application for cane crops of singular or combinations of enhanced efficiency fertilisers (EEFs).

Dr Matt Redding, QDAF's project research leader, explains: "Fortunately, in the area of novel EEFs there is no shortage of prospective technologies. New approaches and new materials with unique characteristics are in abundance in literature and the commercial sphere. On paper, a large number of formulations are theoretically sound in terms of delivering one or more of the desirable characteristics of EEFs."

However, this raises two dilemmas for NUE research:

- (1) Field trials are expensive; and
- (2) The very advantages of field trials, that they incorporate all those in-field variable characteristics, are also their disadvantage when it comes to incremental optimisation of untried technologies. Small changes are hidden behind apparent randomness related to the factors an agronomist cannot control.

"This is why the QDAF team is commencing studies in a more controlled, cost effective, environment," explains Dr Redding.

His team has developed a suite of equipment and methods to automate this process-based fertiliser problem solving. Being continuously improved, the cutting edge ensemble includes computer integration and automated 32 channel manifolds, reaction vessels plumbed with gas lines, probes previously used to measure brain fluid chemistry, a mechatronic plant growth accelerator (with 3D cameras), a rainfall simulator with automated sampling, and a bank of spectrophotometers. The rapid growth pot trials are using mechatronic technologies to carefully control the environment of the experiments, with robotics being used to schedule and apply water whilst taking 3D images to measure growth rates and N soil and plant content.

"We are narrowing our selection of EEFs for later field trials, using plant accelerator studies, laboratory micro-dialysis, and rainfall simulation techniques," explains Dr Redding.

"Given there is such an extensive list of possibilities, we need to efficiently evaluate and optimise, eliminate failures, and finally, economically select the materials that deserve a shot in the field. We can do this in a number of months, rather than years."

Where a field trial produces unexpected results, these testing technologies will also have a role to play. "We can delve into those issues at the process level, to explore further what may enable that technology to work more effectively in the field."

The QDAF team acknowledges that if a technology works in controlled circumstances, it may not work in the field, but this "proof of concept approach" reduces the likelihood of failure in the field.

"If a technology does not deliver the process advantages hoped for on a small scale – testing using large scale expensive experiments won't help," emphasises Dr Redding.

Trial and demonstration sites will be established in the third and fourth years in the Herbert/ Wet Tropics and Burdekin catchments for the QDAF project. In this phase, the team will be able to focus on completing field trials with a limited number of evidence-based EEF formulations for the sugar industry.

Already producing results, to date this approach has identified:

- An inhibitor treatment that can decrease runoff nitrate losses from the rainfall simulator by about half.
- Two inhibitor formulations that can increase plant nitrogen uptake after 12 weeks under highly leached but otherwise controlled conditions. This is a good early success as decreased initial fertiliser vulnerability to loss followed by mid-season availability is one of the key research targets.
- A novel inhibitor formulation that increases plant nitrogen uptake for the period from germination to 20 weeks in a model plant.
- Six novel inhibitor formulations capable of significantly decreasing nitrogen leaching losses.

More on the More Profit from Nitrogen Project can be found at <http://www.crdc.com.au/more-profit-nitrogen>

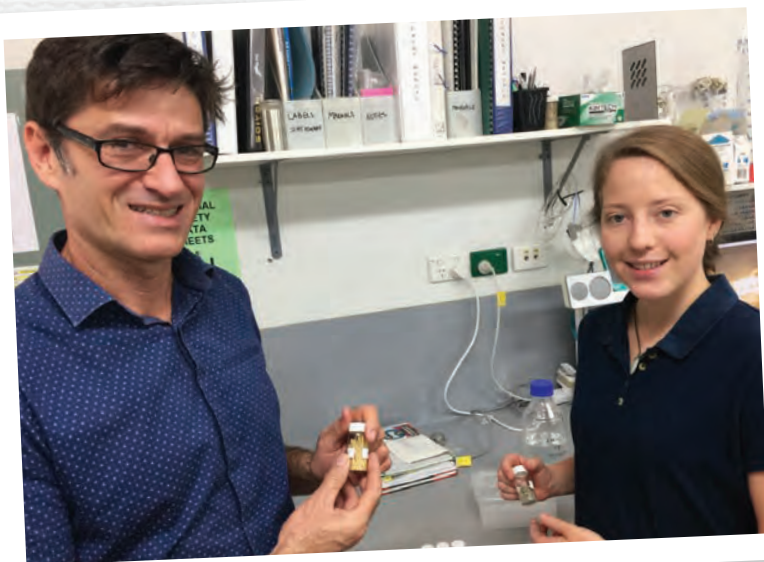


Australian Government
Department of Agriculture
and Water Resources

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program, Queensland Government (Department of Agriculture and Fisheries) and Sugar Research Australia. It is also supported by research collaborators, University of Queensland and AgResearch New Zealand.

