Sugar Research Australia

CaneCONNECTION

Winter 2018

Contents

(Cover page) *Tully grower Tom Harney welcomes the news that SRA researchers have discovered and named the organism responsible for causing chlorotic streak disease. Read more about Phytocercomonas venanatans on page 12 and 13.*

Design: *Catherine Jorissen, SRA.*

Welcome to the Winter 2018 edition of *CaneCONNECTION*

With the harvest underway, we have again taken the chance to look at the results of 2017 trials in the field via the Enhancing the Sugar Industry Value chain project, first through the eyes of MSF Sugar on the Tableland and second through the eyes of Tully harvesting contractor Ian Ghidella. Both were among the 47 trials that were conducted in 2017 and as the season ramps up there will be another 60 trials rights across the industry in 2018.

In this issue we also have a look at a range of projects looking at water quality and nutrient and pesticide management. Readers of CaneConnection will be familiar with the EEF60 project occurring to assess the productivity, profitability, and sustainability of enhanced efficiency fertilisers. We hear from the SRA research teams on the ground working on this project on page 26. We also hear from a similar project in NSW as part of the More Profit from Nitrogen project, and we also look at weed control through the eyes of Tully grower Frank Hughes, who is part of the Protecting our Chemicals for the Future project.

We also hear more about what the new discovery on chlorotic streak means for the industry, and also take a look at the positive impacts of underground trickle fertigation on the Atherton Tableland.

This edition also heads to Mackay to chat with Dennis and John Werner, who have built their own sub-surface mill mud applicator. The Werners have been involved in a range of research projects and on-farm innovations, including an assessment of the mill mud through an SRA-funded project led by Dr Graham Stirling. Read their story on page 10 and 11.

We hope you find this edition useful. If you have any comments or suggestions, please let us know at bpfeffer@sugarresearch.com.au or (07) 3331 3340.

Brad Pfeffer

Executive Manager, Communications

ISSN 2203-1111 (Print) ISSN 2203-112X (Online)

180

The number of trial years' worth of data being collected through the EEF60 project

Page 22

7ML/ha

The approximate reduction in water use made through the switch from furrow to underground trickle

Page 4

By the numbers

$300/ha

The difference in grower revenue per hectare when comparing nominal harvester settings to recommended harvesting settings

Page 14

$3/tonne

The potential increase in revenue for the industry based on 2017 harvest loss trials (in green cane areas)

Page 16

$10,000

The annual benefit of automation of irrigation for one grower in the Burdekin region

Page 24

SRA appoints Regional Coordinators as part of strategy for industry-led adoption

SRA has taken major steps forward in the delivery of the industry-led Adoption Strategy for the Australian sugar industry with the appointment of Regional Coordinators in six regions.

The Adoption Strategy has been developed in consultation with the Australian sugarcane industry and SRA's Government investors and stakeholders over the last 12 months. It aims to provide a more strategic focus to increase the uptake and implementation of new and existing technologies in the sugar industry.

The Strategy identified the need for Regional Coordinators in six regions to work with the local industry and all stakeholders to deliver strategic outcomes.

The original intent was to progressively appoint the Regional Coordinators.

However, the quality of the candidates coupled with the momentum that the Adoption Strategy has generated has meant SRA has decided to appoint all six regional coordinators now in order to maintain the impetus of the Adoption Strategy.

The Regional Coordinators are Mr Sebastian Garcia-Cuenca (New South Wales and Rocky Point), Mr James Ogden-Brown (Southern Region), Mr Phil Ross (Central Region), Mr Anthony Curro (Burdekin Region), Ms Caroline Coppo (Herbert Region), and Mr Daryl Parker (Far North Queensland).

SRA Executive Manager, Regional Delivery, Mr Ian McBean, said that all Regional Coordinators brought significant experience to the role and their knowledge of the region and relationships with the key stakeholders would be invaluable in delivering on the key objectives of the adoption strategy.

"As the key contact in each region, the Regional Coordinators will work closely with the local industry including, millers, growers, productivity services, local CANEGROWERS, the Australian Cane Farmers' Association, NRM groups and others to deliver strategic outcomes in each region," Mr McBean said.

"They will also work closely with researchers across the sugar industry and SRA Adoption Officers in other regions to ensure cross-regional linkages are established and maintained. The appointment of our Regional Coordinators is a major step forward in the delivery of the industry adoption strategy, which will continue to gather momentum as we move forward." ■

Fertigation delivers quantum leap forward in efficiency and productivity

The switch from furrow irrigation to an automated drip fertigation system is delivering a massive jump in productivity and water use efficiency for MSF Sugar's Mousa Farms near Mareeba on the Atherton Tableland.

BY BRAD PFEFFER

While Mousa Farms had been growing cane under the previous owners, it also had a history of cattle production and the soils of the property had been deemed as unsuitable for cropping by the Queensland Department of Agriculture and Fisheries.

Under its previous furrow irrigation set-up, the blocks on Mousa Farms were all bordered by drains or rivers that ran through trees, which meant no tailwater could easily be captured and recycled.

The soils are also extremely variable with poor water holding capacity, which meant MSF Sugar used up to 17 megalitres per hectare to grow an average of 75 tonnes of cane with furrow irrigation.

"It was an extremely wasteful use of our most limiting resource," explained Rik Maatman, Operations Manager for Tableland Farms. "The crop was costing us money to grow, so we really had to do something to improve the situation."

Working in collaboration with Netafim, the sub-surface drip development was commissioned in February 2017 with the cane planted in March of that year. It is due for harvest in July this year, with the official estimate being 145 tonnes/hectare, but with hopes it could push higher.

The drip irrigation has slashed irrigation usage to 10ML/ha, plus effective rainfall. Rik added that they were particularly pleased with the results given the farm had its challenges for drip due to many rocky outcrops on the farm and subsequent issues when pre-ripping the beds.

With harvest underway, Tableland Farms is hoping that their sub-surface drip irrigation (SSDI) water use efficiency (WUE) will be around 12 to 13 tonnes of cane per ML (effective rainfall plus irrigation), which compares to their furrow irrigation of about 8 tonnes of cane per megalitre.

The change in irrigation and fertilising has also changed the focus of labour units, thanks to the opportunity to practice fertigation. The previous frequent furrow irrigation obviously required significant manual labour, but, as Rik explained, this work has now shifted to managing the automation and the batching of the fertiliser in the 25,000 litre tanks at the control shed.

He said that the system is also improving their nitrogen use efficiency.

"In most of other cane growing situations, we would be applying 160-180 units of nitrogen (N) up-front," he said.

"If there's a big rainfall event there will commonly be losses to leeching, but in this situation the maximum amount that we could lose to leeching is seven kilograms of N, which is the most that we are applying within one week."

Rik said nitrogen is applied through the drip when the crop starts tillering and becomes hungry for N, with the rate incrementally increased up to about six months old, when the rate is then tapered down to finish at about seven months (for a 12-month crop).

"Applying N too late in the season can create a risk of production losses in

ripening, but we continue to apply potassium sulphate up to month eight or nine, as it is important for cellulose production and enhances the translocation of sugars."

While the fertiliser rates may change, the ratio of fertiliser in the bulk tanks always stays the same, with MSF Sugar Tableland Farms Irrigation Supervisor Aaron Moore adjusting the dose accordingly, delivering the nutrient direct to the active root zone of the plants at weekly intervals.

With the system driven by two variable-speed drive pumps, they are able to ensure that energy use is precisely what is needed to move each megalitre of water.

The WiSA software puts irrigating and fertilising behind a computer rather than in the paddock with a tractor or a shovel.

"So all this work brings the latest technology and computer programing to cane farming," Rik said.

Aaron Moore said drip irrigation was by far the better option for irrigating cane, subject to suitable soil types and the environment.

"With mounting pressure on our finite water resources across farming in general, the need for growers to use water more efficiently has never been greater," Aaron said.

"Growers chase yields but in order to best utilise the water that is available to us, we need to be looking at more efficient methods of applying irrigation."

Sugarcane in the Tableland region has been traditionally irrigated using overhead or furrow.

Rik Maatman said that while the system at Mousa Farms was at the top end of investment in drip, there were several different investment options for growers.

"For example, one of the family farms here on the Tableland has installed fertigation drip, using a v-tank system similar to that used on horticulture," Rik said.

"The pumps aren't on a variable speed drive but they match their shifts to run the pump at 90 percent efficiency and they've put the system in for probably around a third of the cost. So there are opportunities at different levels of investment." ■

For more information on irrigation work at SRA contact Adoption Officer Andres Jaramillo on
E ajaramillo@sugarresearch.com.au
T (07) 4783 8612

"The WiSA software puts irrigating and fertilising behind a computer rather than in the paddock with a tractor or a shovel."

(Over page) *Rik Maatman at Mousa Farms earlier this year, where the fertigation has been established.* ***(Above left)*** *Netafim Business Development Manager, Peter Durand, with MSF Sugar's Aaron Moore and Rik Maatman.* ***(Above right)*** *Inside the heart of the fertigation operation at Mousa Farms.*

Refining weed management at Tully: less on = less off

Tully grower Frank Hughes has faced an ongoing battle with Calopo vine. This weed pressure has always been highest at the end of rows where the vines access more sunlight and grow vigorously before they can be shaded by the cane.

With the risk of weed pressure creeping further into blocks of older ratoons, Frank was keen to improve his weed control.

In the past, this would mean he would need to resort to photosystem II (PSII) residual herbicides, which Frank has been minimising due to the environmental concerns.

With that in mind, but also needing to get the vine under control, Frank wanted to find out if his system could be fine-tuned in a way that delivered the same weed control outcomes while also improving sustainability outcomes by reducing the risk of herbicide running off his farm.

This is how he became involved in project called Protecting our Chemicals for Future, where researchers are looking at real-world trials with growers on a range of farming practices that marry productivity, profitability, and sustainability outcomes.

At Frank's place, which is at Bilyana about 20km south of Tully, trials in 2017 looked at using targeted PSII residuals only across the first 20 metres of the row, where there was more sunlight from the end-of-row and weed pressure was higher. The vine in the rest of the paddock was controlled with knockdown herbicide and the enclosed canopy of the cane.

The trial was in older ratoon Q208(l) grown on 1.65m wheel spacing. Frank was able to vary the application thanks to his spray rig having two tanks connected to a flat boom and octopus legs, controlled by a GPS variable-rate controller.

