Sugar Research Australia

CaneCONNECTION

Autumn 2020

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(Cover page) SIX EASY STEPS validation trial in the Rocky Point region.

***Design:** Catherine Jorissen, SRA.*

WELCOME TO THE AUTUMN 2020 EDITION OF *CaneCONNECTION*

Welcome to the Autumn edition of SRA's CaneConnection magazine, bringing you information on SRA's investment into research, development and adoption across the industry.

In this edition, we update you on research being led by Norris ECT examining the front-end components of harvesters looking for solutions that could improve the efficiency of harvesting. You can read more about this on page four and five, specifically trials that occurred at Condong, NSW, in late 2019. Just up the road at Rocky Point, we also look at the process for developing new SIX EASY STEPS nutrient management guidelines for that region. The growers involved in this development say that the guidelines are a win-win: saving them money and helping them continue to improve their sustainability.

This edition also visits the Southern Region to see the Aquatill in action; outlines exciting new opportunities that are arising within sugar mills for the application of near infra-red; and also looks at the correct application of liquid imidacloprid.

Finally, a reminder that there are plenty of great events coming up in the next few weeks, including SRA's annual grower research updates. These events are a chance to chat about the latest research developments, meet the scientists and adoption officers doing the work, and to answer your questions. We hope to see you at your nearest update. For more information, visit the events page of the SRA website. You can also contact your nearest SRA station for more information.

Brad Pfeffer

Executive Manager, Communications

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BY THE NUMBERS

50,000

THE PSI OF THE WATER NOZZLES THAT CAN CUT THROUGH CANE TRASH ON THE AQUATILL. PAGE 20

100mm

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$50,000

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80-95

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$1-$1.50

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ROSLYN BAKER NEW CEO AT SRA

SRA's new CEO Roslyn Baker (pictured) commenced at SRA earlier this year and has been in the midst of an extensive listening tour across the industry in February and March.

"My immediate priority is to meet with and listen to SRA's stakeholders and staff to get an in-depth appreciation of how SRA is contributing to the industry," Ms Baker said.

"Throughout February and early March, I have been undertaking a regional listening tour across the industry to hear, first-hand, the important issues in relation to investment in research, development and adoption by SRA as well as broader industry issues that affect this investment. This is also an opportunity to better understand the opportunities and challenges facing the industry, and ensuring SRA continues to deliver value to its customers."

Roslyn Baker comes to SRA with experience as a CEO and Chief Operating Officer in large and complex organisations in the utility sector and in local government in both Queensland and New South Wales.

SRA Chairman Dr Ron Swindells said her experience in leading and engaging people, stakeholder engagement, transformational change, and finance will be a great asset to SRA and the Australian sugarcane industry.

"The Australian sugarcane industry continues to face pressure from the weather and global market forces, but it also has exciting opportunities ahead of it. SRA is here to help the industry capitalise on these opportunities by continuing to deliver world-class research, development and adoption outcomes for growers and millers," Dr Swindells said.

"Roslyn will guide SRA's strategic direction as set in our five-year Strategic Plan with the support of the SRA Board, Executive Team, and our dedicated and professional staff." ■

(Below left) Chris Norris, Norris ECT, during one of the trials in late 2019 in the Condong mill area. (Below middle) Chris assessing stool damage after the modified harvester has been over the top. (Below right) Modified position of the knockdown roller on a John Deere 3520.

OPTIMISING THE FRONT END FOR BETTER HARVESTING

NORRIS ECT HAS BEEN INVESTIGATING THE POTENTIAL FOR MODIFYING THE FRONT-END COMPONENTS OF SUGARCANE HARVESTERS TO UNDERSTAND OPPORTUNITIES FOR IMPROVEMENT AND EFFICIENCY. *BY BRAD PFEFFER*

To see a video of this project in the field, hover your smartphone's camera over the QR code.

The spindles on a cotton picker are matched to groundspeed. The reel on a grain header is also matched to groundspeed.

In the sugarcane industry, however, it is a different story, with the front-end components not matched to the speed of the harvester as it moves along the row.

However, in recent years, research led by Norris ECT has conducted trials with harvesters where spiral and basecutter speed has been matched to groundspeed, in order to help the industry understand the potential efficiencies that could be gained.

This work has occurred with five modified harvesters that have operated in regions from NSW to Far North Queensland over several seasons. The trials have assessed a range of issues and have had a strong focus on yield in subsequent ratoons and ratoon length.

"We discovered from our first series of trials that between 80 and 95 percent of the cane stools were severely damaged after a conventional harvesting operation," Chris Norris, Norris ECT, explained.

"We also saw there was lower shoot emergence and lower yield the following year. We are also collecting more precise information on the impact on yield for subsequent crops and what aspects of the gathering and feeding process were causing this damage."

In addition to trials that have matched front-end component speed to ground

speed, the Norris team has also looked at other modifications to front-end components.