Below: Dr Matt Redding and Taleta Bailey with a number of EEFs being investigated for their potential to better match N applications to crop requirements.

Opposite: QDAF Technician Taleta Bailey checks the 16 micro-dialysis instruments each containing a different EEF formulation.



Above: University of Southern Queensland metatronics engineer, Dr Craig Lobsey and Dr Matt Redding demonstrate the robot designed to control the rapid growth pot trials

Research alliance investigates proper blending of enhanced efficiency fertilisers

Smart blending of enhanced efficiency fertilisers (EEFs) to maximise sugarcane profitability *is one of ten research projects into nitrogen use efficiency (NUE) being conducted under the umbrella of the More Profit from Nitrogen Program - a cross sector collaboration between sugar, horticulture, dairy and cotton.* **By Marguerite White.**

This project, run by the Department of Science, Information Technology, and Innovation (DSITI), with partner organisations, is investigating optimal blending ratios of EEFs, such as polymer-coated urea (PCU), with conventional urea, under various soil and seasonal conditions in six Queensland sugarcane growing regions.

Research leader, Dr Weijin Wang explains: "Nitrogen release patterns of urea or PCUs alone may not match crop nitrogen uptake dynamics and the high cost of EEFs can impede their use by farmers. The research is investigating potential to manipulate nitrogen release patterns by blending these products to better match plant demands. A nitrification inhibitor coated product is also included in the study for comparison. The economic advantages may be substantially reduced nitrogen inputs using precision application techniques and cheaper blended products rather than applying expensive single EEFs."

Across the research sites at Innisfail, Tully, Ingham, Mackay and Bundaberg, the project is analysing the nitrogen dynamics within the plant root zone to 1.2 metres and in plant biomass throughout stages of plant growth.

At-depth soil sampling is being conducted to better understand how EEF products can also have a beneficial effect in preventing nitrogen leaching loss, especially when the nitrogen source is exposed to loss events such as high rainfall.

Herbert Cane Productivity Services Ltd (HCPSL) is one of four research partners in the DSITI project engaged to manage the ground level research on commercial properties. They are responsible for trials at Cordelia and Lannercost.

"These sites are good examples of varying soil and seasonal conditions being explored by the project,"

explains Adam Royle, HCPSL Extension Agronomist. "The Cordelia site is a heavy clay soil and productivity can be highly variable due to wetter conditions and potential flooding. Lannercost is on a lighter textured soil and productivity is fairly average for the district, although it can be susceptible to dryer than average conditions."

Soil samplings of the study plots, established with varying PCU/urea ratio blends at rates below and in accordance with the SIX EASY STEPS guidelines are conducted pre fertilisation, at a number of points post fertilisation and post-harvest to analyse nitrogen levels and potential nitrogen movement in soil.

Biomass sampling is taken to gauge growth and nitrogen uptake in the fertiliser blend and rate trials. Yield and CCS sampling will be conducted by HCPSL and results will be sent to DSITI for further statistical analysis.

To date, soil sampling results have highlighted the following messages for growers:

- About four months after application of conventional urea, little fertiliser nitrogen could be detected in the top 120cm of soil, indicating that a considerable portion of the fertiliser could have been lost apart from those taken up by the crops.
- The nitrification inhibitor DMPP-coated urea significantly slowed down conversion of ammonium to nitrate at least in the first month after fertiliser application. This should help reduce nitrogen losses from leaching or as gases.
- Higher mineral nitrogen levels were found in the soils applied with PCU several months after fertilisation. This means that the PCU product could hold fertiliser nitrogen for a much longer time than conventional urea as expected.

"The trials will help fine-tune the nitrogen fertiliser management practices and provide better understanding of the full benefits to growers," Mr Royle said.