SRA Researcher leading the project, Ms Belinda Billing, said that the block had medium pressure grasses, sickle pod, and various broadleaf weeds.

"Frank rotates chemicals over the crop cycle to avoid resistance, while also paying attention to weed pressure," she explained.

The block was harvested in June 2017, and had two treatments with two applications per treatment as well as an unsprayed control. Spot spraying for guinea grass was completed across the block.

(Above) *Tully grower Frank Hughes has been a keen participant in the Protecting our Chemicals for the Future project.*

Treatments applied

T1: FRANK'S CURRENT PRACTICE	T2: PROPOSED ZONAL CONTOL	CONTROL
1 September 2017 2,4-D @ 1 L/ha Picloram & 2,4-D /Tordon @0.5L/ha – applied with boom **COST: $15/ha**	1 September 2017 2,4-D @ 1 L/ha Picloram & 2,4-D /Tordon @0.5L/ha – applied to whole row with boom Imazapic & hexazinone (Bobcat Imaxx) Paraquat 20m application on end of both rows with octopus legs **Cost: $35/ha**	No treatment applied
14 February 2018 Imazapic @ 400g/L (Flame, Spark etc.) Paraquat @1.2L/ha applied through octpus legs 2,4-D @ 1.5L/ha Picloram/2,4-D (Tordon, Trooper) applied with boom **COST: $25/ha**	**14 February 2018** **2,4-D @ 1 L/ha** **Picloram & 2,4-D /Tordon @0.5L/ha – applied to whole row with boom** **Imazapic & hexazinone (Bobcat Imaxx) 20m application on end of both rows with octopus legs** **COST: $35/ha**	No treatment applied
Spot spray glyphosate @ $10/ha **Total cost: $50/ha**	**Spot spray glyphosate @ $10/ha** **Total cost: $80/ha**	

Weed pressure was assessed throughout.

Frank noted that the 2017 was a dry year, which meant weed pressure was less when the crop was young.

(Continued over page)

TREATMENT 1	TREATMENT 2
Med-high weed pressure early, majority blue top. Weed pressure increased significantly with onset of wet season. Weed pressure reduced by both sprays, long-term reduction in weed pressure achieved with final residual spray. Limited weed pressure in mid section of cane where shading occurs.	Med-high weed pressure early, majority blue top. Improved control on ends evident as weed pressure increased with onset of wet season. Final spray successful in reducing pressure on ends and mid section, with shading reducing weed pressure where knock down chemicals only applied.

"...Frank wanted to find out if the system could be fine-tuned in a way that delivered the same weed control outcomes while also improving sustainability outcomes by reducing the risk of herbicide running off his farm."

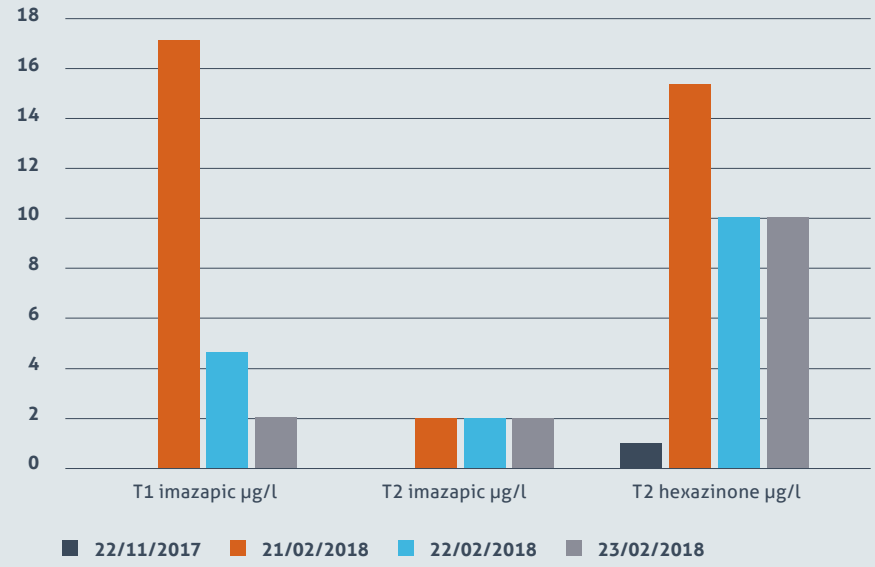
14 February 2018 (T1)

14 February 2018 (T2)

5 March 2018 (T1)

5 March 2018 (T2)

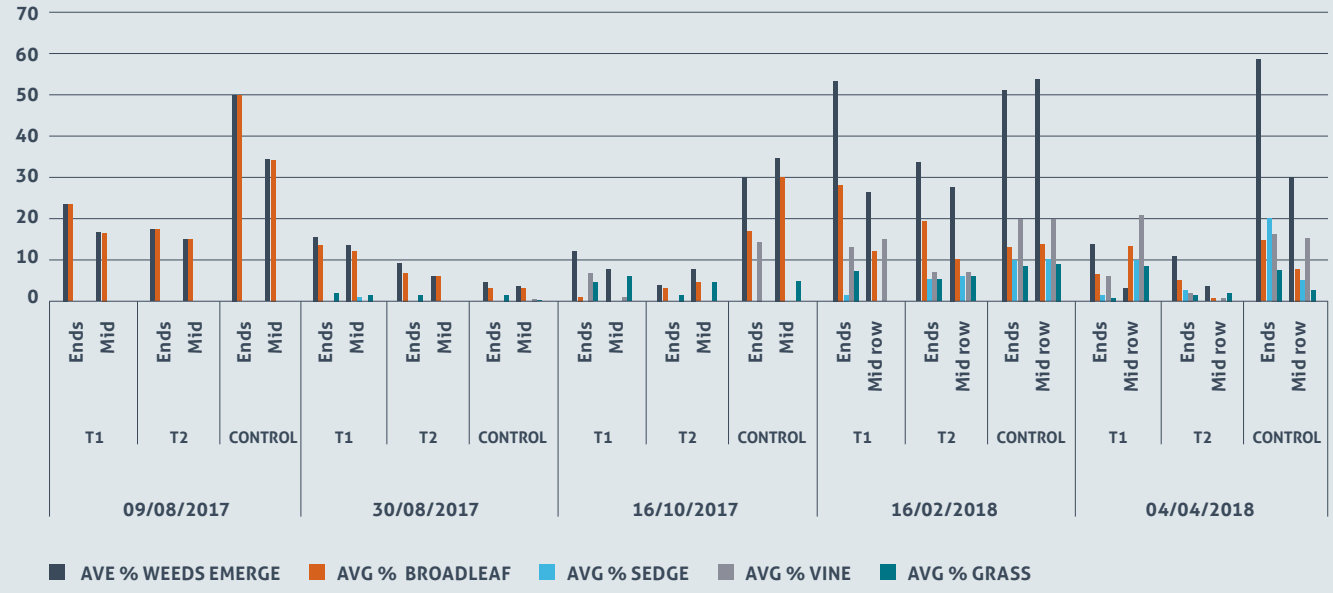
Frank Hughes zonal vs broadcast control over four events



RAINFALL AND RUNOFF

The first rainfall that produced runoff fell on 22 November 2017 (21mm), almost three months after application resulting in a small loss of hexazinone from the Bobcat® I-MAXX only. Subsequent events on 21/02/2018 (14mm), 22/02/2018 (109mm) and 24/02/2018 (17mm) fell one week after application, with a wet soil profile and resulted in the majority of losses. Hexazinone is the greatest component of Bobcat® I-MAXX and is known to be a mobile chemical and therefore makes up the majority of losses from this demonstration. This chemical provides good control of calopo, the weed targeted on the block ends. This strategic use of such a chemical is a good way to get effective control while minimising environmental risk.

2017/ 18 Frank Hughes Weed Observations



Frank is keen to investigate further as he sees there is potential for adopting this approach for tailoring a more specific chemical program into a scenario that works for both him and for the environment.

Frank welcomed the opportunity to participate in the trials and reinforced the value that growers received from seeing results from trials conducted on commercial farms.

"We know the results are directly related to our own environment, our own weed pressure, and the specific weeds we face.

"I think it's fantastic that SRA are running these trials with growers."

This project is a collaboration with SRA, Bayer, James Cook University, Tully Cane Productivity Services Limited, Queensland Government, Nufarm, and Tully Sugar.

For more information,
Belinda Billing on
E bbilling@@sugarresearch.com.au
T (07) 4506 4512

Field Day supports growers to improve water quality

SRA's Meringa Station hosted a field day with a water quality focus on May 1, supporting several projects underway in the Wet Tropics.

BY GAVIN RODMAN AND PHIL ROSS

The field day supported three projects based in the Wet Tropics*: Russell-Mulgrave growers and the nitrogen story (Cane to Creek), Protecting our chemicals for the future* and *Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics.*

Growers and advisors from Tully to Mossman heard from the Queensland Department of Environment and Science about the Great Barrier Reef water quality monitoring program and from Cairns Regional Council about their local water quality program.

Other information stalls provided information and updates from a number of local activities:

- **SmartCane BMP, "Project 25" and nutrient management planning:** CANEGROWERS Cairns Region and the Wet Tropics Sugar Industry Partnership (WTSIP). These programs are recognising growers' efforts in managing the environmental impacts of farming.
- **Enhanced efficiency fertiliser trials:** Jacob Fries and Nikita Tahir from The Department of Natural Resources, Mines and Energy spoke about trials at Silkwood that are looking at nitrogen losses through drainage and how losses vary depending on the form of nitrogen fertiliser used.
- **Protecting our chemicals for the future:** Run by SRA's Belinda Billing, this project encourages growers to think about different strategies in using pesticides to minimise their environmental impact,
- **Stoolzippa® imidacloprid press wheel:** In a project led by Department of Agriculture and Fisheries (DAF), EHS Engineering in Mackay designed and built a new type of spiked wheel to close the slot in the ground left after the application of the canegrub insecticide imidacloprid. Bayer have invested into a number of these units that growers can try out on their own farms.
- **Legume fallow crops:** DAF and MSF Sugar have undertaken a number of trials to promote the use of legume rotations to assist in improving soil health. DAF Principle Agronomist Derek Sparkes was on-hand to show how the nitrogen fixed by legumes is available for the subsequent cane crop.
- **Unmanned Aerial Vehicles (UAVs):** There is increasing interest in how drones can help farmers manage their crops. Markus Bulstrode from DAF is looking at how drones can be used to identify and spray patches of weeds and to find other problem areas in crops.

A live survey conducted on the day showed support for the range of water quality focussed projects currently being undertaken and also provided insight into possible future activities. The survey indicated that growers in the Wet Tropics have reduced the usage of diuron-based herbicides and are moving to other preemergent herbicide options with more favourable environmental outcomes.

- SRA acknowledges the funding contribution from the Queensland Government toward this research activity. ■

***(Above)** Marcus Bulstrode from DAF demonstrates the potential for drones in agriculture.*

Holistic approach to soil health to stay ahead of the cost wave

The Werner family at Septimus have been involved with a range of research activities, along with implementing advanced farming practices, to continually lift production.

BY BRAD PFEFFER

Mackay district farmers Dennis, Annette and John Werner have done the sums on increasing input costs.

Based on the current rate of increasing costs, especially for big ticket items like electricity, the Werners estimate that they need to produce 125 tonnes of cane per hectare (TCH) across their whole farm by 2025 to remain viable.

This need to lift the bar is not new to the Werners, as they have been long-term innovators and early adopters. In recent years, this work has paid off as they have seen their production lift from around 75 TCH to about 95 TCH.

They said that there is no one silver bullet to lifting productivity, but it comes through a range of improvements and measures all working together.

A big part of that is improving their soil health.

"For many years, we only looked at what happened above the ground, but now we realise there is much more happening under the ground. That's where we've got to farm: underground, and then work upwards," John Werner said.

This involves a range of practices that include: 1.8 metre (single) row spacing, rotational crops at the end of the crop cycle, a comprehensive soil testing regime treating all varieties and blocks differently, using liquid fertiliser, improving soil pH with lime, and improving their efficiency with pesticides and herbicides.

In addition, they say that the application of mill mud has been an important part of their farming regime.

They have constructed a slab that meets Queensland Government regulations for the mud. Being 32km from the mill, this means that they can take deliveries of mud during wet conditions when trucks can't get onto the paddocks close to the mill.

They have also designed and built their own sub-surface applicator that uses two discs to place the mud in furrows 70mm wide and 150mm deep, either side of the cane row and about 30cm from the centre. This machine – and also their shielded sprayer – was built with the help of the Reef Rescue program.

The mud is applied for the plant crop and at second ratoon. It isn't applied every year to avoid concerns about high phosphorous concentrations.

"We want to keep feeding the soil fertility across the crop cycle, which means multiple applications," Dennis Werner said.

Dr Graham Stirling has worked with the Werners to assess some of their work as part of an SRA-funded project (2014/004) examining the role of the complex web of organisms living in sugarcane soils.

Dr Stirling said that a range of key soil health indicators have improved through the use of the mud and that it was clear visually that roots were also healthier.

In a paper published at the Australian Society of Sugarcane Technologists

Conference this year, Dr Stirling indicated that carbon levels were almost double the level in the area where the mill mud was placed compared to the untreated area.

Carbon dioxide respiration and numbers of free-living nematodes increased significantly and numbers of plant-parasitic nematodes declined by about 67 percent.

The Werners' work on mill mud – where Dr Stirling conducted his sampling – was also assessed as part of a project through the Australian Government Carbon Farming Futures program run by Farmacist at Mackay.

John Markley (Farmacist Mackay) said the results from the mill-mud trials were encouraging, but that sub-surface application of mill mud requires further research.

"In particular, there is a need to investigate the energy requirements of a sub-surface applicator when compared to a surface applicator," he said.

With the trial having a corresponding decrease in granular inputs for the mud treatment, Mr Markey said that the trial indicated that this reduction in nitrogen inputs had no impact on cane and sugar yields when compared to the industry standard application.

Farming at Septimus, the Werners grow cane on about 95 hectares and also run beef cattle.

John Werner said they were very fussy about what chemicals they used and ensuring chemicals and nutrients were kept on farm as much as possible.

"All our nutrients are buried sub-surface," he said. "The reason we built the sub-surface applicator is primarily to ensure we are farming properly for the Great Barrier Reef." ■

A snapshot of the analysis by Dr Graham Stirling from samples at the Werners after three successive years of treatment:

DIFFERENCE BETWEEN UNTREATED COMPARED TO MILL MUD TREATED
Carbon ↑
Microbial activity (measured as carbon dioxide respiration) ↑
Root health rating, dry root weight, and root surface area ↑
Plant-parasitic nematodes: root-lesion, stunt, stubby ↓
Free living nematodes (which are a useful indicator of soil health) ↑

(Over page) *Dennis and John Werner with a crop of first ratoon Q240() that they are hopeful will cut 150 TCH thanks to their farming regime and a good break in the season after the dry summer.* ***(Above top)*** *The Werners' self-built sub-surface mill mud applicator.* ***(Above bottom)*** *Roots of cane collected in October 2016 from untreated soil (left) and soil where mill mud had been applied for three successive years (right).*

New discovery on chlorotic streak to lead to better management

The new scientific discovery on chlorotic streak is leading to improved information on varietal resistance to the disease, and also management options through development of a diagnostic tool.

Tom Harney knows that the potential industry losses from chlorotic streak disease (CSD) are huge.

At the same time, having seen the impact on his own farm, he also knows that the true losses from this disease are difficult to precisely quantify.

"I've seen blocks that look good before we start cutting, but then we get in and there are unexplained reasons why the CCS is down," he said. "The reason is usually because it had chlorotic streak at an earlier stage. The crop may grow out of it, but the plant is so backwards in producing sucrose that it never really catches up."

Previous research in the Australian industry has shown yield losses from CSD as high as 40 percent of sugar yield in susceptible varieties, with an estimated cost to industry of $8-$10 million annually, making it one of the most costly diseases facing the industry.

For Tom, who farms at Tully, he knows he is in a risk zone for chlorotic streak, which is a disease that spreads through wet soil, drainage water, and floods.

When CaneConnection visited on a rainy day in April, following what had already been a very wet 2018, he was able to point out many symptomatic leaves, as well as noting that the symptoms can be erratic, which makes the true extent of the problem hard to estimate.

With all this in mind, he is heartened by the news that SRA researchers have discovered and named the organism responsible for causing CSD.

SRA Researchers have just published two papers on CSD and its cause in the journal Phytopathology, which is considered one of the premier international journals for plant diseases.

In these papers, the researchers including Dr Kathy Braithwaite and Dr Chuong Ngo identified the organism as a type of Cercozoa, which are single-cell organisms.

The Cerozoa responsible for CSD is new to science and was given the name *Phytocercomonas venanatans*. The name means "swims in the veins" and refers to its method of movement and its home in the xylem vessels. It is about 10 micrometres in length, or about 0.01 millimetres.

The search for the culprit behind CSD dates back to 1929 when the disease was first identified, almost simultaneously in Australia, Indonesia, and Hawaii.

Almost 90 years later, thanks to modern DNA technologies such as polymerase chain-reaction (PCR) and high throughput sequencing, SRA researchers have discovered the causal organism and developed a diagnostic test for CSD. Pinpointing the organism is a critical step in improving its management and reducing the disease's impact on the industry.

As outlined in the publications, the researchers have identified, isolated and cultured the organism and infected clean plants to successfully prove the cause of the disease was this organism.

This work is leading to future possibilities for improved understanding and management of chlorotic streak, already underway via a new project led by Dr Braithwaite.

The project is developing a variety resistance screening method for CSD and working to incorporate this into the SRA plant breeding program, so that industry is provided with more useful data on CSD susceptibility as new varieties are considered for approval.

The project is also working on further developing a diagnostic test and service, which would be integrated with SRA's current diagnostic service for ratoon

(Above left) *At about 0.01 millimetres, Phytocercomonas venanatans gets its name from "swims in the veins".* ***(Above right)*** *Symptoms of CSD.*

stunting disease (RSD). The PCR test already exists as a research tool and is hoped to be extended beyond the research phase and used to assist productivity services organisations in delivering clean plant source material.

"Now that techniques are available to visualise, isolate and quantify the organism experimentally, we can begin to address questions such as how the organism infects naturally through the roots, how it lives within the plant and causes disease, how cells are released back into the soil and how the organism survives for extended periods outside the plant," the researchers said in their paper.

Tom Harney said he is hopeful it will lead to practical outcomes on the ground.

"Now that SRA has identified the cause of CSD, there should be better management practices for it: how to prevent it, and how not to get it in the first place.

"There is also an information gap with varieties, and I hope that this discovery improves that." ■

Vigilance helps mitigate CSD impact

For Tom Harney, CSD is something that requires ongoing vigilance. To manage it, he says it is vital to maintain a clean seed source, knowing that CSD is a disease controlled by hot water treatment.

He is also very careful in choosing where varieties are propagated on his farm, and particularly avoids the wettest areas.

After those steps to help avoid it spreading, he also said variety selection is important to minimise the impact and further stop its spread.

"CSD is a consideration when I look at a new variety and if a variety is known to be hit badly with chlorotic streak then that variety probably isn't suitable for me."

He also relies on information such as the SRA Variety Guides and local support for that information through the Tully Variety Management Group.

"Farmers are increasingly getting more information about varieties and that is really informing how we choose varieties," he said. "Gone are the days where a farmer might trial 20 or 30 acres of a variety and 'give it a go'.

"We are still putting out smaller areas to experiment, but that information is helping reduce the need for experimentation." ■

"...variety selection is important to minimise the impact and further stop its spread."

Maximising industry value through optimised harvesting practices

Participation in 2017 harvesting demonstration trials with SRA is leading to further efficiency gains and harvesting improvements for MSF Sugar.

BY BRAD PFEFFER

At MSF Sugar's Tableland Mill, the aim is that the trucks never stop.

With 24 hour harvesting and 12 trucks hauling cane to the mill, but no storage of bins at the mill, a truck needs to be at the mill about every seven minutes to ensure they are pushing through 200 tonnes of cane per hour.

Any less than that, and milling costs increase through inefficiency and they are burning valuable bagasse that would otherwise be used for electricity cogeneration.

As with all regions, this means that there is a huge logistics operation in tracking the trucks and harvesters with GPS, as well as scheduling groups in different sub-districts to keep the cane flowing.