Dr Weijin Wang summarises: "Optimum product blending ratios to balance sugar yield, NUE and profitability are being investigated to develop a support tool that will assist growers in product selection and quantitative decisions. The results will contribute to efficient and effective nitrogen fertiliser management strategies for the sugarcane industry with potential outcomes being considerably lower fertiliser N inputs, lower nitrogen exports to waterways and enhanced farming profitability."

More on the More Profit from Nitrogen Project can be found at <http://www.crdc.com.au/more-profit-nitrogen>



Australian Government
Department of Agriculture
and Water Resources

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program, the Queensland Government's DSITI, DEHP and DAF, Sugar Research Australia, Herbert Cane Productivity Services Limited, T.R.A.P Services and Farmacist Pty Ltd, together with support from ICL Specialty Fertilisers and Incitec Pivot.

Below: Applying the field trials.

Opposite: HCSPL staff on site at one of the Herbert trial sites.



Total Research Investment

Sugar Research Australia aims to invest in projects that will deliver real benefits on key issues for its investors.

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 1 (Optimally-adapted varieties, plant breeding and release)				
Improving the accuracy of selection in sugarcane breeding trials through accounting for site variability	2012/351	SRA	Xianming Wei	02/06/2018
Applying the genome sequence for variety improvement: validation and implementation	2013/030	CSIRO	Karen Aitken	01/08/2018
Sugarcane root systems for increased productivity; development and application of a root health assay	2015/002	CSIRO	Anne Rae	01/07/2018
Impact of stool architecture on ratooning ability	2015/004	CSIRO	Anne Rae	01/08/2018
Leaf sucrose: the link to diseases such as YCS and enhancement of sugarcane productivity	2015/016	SRA	Gerard Scalia	30/06/2018
Generation of a high throughput SNP marker chip for introgression of resistance genes from wild germplasm into sugarcane, targeting smut, pachymetra and nematodes, to generate more resistant varieties faster	2015/025	CSIRO	Karen Aitken	01/08/2018
Selecting high value chromosomes from wild introgression material to deliver more resistant varieties faster	2015/026	CSIRO	Karen Aitken	01/08/2018
Improving early stage selection of SRA breeding program by indirect selection of plant vigour	2016/028	SRA	Jaya Basnayake	01/07/2019
Optimising productivity, variety recommendations and mill operations through analysis of mill data	2016/032	SRA	Jo Stringer	01/02/2021
New approaches to identify and integrate Pachymetra resistance genes from Erianthus into the SRA breeding program	2016/039	SRA	Nathalie Piperidis	31/12/2019
Licence to Farm: Nitrogen use efficient varieties to meet the future environmental targets	2016/044	SRA	Prakash Lakshmanan	01/07/2019
Reviewing and extending knowledge of fibre quality assessment and effects of cane varieties	2017/001	QUT	Geoff Kent	01/09/2018
Implementing and validating genomic selection in SRA breeding programs to accelerate improvements in yield, commercial cane sugar, and other key traits	2017/002	UQ	Ben Hayes	01/07/2022
Genetic control and genomic selection for important traits in sugarcane (funding through: Australia-India Strategic Research Fund)	2016803	SRA, Sugarcane Breeding Institute, Coimbatore	Prakash Lakshmanan	01/05/2019