It is a finely tuned operation that is working well, and, now, MSF Sugar is keen to keep it moving forward to make the most of the opportunities that come through harvest optimisation.

Two of the men helping to coordinate that balancing act are Allan Cross (Operations Manager – South Johnstone Farms) and Wayne Reys (Tableland Farms Harvesting Supervisor). They are part of the team that oversees harvesting contracts that cut 213,000 tonne of MSF Sugar's own cane and about 132,000 from Tableland growers.

As part of that, the pair worked with SRA on demonstration trials in 2017 to assess cane and juice loss, which was then followed with a workshop with their staff to drive positive practice change.

They have worked with SRA to optimise the feedtrains in their harvesters, and harvesting parameters such as ground speed and fan speed are now run according to the SCHLOT recommendation. They are fitting chopper drums that reduce losses through an efficient cut, and are also watching current research underway by Norris ECT that is investigating ways that the front end components of harvesters (spirals, knockdown rollers and finned rollers) could also be optimised. They have also modified their machinery to suit 2m row spacing that are being adopted to improve farm productivity.

An analysis of the optimisation of the feedtrain alone showed that optimised machines compared to unoptimised machines were 6.7TCH better under low loss harvester settings, and 4.6TCH better under nominal harvester settings.

"It is the research that continues to drive our decisions," said Allan Cross. "We know that sugar loss is occurring, but we cannot see a specific figure on it just from looking out the back of a harvester.

"The research has to be done in the field to prove it. Once it's been proved, we are adopting that research."

The improvements to the farming system across MSF Sugar farms are also flowing through to positive impacts for harvesting.

According to Operations Manager of Tableland Farms, Rik Maatman, the 2m rows, for example, mean that the harvester already needs to slow down by 1 to 1.5 km/hour compared to 1.8m or 1.6m row systems.

"We are currently only cutting young 2m crops as we are developing that system, so it is all good yielding cane, and that means that our guys would rarely ever go over 4km/hour," Rik said.

They also continue to make other improvement to the farming system to improve harvesting efficiency. This includes long and straight runs, wide headlands, and having bin pads close to paddocks.

"With our farming system, GPS guidance also ensures that we aren't damaging the stool at all and, over the long term, we hope that the gains aren't just in reducing sugar loss, but also potentially growing an extra ratoon crop," Wayne Reys said.

The MSF Sugar team said that because they grow, harvest, and mill the cane, they are in an ideal situation to make the most of any changes.

The trials showed the clear gains to be made in reducing cane and sugar loss, but also showed that this also came with increased harvesting and freight costs due to issues such as bin weights and bins per hectare.

According to last year's trial, the grower revenue net of costs was $4494 per hectare for the recommended treatment, which compared to $4253/ha for the nominal treatment and $3964/ha for the aggressive treatment.

"Our rule of thumb is that we were saving $3 in cane and it was costing us about $1 in freight, so obviously that is a good investment ratio. As we continue to implement harvest optimisation, the next step will be looking at improving the freight," Rik said. ■

This work is one element of a much larger project called Enhancing the sugar industry value chain, which is funded by the Department of Agriculture and Water Resources and SRA as part of the Rural R&D for Profit Program. A new round of demonstration trials across the industry are about to get underway for 2018.

For more information, contact: SRA Harvesting Adoption Officer, Phil Patane on ppatane@sugarresearch.com.au or (07) 4776 8202

The 2017 trial had four treatments:

TREATMENTS	FAN SPEED (RPM)	GROUND SPEED (KM/HR)	SECONDARY EXTRACTOR FAN
Low	600	3	Off
Recommended	750	4	On
Nominal (Conventional practice)	750	6	On
Aggressive	950	6	On

This table provides a snapshot of the results:

	CANE YIELD (TONNE/HA)	CCS (%)	SUGAR PRODUCTION (TONNE/HA)	BINS PER HECTARE	GROWER REVENUE PER HECTARE (AFTER MILL DEDUCTIONS)	CONTRACTOR REVENUE PER HECTARE
Low	136.5	14.2	21.5	6.8	$6028	$1097
Recommended	129.5	14.7	20.7	5.8	$5813	$1023
Nominal (Conventional practice)	122.3	14.6	19.7	6	$5513	$976
Aggressive	118.1	14.7	18.2	4.9	$5125	$900

Australian Government
Department of Agriculture and Water Resources

(Over page) *The crop at one of MSF Sugar's Tableland farms pictured earlier this year (February).* ***(Above left)*** *MSF Sugar's Allan Cross and Wayne Reys are adopting the outcomes of harvesting efficiency research.* ***(Above right)*** *Wayne Reys, Rik Maatman, and Allan Cross discuss harvesting plans for the 2018 season.*

Working together to maximise returns for grower, miller, and contractor

A collaborative approach between contractor and grower is delivering results for Ian Ghidella and his harvesting group.

BY BRAD PFEFFER

Tully harvesting contractor Ian Ghidella reckons one of the best components of his harvester is one of the most simple.

It's not its power, it's not its colour, and it's not anything to do with the range of improvements he has made to optimising the machine.

It's the second seat inside the cab.

That seat gives him the opportunity to encourage growers to sit with him as he is cutting their blocks and, together, they can talk about the challenges that might be in a particular block, and how they can achieve the best job possible.

This collaboration is typical of his philosophy for optimising the harvest and working with his growers, and others, to get the best results that are achievable.

"I think it's all about having the right attitude," Ian told CaneConnection as he was servicing and painting gear leading up to this year's crush. "I have nothing to hide, and I encourage growers to sit in the cab with me and together we focus on results at the end of the season and target the bonus payments for quality from Tully Sugar.

"Anyone can have a bad day or miss a stool of cane somewhere – it's the results at the end of the season and future ratoons that matter."

He also said that the online tool developed by Norris ECT, called SCHLOT (sugarcane harvest logistics optimisation tool), allows him to back up his own experience with research data.

He also participated in trials with SRA in 2017 to assess losses with the in-field sucrose loss measurement system.

"After doing the trials and using the SCHLOT calculator, which I have saved on my phone, it helps me continue to keep losses to a minimum and to try and get as much possible from the block for the farmer, for myself, and for the miller," he said.

"Normally, I will go in and cut a few rows first and then I'll go into the calculator and ask it 'what is the optimum cutting for a block of Q208(!) that's a bit sprawly, on an overcast day?'.

"All these things are estimated in SCHLOT in relation to groundspeed, pour rate, fan speed, and it calculates the losses, and then I've got a useful guide as to how I'm going."

He knows that some further real-world adjustment may be required, but sees SCHLOT as a valuable guide

Ian's business, Mission Harvesting, cut 57,000 tonnes last year and while he admits that the size of the contract gives him a little more leeway to do a better job, he still feels that he could achieve optimum results even with a bigger contract of, say, 70-80,000 tonnes.

"There are a lot of other variables like paddock size, row length, wet weather, and shifting between farms, and all of this comes in to play."

As demonstration of the success of his work, Ian was awarded the 2017 cane harvesting award from the Tully Mill, and he prides himself on providing consistent results year-to-year since the business began in 2014.

Ian has made a number of modifications over the years to achieve a better cut, quality billets, and put less dirt through the machine. This year this has included shark fin rollers to ensure the cane is evenly spread.

After a lifetime in sugarcane, he said that harvest optimisation is about continued learning and collaboration.

"There is a need for a greater understanding of the difference between just driving a harvester and learning how to operate one properly to maximise production. This is a learning curve for harvester contractors and farmers working together for the same outcome: a profitable living."

Ian's group was one of 47 trials that were conducted in 2017 in green-cane areas, with a further 60 trials planned in 2018 right across the industry.

"If anyone wants to know more I'd encourage them to contact SRA and get involved, as it is really valuable to see the different harvester settings tested and compare the aggressive with normal with low loss," Ian said.

Regional results were presented at recent harvesting forums across the industry, while each group has had further discussions and meetings with SRA.

The project is also looking at the economics of harvesting, including contracting, through the Queensland Department of Agriculture and Fisheries.

"In the forty-three trials along the QLD coast, we looked at the revenue benefits in the different regions from using BMP settings. We found that industry revenue across all the green cane areas increased by an average of $3 per tonne. There were variations in revenue, that can be attributed to the particular region, contractor and the block being harvested," said DAF Senior Agricultural Economist Matt Thompson.

"The Department is developing a custom spreadsheet tool that calculates the labour, fuel, maintenance, depreciation, interest and overhead costs at particular harvester ground speed and fan settings. So far, six harvesting contractors have provided information to measure their changes in harvesting costs at the trial sites and more are expected to join the project. The work is ongoing and additional data will be collected in the 2018 harvest season to further inform the economic findings." ■

"...it's the results at the end of the season and future ratoons that matter."

Australian Government
Department of Agriculture and Water Resources

(Over page) *Tully harvesting contractor Ian Ghidella worked with SRA on harvest loss demonstration trials in 2017.*

Visit *www.schlot.com.au*

This work is one element of a much larger project called Enhancing the sugar industry value chain, which is funded by the Department of Agriculture and Water Resources and SRA as part of the Rural R&D for Profit Program.

Due to the success of the program and the overwhelming support of the Burdekin growers, the program has now become available in the Central region. For more information about RP161 or how you can become involved, please contact the Farmacist Burdekin office on (07) 4782 2300 or the Mackay office on (07) 4959 7075.

Tailored planning delivers nutrient use efficiency

The Complete Nutrient Management Planning for Cane Farming (RP161) project provides practical assistance to cane farmers in the Burdekin to adjust their fertiliser application rates to the industry standard, SIX EASY STEPS.

PROJECT DETAILS

Project name: **RP161 – Complete Nutrient Management Planning for Cane Farming**

Funding partner: **Department of Environment and Science, Queensland**

Start date: **1 July 2016**

End date: **30 December 2020**

Burdekin cane grower Joseph Quagliata is a third generation farmer who purchased his Airville property in 1996 from his father.

Joe has been involved with the RP161 project since 2016 and has seen the benefits of being involved firsthand.

The RP161 project provides practical assistance and one-on-one extension to growers and aims to improve productivity and profitability while meeting their regulatory requirements.

Farmacist is providing this practical assistance through the development of whole-of-farm nutrient management plans based on individual farm data, on-farm calibrations of fertiliser applicators, farm visits, phone support, and training for growers who are involved with the project. The project not only focusses on nutrients but employs a holistic management approach to all aspects of farming. To date, 109 growers have already completed the program and another 50 growers are involved in the program for the 2018 season.

RP161 looks at the individual farmer's system and tries to identify areas that could lead to improved profitability to ensure the growers are getting the best return for their investment, especially when the sugar price is depressed as it currently is. "I have been getting water and soil tests in the past but what I have found with Farmacist is that they have fine-tuned what I've been doing for the last ten years. I was also surprised to find what was in my water and we've adjusted the fertiliser rates because of that. We are starting to see a lot of benefits," Joe said.

"We, as growers, need to start learning that it's not about tonnes per hectare anymore, it's tonnes of sugar per hectare. We have to start educating ourselves for that.

"We implemented some replicated trials in our early plant block last year, which included sections of straight urea and sections of a mixture (in line with SIX EASY STEPS). We found using the mixture gave us more tonnes of sugar per hectare which swung me straight away. I've learnt a big lesson from that."

While RP161 is primarily focused on nutrition, tools such as the G-Dot moisture monitor and Water Alert Sensor are available to growers to help optimise irrigation and improve nitrogen use efficiency.

Joe states, "The G-Dot is another great tool. I've noticed on a paddock behind my house, when I irrigate normally the G-Dot only moves up about 4 dots but when it rains it goes all the way to the top. This is telling me that my irrigation water is not soaking across the bed, but a rain event does. The G-dot has taught me that this paddock might need a bit of gypsum after it is cut."

Heidi Hatch, agronomist at Farmacist, explains that the program provides a legacy and a pathway forward well after the completion of the project. "Growers really appreciate the nutrient plans and spatial recording of their data," she said.

"Having all of their soil test and electrical conductivity (EC) data easily accessible through a simple geographic information system (GIS) platform allows them to easily see all of their historical and current information in one place allowing them to make informed decisions," she said.

"Tailoring nutritional plans to their farm makes it personal and relevant not only for the project year, but identifies a strong platform that growers can use going forward.

"The tools provided as part of the program such as moisture probes, EC data and soil tests have been well received and growers are using them to get a better insight into improving other aspects of farm management."

The RP161 project aims to engage up to 210 farms across the Burdekin over the four-year life of the project.

Joe states, "I have encouraged a lot of growers to become part of the RP161 project as it will benefit them in the long run. It is a great service and well worth it. Every day we come across problems and knowing that Farmacist is there and only a phone call away is really reassuring." ■

(Over page) Joe Quagliata and Farmacist agronomist, Heidi Hatch, sighting soil sample locations and results on Google Earth App on Joe's iPhone. ***(Above left)*** *Joe, Jayson Dowie (Senior Agronomist and Burdekin Manager with Farmacist) with Lenny Quagliata (Planting Contractor).* ***(Above right)*** *Joe and Rita Quagliata viewing their grower folder.*

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

PLANNING

- *Benchmark current nutrient practice*
- *Collect and spatially locate all relevant soil test data to allow for site specific nutrient requirements*
- *Conduct a full farm nutrient plan considering varieties, crop classes, soil types, soil chemical analysis, limitations and previous block history (mud, legumes and ameliorants). Provide a block by block plan in accordance with the industry accepted SIX EASY STEPS program providing what blend to use, what rate, when to apply, and product placement. This data is then uploaded into a free spatial program such as google earth for their records.*
- *Variety and Class Planning*

APPLICATION

- *Go on-farm and calibrate the fertiliser box with the grower to ensure they understand the process to enable correct calibrations for them to do in the future.*
- *Farm visits to ensure all other factors that lead to efficient N use are under control (irrigations, pests and weeds etc.)*
- *Phone support*
- *Collect actual application records after project to determine practice change*

EDUCATION

- *Provide SIX EASY STEPS and Google Earth training for project participants*
- *Provision of free tools to enable soil specific recommendations and improve farm management decision support, including two from the following list: soil test, G-Dot moisture monitor, Water Alert Sensor (WAS) and EC Mapping (up to 10ha).*

Fertiliser calibrations have never been easier

Calibrating your fertiliser applicator can be a chore. SRA has developed a new tool called CogCalibrator™, which does some of the hard work for you.

BY GAVIN RODMAN AND DANIELLE SKOCAJ

WHY IS CALIBRATING A FERTILISER APPLICATOR IMPORTANT?

The task of calibrating a fertiliser applicator may seem mundane and repetitive, but it is a necessary part of efficient nutrient management. While you may be using the same fertiliser blend as last year, consistency and granule size of fertilisers will vary from year to year. In addition, different granule sizes and mixtures will flow at different rates, so when changing fertilisers, a calibration should be conducted prior to application.

Calibrating a fertiliser applicator will tell you how much fertiliser is being applied. This is necessary information when it comes to ordering fertiliser, so that you will not have too much or not enough to finish the job. With a reduction in sugar prices, over-application of fertilisers is an unnecessary expense that can be avoided with calibration.

It is important to ensure all nutrients are supplied as per the SIX EASY STEPS nutrient management guidelines to ensure a balanced nutritional program and to give the crop the best chance of reaching its potential. Another reason to calibrate your fertiliser applicator is to comply with legislation. Under the *Environmental Protection Act 1994* (QLD), all Queensland sugarcane growers are required to keep records of soil tests, use of fertilisers and use of agricultural chemicals. This includes calibration results.

IS THERE ANYTHING THAT CAN HELP WITH THE CALIBRATION PROCESS?

SRA has developed a new tool to make calibrating a cog driven fertiliser applicator simpler.

CogCalibrator is a Microsoft Excel based tool that will give you a recommendation on the cogs to use to achieve your target application rate.

While the tool doesn't stop you from having to collect fertiliser in a bucket over a specified distance and weighing it, it does do the rate and cog configuration calculations for you. ■

FertFinder® V2 has been released with a new calculator, allowing plant mixes to be found easier.

Fertiliser blends can now be searched using N or P as the rate determining nutrient.

You can find both FertFinder® V2 and CogCalibrator at *www.sugarresearch.com.au*

New research to deliver outcomes for Australian sugarcane growers and millers

SRA has announced 12 new research projects that will begin from July 1, 2018, to drive productivity, profitability, and sustainability for Australian sugarcane growers and millers.

SRA's new investment will complement the existing portfolio of research investment and will address critical research gaps and requirements that have been identified in SRA's five-year Strategic Plan.

SRA CEO Mr Neil Fisher said the new research investment would see research providers from several leading research institutions undertake work to address critical issues for the Australian sugar industry.

"These projects have an emphasis on new and innovative research," Mr Fisher said. "For example, CSIRO will be looking closer into the genetics of sugarcane and molecular markers, which will help us to continue to modernise the SRA breeding program, leading to better varieties for growers and millers.

"We are also investing in a major project with QUT to improve pan design and how pans operate. The pan stage of milling is where syrup is converted to sugar, and there is an opportunity with this research to improve the efficiency of this critical component of the milling process, and to do so in a way that minimises the capital investment for our Milling Members.

"Our investments are also looking at other key topics including improved irrigation system selection, nitrogen use efficiency, and improved farming systems.

"We are also investing in a project led by SRA to ensure our industry is prepared for the possible biosecurity risk posed by moth borers, which exist in neighbouring sugarcane growing countries and would cause serious problems for our industry if we faced an incursion. This type of preparation is a vital insurance policy for the future of our industry."

Mr Fisher said these projects had been chosen based on a rigorous selection process over the last six months, overseen by the SRA Research Funding Panel (RFP).

"These projects have all been assessed based on the outcomes they will provide to the industry, leading to positive outcomes for our investors." ■

The full portfolio of SRA's research investment is available via the SRA website: *www.sugarresearch.com.au/research-portfolio/*

SRA's investment is funded by the statutory levy of 70 cents per tonne of cane, to which growers and millers each contribute 35c per tonne of cane each. This investment in research is supported by a co-contribution of about $7.2M from the Federal Government and $2.85 million from the Queensland Department of Agriculture and Fisheries (DAF).

***(Above)** One of the new project investments is being led by Dr Barry Salter (SRA) and looking at a range of soil health issues facing the industry.*

Determining the best fit for enhanced efficiency fertilisers for the cane industry

EEF60 is a joint initiative of Queensland CANEGROWERS and SRA, with SRA as the lead research agency, and a number of productivity services organisations partnering in the project to deliver extension to industry.

In most parts of the industry this year, farmers have worn a well-trodden path to their rain gauge.

Numerous floods, heavy rainfall, and near-hit cyclones have peppered the industry across the summer.

The conditions have been positive for some growers and horrendous for others, especially those in the hardest-hit flood regions.

Where there is heavy rain, and more generally, there is also discussion about the best timing and efficient uptake of nutrient inputs by the cane plant.

Against that backdrop, a major project is underway assessing various types of enhanced efficiency fertilisers (EEFs) and their role for productivity, profitability, and sustainability outcomes for the Australian sugarcane industry.

EEFs are not new products, but in the sugar industry there remain a number of important questions for growers and advisors, especially around these products' efficacy and how this stacks up against the extra cost that comes with most of these products when compared to standard urea.

EEFs come in two main forms: polymer-coated products and nitrification inhibitors.

The polymer coated products release nitrogen slowly and ideally this release pattern matches with the nitrogen requirements of the cane, while the nitrification inhibitors stabilise N in the ammonium form, which is available for the cane but less likely to be lost than nitrate.

It has been a busy year for the teams on the ground, led by SRA's Julian Connellan at Gordonvale, Nick Hill at Mackay, and John Panitz at Bundaberg.

Across the project, from the Wide Bay north, there are to be 60 trials controlled and replicated field trials, which will be assessed and analysed over three seasons, representing a massive 180 trial-years of data. As the project progresses, this wealth of knowledge
will be combined with economic information and continually extended back to industry through the extension officers and regular communication.

In recent months, the teams have been in the field and undertaking biomass sampling of crops, targeting the 9-month crop stage.

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

Nick Hill explained that the purpose of this is to gather information about nitrogen uptake by the crop.

"The process involves counting and cutting stalks across a defined distance, weighing the samples and then processing a subsample in preparation for chemical analysis so as to determine what amount of nitrogen was taken up and how it is partitioned by the plant into millable stalk or leaf and cabbage," he said.

"This is important for determining whether EEF products improve nitrogen use efficiency.

"My team works across the Central and Burdekin regions, where the wet weather has been largely welcome, but also meant some juggling to get the job done, just is the case with everyone in the industry."