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability)				
Strategies to manage soil-borne fungi and mitigate sugarcane yield decline	2013/101	CSIRO	Paul Harvey	01/06/2018
Boosting N-use efficiency in sugarcane through temporal and spatial management options	2014/045	USQ	Bernard Schroeder	01/10/2017
Improving NUE for sugarcane crops with constrained yield potential	2015/065	SRA	Danielle Skocaj	30/06/2019
Decision support for informed nitrogen management: soil nitrogen mineralisation test and the assessment of soil crop N contribution to crop N requirements	2015/069	DSITI	Phillip Moody	30/06/2018
Improving management practices of legume crop residues to maximise economic and environmental benefits	2015/074	DSITI	Weijin Wang	30/06/2018
How much N will that crop need? Incorporating climate forecasting into nitrogen management in the Wet Tropics	2015/075	JCU	Yvette Everingham	30/06/2019
Waste to revenue: Novel Fertilisers and feeds (Rural R&D for Profit)	2015/905	APL	Janine Price	30/06/2018
More profit from nitrogen	2015/907	CRDC	Felice Driver	30/06/2020
Master classes in soil health and soil biology for the sugar industry	2016/025	SRA	Andrea Evers	30/07/2018
Molecular assay of major soil-borne pathogens for better exploitation of commercial varieties	2016/047	SRA	Rob Magarey	01/07/2018
SIX EASY STEPS – continuing perspectives in time and space	2017/004	USQ	Bernard Schroeder	31/12/2021
Measuring soil health, setting benchmarks and driving practice change in the sugar industry	2017/005	SRA	Dave Olsen	30/06/2022
Unravelling the impact of climate and harvest time on nitrogen fertiliser requirements	2017/009	SRA	Danielle Skocaj	01/02/2022
Key Focus Area 3 (Pest, disease and weed management)				
Solving yellow canopy syndrome	2014/049	SRA	Dave Olsen	30/06/2018
Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics area	2014/050	SRA	Emilie Fillols	01/01/2018
A Novel Polyphasic Framework to resolve yellow canopy syndrome Paradox	2014/082	UWS	Brajesh Singh	30/06/2018
Delivery of remote sensing technology to combat canegrubs in Queensland cane fields	2015/038	SRA	Andrew Ward	01/01/2018
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with the existing product	2016/003	SRA	Andrew Ward	01/01/2020
You can't manage what you can't identify – Managing threat from exotic moth borers through accurate identification	2016/041	SRA	Andrew Ward	01/07/2018
Molecular assay of major soil-borne pathogens for better exploitation of commercial varieties	2016/047	SRA	Rob Magarey	01/07/2018
Investigation of biotic causes of yellow canopy syndrome	2016/064	UQ	Andrew Geering	01/12/2019
Keeping chemicals in their place – in the field	2017/008	SRA	Emilie Fillols	30/06/2020
Delivering solutions for chlorotic streak disease	2017/010	SRA	Kathy Braithwaite	30/06/2020
Integrated disease management of sugarcane streak mosaic in Indonesia (ACIAR-funded project)	HORT/2012/083	SRA	Rob Magarey	31/12/2018

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 4 (Farming systems and harvesting)				
A non-pneumatic cane cleaning system with no cane loss	2014/035	QUT	Floren Plaza	20/12/2017
Increased harvest recovery: reducing sugar loss and stool damage	2014/048	SRA	Joseph Bonassi	01/05/2019
Demonstration of GPS-guided laser levelling and its associated productivity response	2014/094	Mulgrave Central Mill	Matt Hession	01/02/2018
Assessment of new management strategies for marginal soils	2015/007	SRA	Barry Salter	31/12/2019
Bio-prospecting for beneficial endophytes of sugarcane	2015/051	AgResearch	Stuart Card	01/02/2019
Opening the data highway: Access to remotely sensed spatial and temporal data for the Australia sugar industry to assist with yield forecasting and nitrogen management	2016/062	UNE	Andrew Robson	01/01/2020
Understanding interactions between basecutters and other forward – feed components with the cane stalk, and determining practical strategies to minimise damage as harvester speed increases (Rural R&D for Profit)	2016/952	Norris ECT	Chris Norris, Phil Hobson	01/04/2020
Commercial scale economic evaluation of post-harvest cane cleaning to maximise the returns to the supply chain (Rural R&D for Profit)	2016/953	QDAF	Stephen Ginns	30/06/2019
Southern Sugar Solutions	2017/012	DAFQ	Neil Halpin	31/12/2020
Seeing is believing: managing soil variability, improving crop yield and minimising off-site impacts in cane using digital soil mapping	2017/014	UNSW	John Triantafilis	30/06/2020
Cane Farmer Trials of Enhanced Efficiency Fertiliser in the Catchments of the Great Barrier Reef (Funding provider: Commonwealth Department of Environment and Energy and Queensland Government Great Barrier Reef Innovation Fund (Reef Trust 4))	2016/807	CANEGROWERS and SRA	Barry Salter	01/05/2021
Key Focus Area 5 (Milling efficiency and technology)				
Real time harvest and transport system	2014/037	QUT	Geoff Kent	01/05/2018
Improving mill efficiency through rapid analysis methodologies	2014/051	SRA	Steve Staunton	01/09/2017
Managing aspects of raw sugar quality in the Australian sugar industry	2014/052	SRA	Steve Staunton	01/08/2017
Investigation into modifying pan boiling techniques to improve sugar quality	2015/013	QUT	David Moller	30/06/2018
Increasing capacity to undertake cane preparation research through modelling and experimentation	2015/018	QUT	Geoff Kent	01/05/2018
Develop a blueprint for the introduction of new processing technologies for Australian factories	2015/043	QUT	Ross Broadfoot	01/12/2017
Online analysis systems to measure the available nutrients in mill mud	2016/019	SRA	Steve Staunton	01/03/2020
Reducing boiler maintenance costs and deferring capital expenditure through improved technology	2016/020	QUT	Floren Plaza	01/07/2020
Evaporator liquor brix sensor	2017/003	Wilmar	Robert Stobie	31/12/2018
Managing aspects of raw sugar quality in the Australian sugar industry – Part II	2017/006	Griffith University	Chris Davis	30/06/2019
Investigations to mitigate the effects of sucrose degradation and acid formation in factory evaporators on sugar recovery and quality, corrosion and effluent loadings	2017/007	QUT	Darryn Rackemann	01/12/2020