In the north, Julian Connellan and his team have faced even wetter conditions, which they are hopeful will put the products to the test and produce useful results for industry after the harvest data has been collected.

The project team is now looking ahead to the busy harvest period.

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.

There are also six water quality monitoring sites across the project, and this data has been collected. ■

*(Over page) Julian Connellan loading samples at Mulgrave for assessment. **(Above left)** Weighing biomass samples at the SRA Meringa research station. **(Above right)** SRA technicians Eric Kok and David Martyr with the team based at Mackay removing the last of the water quality monitoring equipment. **(Bottom right)** SRA Researcher Julian Connellan and technician James Oldacre biomass sampling at Mulgrave, south of Cairns.*

Research shows automation of irrigation stacks up with a range of benefits

A recent SRA-funded project has examined the potential for automation of furrow irrigation at three very different farms in the Burdekin.

The National Centre for Engineering in Agriculture (NCEA) received funding from SRA to investigate the automation of furrow irrigation in the sugar industry. This involved a review of potential commercially available control hardware, sensors and radio systems and the installation of this equipment on three farms. These farms were chosen because they represented three different, but common, types of irrigation infrastructure in the Burdekin. The sites are: delta farm with multiple pumps, interconnected pipelines and recycling; BRIA farm with channel supply and no pumping or recycling; BRIA farm with river pumps and recycling. The costs and benefits associated with each site are unique to that setting and are only intended as a guide.

(Above) Using WiSA technology and solar power, here the automation controls the actuators to open and close valves.

Summary of automated sites

	RUSSELL JORDAN UPPER HAUGHTON	AARON LINTON LEICHHARDT	DENIS POZZEBON AIRVILLE
Irrigation delivery system	Gravity feed	River pumps and recycling	Bores, open water and recycling pumps
Area (ha)	82	53	27
Total Cost	$49,700	$68,365	$59,700
Cost/ha	$606	$1,290	$2,211
Annual Cost (assuming 7 yr life)	$6,957	$9,766	$8,529
Annual Benefit	$12,653	$20,034	$8,581
Annual Benefit - Cost	$5,553	$10,268	$53
Summary of Benefits			
Water saving	√√ Approx. 10-15%	Blocks were being underwatered	√√ Approx 20%
Energy use saving— reduced pumping time	Gravity system, no pumping	Not applicable	√√√
Saving from changing electricity tariff	No pumping	√√√√ >40% reduction	Potential saving but not investigated during project
Labour saving— time spent changing/checking irrigation and travelling to the farm	√√√√	√√√√	√√√√
Vehicle cost saving	√√	√√√√√ > 10,000 km/yr	√
Improved record keeping— irrigation is automatically captured	√√	√√	√√
Social or family benefits	√√√√	√√√√	√√√√
Water quality improvement	√√	√√	√√
Reduced deep drainage losses (water table impacts)	√√√	√	√√

KEY PROJECT FINDINGS

- Automation of furrow irrigation is possible, practical and in many cases cost effective.
- Many systems in the Burdekin can be automated with minimal changes to on-farm infrastructure.
- The installed automation systems allow farmers to control, schedule and monitor irrigations from offsite.
- Automation provides the major benefit of a reduction in farm labour.
- Automation once used to its full potential allows better timeliness of irrigations leading to potential reductions in water and energy use.
- Automation allows irrigators to better target off-peak power tariffs.
- End of row sensors and within field sensors allow the system to adapt to changes in soil intake and/or flow rates and adjust the irrigation timing appropriately.
- The system is commercially available.

CONCLUSIONS

The three farms in this project have demonstrated a range of costs and benefits. The different farm layouts and irrigation systems have highlighted the fact that a favourable cost benefit scenario is reliant on the farm design, water sources and current management. Not all growers will see a positive cost benefit outcome from installing automation, or they may only achieve a positive outcome if the automation allows them to improve their irrigation scheduling and management. On the other hand, some growers may see extensive benefits. It should also be noted that the cost of borrowing money to install an automation system has not been considered in these scenarios.

Growers who are considering automation are encouraged to seek assistance with developing their own cost benefit analysis to inform their decision on whether to invest in this technology. ■

A series of detailed information sheets have been developed on the project and are available under the irrigation section of *www.sugarresearch.com.au.*

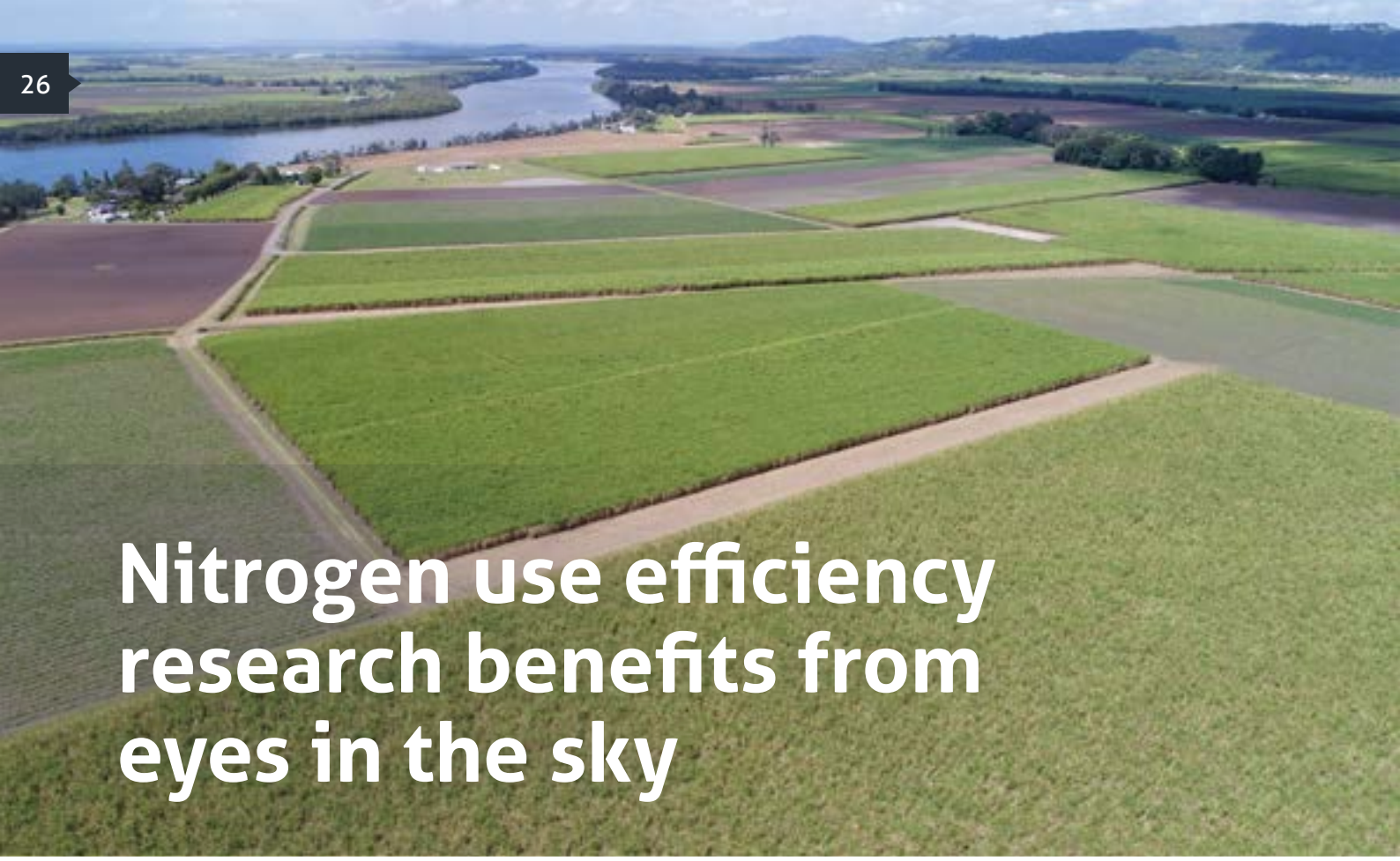
For more information contact:

Steve Attard (AgriTech Solutions)
E steve@agritechsolutions.com.au
M 0418 155 844

Malcolm Gillies (NCEA & USQ)
M 0429 662 802
E malcolm.gillies@usq.

Andres Jaramillo (SRA)
E ajaramillo@sugarresearch.com.au
M 0475 973 282

Marian Davis (BPS)
E mdavis@bps.net.au
M 0428 927 079



Nitrogen use efficiency research benefits from eyes in the sky

The NSW Department of Primary Industries (NSW DPI) is challenging the way in which N levels may be rapidly measured and monitored as part of their research on one- and two-year cane crops in the Tweed and Richmond catchments.

Over the past eighteen months, research has been underway to assess the nitrogen (N) stores in soil to improve understanding of N supplied from the natural breakdown of soil organic matter. It is also investigating optimal use of a 90-day polymer coated urea (PCU) enhanced efficiency fertiliser (EEF), to better match N supply with N demand from the crop.

The research is one of ten cross-industry projects seeking to increase nitrogen use efficiency (NUE) under the *More Profit from Nitrogen Program*, supported by the Australian Government's Department of Agriculture and Water Resources Rural R&D for Profit program and SRA.

The outcome of this research will be the development of a dose response and economic return model for traditional urea versus PCU, considering soil type and N supplied via mineralisation, so that growers can consider crop response and economic scenarios in making N fertiliser decisions.

The application of remote sensing technology is helping the research to tackle costly, time consuming and logistically challenging high frequency leaf sampling needed to observe N response to varying products and rates. The use of unmanned aerial vehicles – commonly known as drones – with multispectral imaging may sound futuristic, but its use in the research gives the industry an insight into how close this type of technology may be to more common grower use.

"This type of research is all about ground-truthing what we are capturing using the technology," said Josh Rust, NSW DPI's technical officer. "We have compared data from various indices captured by the imaging to traditional leaf N analyses take throughout the growing cycle and sugarcane yield at crop maturity."

Spectral data is collected using a Micasense Red Edge™ 5-band camera fitted to a DJI M600 hexacopter. The camera captures images simultaneously at five discrete wavebands, effectively separating green, blue, red, near-infrared (NIR) and rededge, with data outputs enabling the team to test and optimise mathematical algorithms which will ultimately inform the N dose and economic response model for growers.

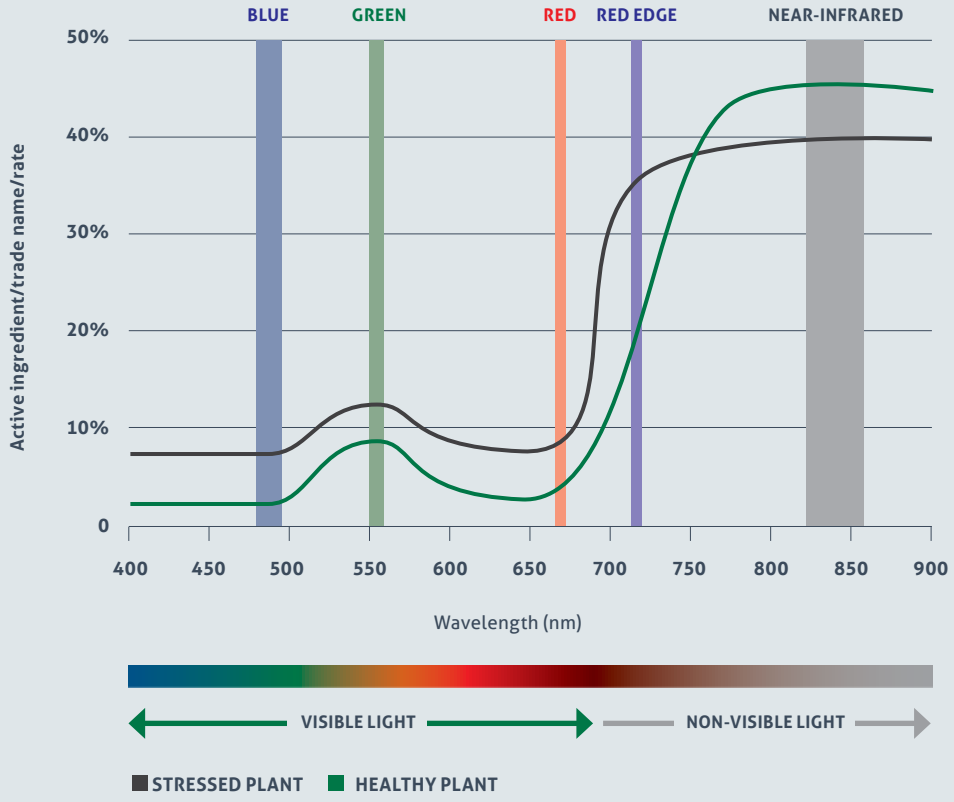
While the NSW DPI team view initial work as preliminary, there has been correlation found between reflectance (using Normalised Difference Vegetation Index (NDVI)) and field measured leaf N content. Team leader, NSW DPI's Lukas Van Zwieten, admits there are still "fine tuning" bumps to address.

"We are investigating some alternative algorithms for reflective indices as we discovered NDVI was subject to saturation as the crop canopy closed. We also need to pinpoint analysis to account for small areas of reflectance from shadow, soil surface variability and buffer rows."

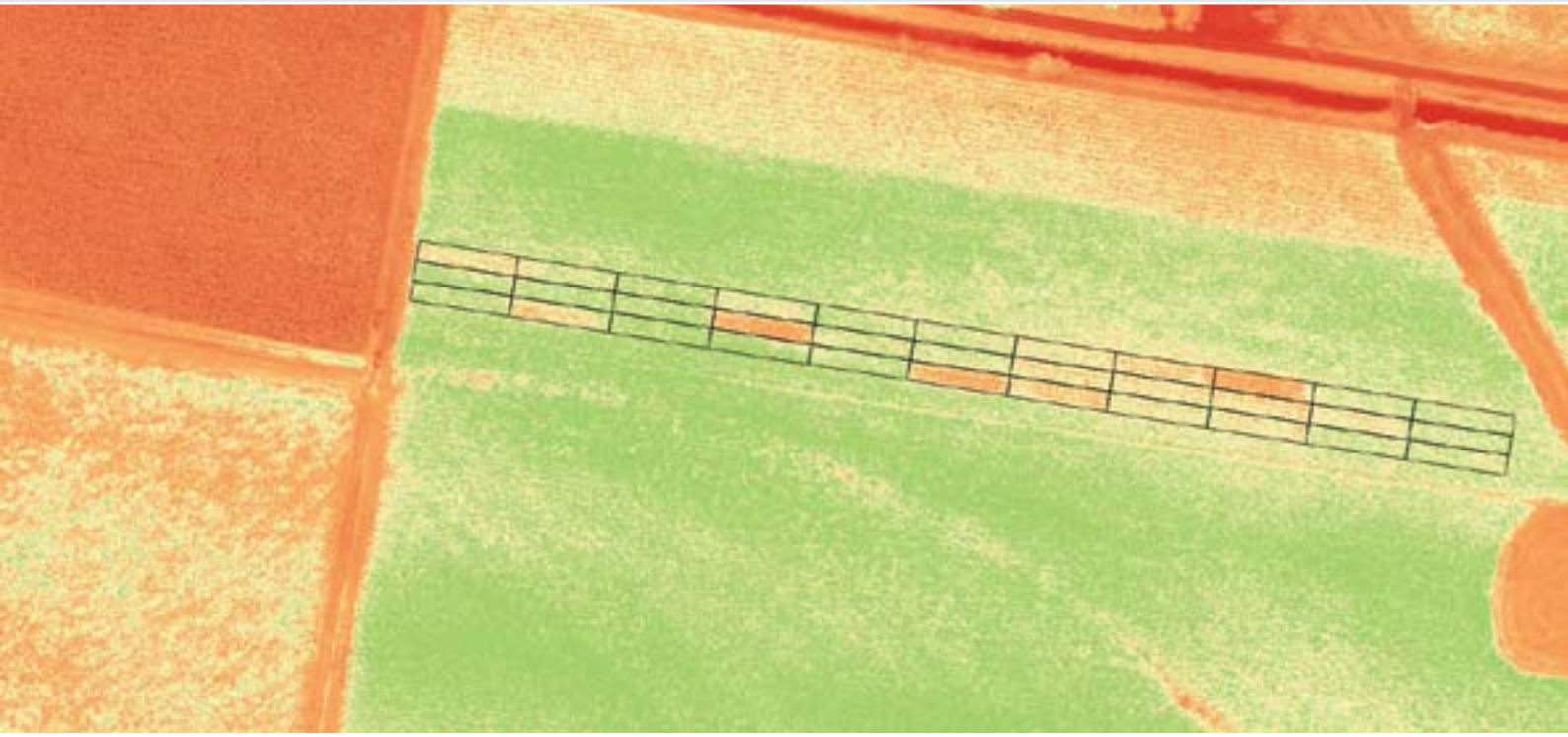
While the spectral data is being used at this stage to assist with research on EEFs, the technology also has potential to accurately identify areas in the field with other constraints limiting yield and fertiliser use efficiency. There is no doubt, however, that a future of accurately predicting in-field N stocks with remote sensing technology is drawing upon the industry and will only improve the precision in which EEFs are utilised and assessed for their economic returns by growers. ■

www.crdc.com.au/more-profit-nitrogen

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, NSW Department of Primary Industries and Sugar Research Australia. It is also supported by research collaborators Southern Cross University and Sunshine Sugar Agricultural Services.



(Over page) Richmond Catchment Trial Site - Northern NSW. ***(Left)*** *By measuring the reflectance of a plant at different wavelengths, multispectral imaging enables identification of areas of stress in a crop, and provides a quantitative metric for the vigor of a plant. (image c/o Micasense).* ***(Below)*** *NDVI image of the EEF cane trial site in the Richmond Catchment Northern NSW (experimental plots overlayed). The trial is testing five rates of urea, five rates of the EEF 90 day polymer coated urea, and nil N control with three replicates in a randomised blocked design. Green indicates higher leaf N content.* ***(Bottom left) 1.*** *Micasense Red Edge™ camera.* ***(Bottom left) 2.*** *DJI Matrice 600 Pro Hexacopter.*



1.

2.

Total Research and Development Investment

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 1 (Optimally-adapted varieties, plant breeding and release)				
AISRF: Genetic control and genomic selection for important traits in sugarcane	2016803	SRA, Sugarcane Breeding Institute - Coimbatore	Prakash Lakshmanan	1/05/2019
Exploiting introgression for the development of productive & regionally adapted varieties for NSW	2013/022	NSW Sugar Milling Co-Operative Limited	Roy Parfitt	1/05/2020
Applying the genome sequence for variety improvement: validation and implementation	2013/030	CSIRO	Karen Aitken	1/08/2020
Sugarcane root systems for increased productivity; development and application of a root health assay	2015/002	CSIRO	Anne Rae	1/07/2018
Impact of stool architecture on ratooning ability	2015/004	CSIRO	Anne Rae	1/08/2018
Leaf sucrose: The link to diseases, physiological disorders such as YCS and sugarcane productivity	2015/016	SRA	Gerard Scalia	30/06/2019
Generation of a high throughput SNP 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	1/08/2018
Selecting high value chromosomes from wild introgression material to deliver more resistant varieties faster	2015/026	CSIRO	Karen Aitken	1/08/2018
Improving early stage selection of SRA breeding program by indirect selection of plant vigour	2016/028	SRA	Jaya Basnayake	1/07/2019
Optimising productivity, variety recommendations and mill operations through analysis of mill data	2016/032	SRA	Jo Stringer	1/02/2021
New approaches to identify and integrate Pachymetra resistance genes from Erianthus into 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	1/07/2019
Reviewing and extending knowledge of fibre quality assessment and effects of cane varieties	2017/001	QUT	Geoff Kent	1/09/2018
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	1/07/2022
Compendium of sugarcane traits and their associated genes	2018/001	CSIRO	Donna Glassop	1/06/2019
Validating root system traits for enhanced nutrient capture in challenging environments	2018/002	CSIRO	Anne Rae	1/09/2021
Impact of stool architecture on ratooning: extending current trial to 4R to strengthen correlations	2018/004	CSIRO	Anne Rae	1/03/2021
Genetic analysis and marker delivery for sugarcane breeding	2018/005	CSIRO	Karen Aitken	30/06/2022
Selecting high value chromosomes from Saccharum species - extension to 2015/026	2018/006	CSIRO	Karen Aitken	30/06/2020
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability - *continued*)				
Strategies to manage soil-borne fungi and mitigate sugarcane yield decline	2013/101	CSIRO	Paul Harvey	1/09/2018
Improving NUE for sugarcane crops with constrained yield potential	2015/065	SRA	Danielle Skocaj	15/0602018
Improving management practices of legume crop residues to maximise economic and environmental benefits	2015/074	DSITI	Weijin Wang	30/06/2018