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 6 (Product diversification and value addition)				
Process for making bagasse paper pulp	2012/053	QUT	Thomas Rainey	01/05/2018
A profitable future for Australian agriculture: biorefineries for higher-value animal feeds, chemicals and fuels (Rural R&D for Profit)	2015/902	QUT	Ian O'Hara	01/03/2019
Key Focus Area 7 (Knowledge and technology transfer and adoption)				
Increasing farm business intelligence within the sugar industry	2014/001	AgProfit	Matthew Bryant	01/09/2017
Measuring the profitability and environmental implications when growers transition to Best Management Practice (as defined by the new Canegrowers Smartcane BMP)	2014/015	DAF	Mark Poggio	02/05/2018
Sugar industry productivity and data recording spatial data hub for research and extension	2015/045	Agtrix	Robert Crossley	28/02/2018
Stimulating private sector extension in Australian agriculture to increase returns from R&D (Rural R&D for Profit)	2015/906	Dairy Australia	Neil Webster	30/06/2019
Protecting our chemicals for the future through accelerated adoption of best management practice	2016/002	SRA	Belinda Billing	01/08/2019
Master classes in soil health/soil biology for the sugar industry	2016/025	SRA	Andrea Evers	30/06/2018
Development of an intelligent tool to allow real time evaluation of harvesting practices as part of a framework for improved harvester payment systems (Rural R&D for Profit)	2016/951	Norris ECT	Stuart Norris, Rob Crossley	30/06/2019
Adoption of practices to mitigate harvest losses (Rural R&D for Profit)	2016/955	SRA	Phil Patane	30/06/2019
Productivity improvements through energy innovation in the Australian sugar industry	2017/011	Ag Analytics	Jon Welsh	30/06/2020
Key Focus Area 8 (Collaboration and capability development)				
Enhancing sugarcane for decreased water content and increased sugar content at harvest	2011/072	QUT	Anthony Brinnin Mark Kinkema	01/05/2018
Production of furanics and chemicals from bagasse and molasses	2012/074	QUT	Joshua Howard William Doherty	01/06/2017
Effect of organic nutrients on sugarcane growth, microbial activity and greenhouse gas emissions	2013/078	UQ	Susanne Schmidt	01/06/2018
Sugarcane for water limited environments: characterization of a selected sugarcane germplasm for transpiration efficiency and high biomass production for the sugarcane growing regions in Australia	2014/102	UQ	Sijesh Natarajan Shu Fukai	30/06/2018
Investigation of genetic control of sugar accumulation within the sugarcane culm (stalk)	2014/107	UQ	Patrick Mason	01/06/2018
Soil nitrogen dynamics – a microdialysis approach to quantify nitrogen cycling in sugarcane soils	2014/108	UQ	Scott Buckley	01/06/2018
Statistical data mining algorithms for optimising analysis of spectroscopic data from on-line NIR mill systems: improving system calibrations for quality measures and variety discrimination	2014/109	JCU	Justin Sexton	01/02/2019
Delivering a novel DNA-based diagnostic for root health to the sugar industry	2015/402	CSIRO	Johann Pierre	01/12/2017
A boiler simulator for improved operator training	2016/001	QUT	Anthony Mann	01/07/2018
Integrated standardised competency based training for sugar milling operators	2017/013	QUT	David Moller	01/12/2019

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