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability - *continued*)				
More profit from nitrogen: enhancing the nutrient use efficiency of intensive cropping and pasture systems	2015/907	CRDC	Felice Driver	30/06/2020
SIX EASY STEPS - continuing perspectives in time and space	2017/004	USQ	Bernard Schroeder	1/02/2022
Measuring soil health, setting benchmarks and driving practice change in the sugar industry	2017/005	SRA	Dave Olsen	1/08/2022
Unravelling the impact of climate and harvest time on nitrogen fertiliser requirements	2017/009	SRA	Danielle Skocaj	4/03/2022
Seeing is believing: managing soil variability, improving crop yield and minimising off-site impacts in sugarcane using digital soil mapping	2017/014	UNSW	John Triantafilis	1/10/2020
Decision support for choice of enhanced efficiency fertilisers - Herbert catchment pilot study	2017/015	CSIRO	Kristen Verburg	28/02/2019
Implementation of root system diagnostics to deliver a field-based measure for root health	2018/ 003	CSIRO	Anne Rae	1/08/2021
Greenhouse gas emissions from sugarcane soils: strategies for increasing NUE and reducing environmental pollution	2018/007	QUT	Peter Grace	30/06/2021
Establishing sugarcane farming systems to improve soil health	2018/008	SRA	Barry Salter	1/03/2023
Complete nutrient management planning for cane farming (**Funding provider:** Queensland Government Department of Environment and Science)	2016804/ RP161/ EHP16032	SRA/Farmacist	Frikkie Botha	30/06/2019
Improved water quality outcomes from on-farm nitrogen management. (**Funding provider:** University of Queensland)	2016805/ UQ_NESP	SRA	Danielle Skocaj	30/12/2018
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))	2016807	CANEGROWERS / SRA	Barry Salter	1/05/2021
Key Focus Area 3 (Pest, disease and weed management)				
Integrated disease management for sugarcane streak mosaic in Indonesia (**Funding provider:** Australian Centre for International Agricultural Research)	2013802	SRA	Rob Magarey	31/12/2018
Soldier fly management	2015804	SRA	Andrew Ward	31/12/2019
Cane to creek: Russell Mulgrave growers and the nitrogen story (**Funding provider:** Queensland Government Department of Environment and Science)	2017801	SRA	Belinda Billing	31/07/2019
Feeding behaviour of Soldier fly	2017808	SRA	Andrew Ward	30/06/2019
Development for an improved commercial assay for ratoon stunting disease (RSD)	BIOBRSD	SRA	Rob Magarey	30/06/2020
Modern diagnostics for a safer Australian Sugar Industry	2017809	SRA	Nicole Thompson	30/06/2022
Solving Yellow Canopy Syndrome	2014/049	SRA	Dave Olsen	30/06/2019
A Novel Polyphasic Framework to resolve Yellow Canopy Syndrome Paradox	2014/082	UWS	Brajesh Singh	1/09/2018
Using Remote Sensing to improve canegrub management in North Queensland cane fields	2015/038	SRA	Nader Sallam	1/12/2018
Field ready, optimised precision weed identification sensor system	2015/055	USQ	Steve Rees	1/04/2019
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with the existing product.	2016/003	SRA	Andrew Ward	1/01/2020

PROJECT TITLE	PROJECT NUMBER	PRINCIPAL R&D PROVIDER	CHIEF INVESTIGATOR	END DATE
Key Focus Area 3 (Pest, disease and weed management - *continued*)				
You can't manage what you can't identify - Managing threats from exotic moth borers through accurate identification	2016/041	SRA	Andrew Ward	1/07/2018
Molecular assay of major soil-borne pathogens for better exploitation of commercial varieties	2016/047	SRA	Rob Magarey	1/07/2018
Investigation of biotic causes of yellow canopy syndrome	2016/064	UQ	Andrew Geering	1/12/2019
Keeping our chemicals in their place - in the field	2017/008	SRA	Emilie Fillos	1/07/2021
Delivering solutions for chlorotic streak disease	2017/010	SRA	Kathy Braithwaite	30/06/2020
Development of commercial molecular biological assays for improved sugarcane soil health and productivity	2018/009	SRA	Rob Magarey	30/06/2021
Moth Borers – how are we going to manage them when they arrive?	2018/010	SRA	Andrew Ward	1/08/2021
Key Focus Area 4 (Farming systems and harvesting)				
A non-pneumatic cane cleaning system with no cane loss.	2014/035	QUT	Floren Plaza	1/06/2019
Increased Harvest Recovery: Reducing sugar loss and stool damage	2014/048	SRA	Joseph Bonassi	1/05/2019
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	1/02/2019
Sugar from space: improved data access, yield forecasting and targeted nitrogen application for the Australian Sugar industry	2016/062	UNE	Andrew Robson	1/01/2020
Understanding Interactions Between Basecutters and Other Forward-feed Components with the Cane Stalk, and Determining Practical Strategies to Minimise Damage as Harvester Speed Increases.	2016/952	Norris ECT	Chris Norris, Phil Hobson	01/042020
Commercial Scale Economic Evaluation of Post-Harvest Cane Cleaning to Maximise the returns to the Supply Chain.	2016/953	QDAF	Stephen Ginns	30/06/2019
Adoption of practices to mitigate harvest losses	2016/955	SRA	Phil Patane	30/06/2019
Southern Sugar Solutions	2017/012	DAFQ	Neil Halpin	1/01/2021
Improved irrigation system selection and operation for increased sugarcane productivity and profitability	2018/011	USQ	Michael Scobie	30/06/2021
Cane Cleaning Project (**Funding provider:** Queensland Government Department of Agriculture and Fisheries)	2016808	SRA	John Panitz	1/05/2019
Key Focus Area 5 (Milling efficiency and technology)				
Real time harvest and transport system	2014/037	QUT	Geoff Kent	1/09/2018
Investigation into modifying pan boiling techniques to improve sugar quality	2015/013	QUT	David Moller	30/05/2019
Increasing capacity to undertake cane preparation research through modelling and experimentation	2015/018	QUT	Geoff Kent	1/04/2019
Online analysis systems to measure the available nutrients in mill mud	2016/019	SRA	Steve Staunton	1/03/2020
Reducing boiler maintenance costs and deferring capital expenditure through improved technology	2016/020	QUT	Floren Plaza	1/07/2020
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 juice degradation in factory evaporators on sugar recovery and quality, corrosion and effluent organic loading	2017/007	QUT	Darryn Rackemann	1/12/2020

PROJECT TITLE	PROJECT NUMBER	PRINCIPAL R&D PROVIDER	CHIEF INVESTIGATOR	END DATE
Key Focus Area 5 (Milling efficiency and technology - *continued*)				
Pan design and operational changes to suit Australian pan stages operating on low pressure vapour	2018/012	QUT	Ross Broadfoot	1/10/2021
Evaluation of the Neltec Colour Q for measuring the purity of magma from C centrifugals	2018/201	Isis Central Sugar Mill Company Ltd	David Pike	1/05/2019
Improving the impact of evaporator calandria noxious gas bleeding arrangements on evaporator rate and condensate quality at Racecourse Mill	2018/202	Mackay Sugar Limited	Brett Bampton	14/05/2019
Understanding the cause of high colour sugar - intrinsic cane colour, extraneous matter or factory practices?	2018/203	Wilmar Sugar	Robert Stobie	1/04/2019
Activated Sludge Plants – Optimizing Operations and Technology	2018/204	Wilmar Sugar	Robert Stobie	1/04/2019
Key Focus Area 6 (Product diversification and value addition)				
A profitable future for Australian agriculture: Biorefineries for higher-value animal feeds, chemicals and fuels	2015/902	QUT	Ian O'Hara	1/02/2019
Manipulation of carbon partitioning to enhance the value of sugarcane (ARC LINKAGE UQ collaboration with SRA contribution)	2016801	UQ (SRA contribution)	Frikkie Botha	30/12/2019
Key Focus Area 7 (Knowledge and technology transfer and adoption)				
A boiler simulator for improved operator training	2016/001	QUT	Anthony Mann	1/07/2018
Protecting our chemicals for the future through accelerated adoption of best management practice	2016/002	SRA	Belinda Billing	1/08/2019
Development of an Intelligent Tool to allow real time evaluation of harvesting practices as part of a framework for improved harvester payment systems.	2016/951	Norris ECT	Stuart Norris, Rob Crossley	30/06/2019
Productivity improvements through energy innovation in the Australian sugar industry	2017/011	Ag Analytics	Jon Welsh	30/06/2020
Pathways to water quality improvements in the Myrtle Creek sub catchment (**Funding provider:** Queensland Government Department of Environment and Science)	2017810/ EHP17066	SRA	Phil Ross	30/05/2020
Key Focus Area 8 (Collaboration and capability development)				
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	15/10/2018
Investigation of genetic control of sugarcane accumulation within the sugarcane culm (stalk)	2014/107	UQ	Patrick Mason	1/06/2018
Soil nitrogen dynamics - a microdialysis approach to quantify nitrogen cycling in sugarcane soils	2014/108	UQ	Scott Buckley	1/03/2018
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	1/02/2019
Combining controlled release and nitrification inhibitor properties to deliver improved fertilizer nitrogen use efficiency in high risk environments	2016/101	UQ	Chelsea Stroppiana	31/03/2020
Development and modelling of novel controlled release fertilisers for improved nutrient delivery efficiency	2016/102	UQ	Ian Levett	1/09/2020
Integrated standardised competency based training for Sugar Milling operations	2017/103	QUT	David Moller	1/12/2019

Sugar Research Australia Limited
ABN 16 163 670 068

Head Office
50 Meiers Road
Indooroopilly QLD 4068
Australia

Postal Address
PO Box 86
Indooroopilly QLD 4068
Australia

Tel 07 3331 3333
Fax 07 3871 0383
Email sra@sugarresearch.com.au
Web sugarresearch.com.au