Before that occurred, though, an important part of this process was understanding the baseline of the damage from the basecutters. To do this, the research team needed a trial that understood the true impact of the spirals and the knockdown and fin roller.

With that in mind, in the 2018 season, the Norris ECT team cut cane by hand at about 20cm above the ground and then harvested it with a conventional harvester.

This meant that the cane passing through the harvester never touched the forward-feeding components. This allowed Norris ECT to understand how much of the damage to the stool was occurring before the cane reached the basecutters. By assessing each stool, and comparing it to conventionally harvested cane, this gave the Norris ECT team information on the relationship between the spirals and knockdown and fin roller on stool damage.

"In 2019 we went in again with a conventional harvester into the plots that were hand cut in 2018," Chris explained. "From that, our yields were between 7 percent and 25 percent higher in those sections compared to the section beside that had been treated conventionally.

"This trial took out the gathering and knockdown effect. When we did the post-harvest analysis we saw that the damage to the stool was about halved."

With that baseline information, Norris ECT understood that there was an opportunity for the industry to regain value.

Their next step was to investigate modifications to the harvester that would improve the feeding of the cane and therefore result in less damage to the stool. This included an assessment of a new positioning of the knockdown roller so that the cane was more erect as it entered the harvester.

When CaneConnection caught up with Norris ECT recently, they were harvesting a trial at Condong on the Tweed Valley in the final days of the 2019 crush.

This trial included an assessment looking at a modified positioning of the knockdown roller on a John Deere 3520 owned by Citifarm, whose manager is Dave Bartlett. The roller is positioned so that the cane reaches the basecutters at a more erect position.

On the day of this trial, the machine was harvesting a crop of about 110 tonnes per hectare and Chris said it appeared to be feeding well at a groundspeed of 6km per hour.

"We are trying to prove that if we don't knock the cane down as hard then there will be a lot less damage. We are also observing how the cane is feeding into the machine, including through GoPro cameras attached to the harvester."

This work builds on research from the early 2000s by Sander Kroes, particularly around the determination of how far cane can bend before it reaches an angle where it breaks.

"We are hoping to see a lot less stalk snapping below the surface and a lot less shattering. In a standard system there is a lot of pressure on the stalk prior to cutting, which results in deep shatters and snapping. The result we hope is an improvement in ratooning and better crop growth and therefore an improvement in yields the following year."

Norris ECT are also collaborating with researchers at the Queensland University of Technology on this project, who are using computer modelling to simulate the breaking point of cane and the impact on billets. ■

Australian Government
Department of Agriculture

This project is supported by funding from SRA and the Australian Government Department of Agriculture as part of its Rural R&D for Profit program.

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(Over top left) *Gavin Rodman and Ben Spann weighing fertiliser as part of the calibration.*
(Over top right) *Ben Spann, Gavin Rodman and Sebastian Garcia-Cuenca calibrating Ben's fertiliser box for the application of one of the trials in November 2019.*
(Over middle right) *Larry Spann (pictured) and Ben Spann grow cane on over 200 hectares at Norwell.* ***(Over bottom)*** *In the field calibrating the fertiliser box for the trials.*

EASY AS 1, 2 3 .... 4, 5, 6

SRA IS WORKING WITH LOCAL INDUSTRY IN THE ROCKY POINT REGION TO DEVELOP SUSTAINABLE NUTRIENT MANAGEMENT GUIDELINES FOR THAT AREA, HELPING IMPROVE PROFITABILITY AND SUSTAINABILITY.
BY BRAD PFEFFER

Father and son team Larry and Ben Spann grow cane on about 200 hectares of lease country in the Rocky Point region near Norwell.

They see a solid future for the industry to the point where they are developing another 30ha of country for planting this year. However, at the same time, they are also acutely aware that the low sugar price means that they must be efficient with their inputs and reduce costs.

This need to improve efficiency and profitability for the business was a key reason that Ben has worked with fellow Rocky Point grower, Josh Keith, in recent years to drive the development of SIX EASY STEPS guidelines for their region, between Brisbane and the Gold Coast.

"When you are leasing country, your economics are very tight, so profitability has been a key driver for me when pushing to have SIX EASY STEPS guidelines for the district," Ben said.

"As an industry we are also aware of the need to improve sustainability and reduce our environmental impact. Developing the guidelines was a chance for us to be proactive, and the upside is that we should be able to save money."

To date, SIX EASY STEPS guidelines are in place for all other regions of the Australian cane industry. Now, thanks to the work of Ben and Josh, with support from SRA, the local Rocky Point draft guidelines are being validated through trials.

This work is occurring through SRA staff Sebastian Garcia-Cuenca (Regional Coordinator for New South Wales and Rocky Point), Gavin Rodman (Adoption Officer), John Panitz (Principal Technician), along with Bernard Schroeder from the University of Southern Queensland and Victor Schwenke with the local productivity services.

CaneConnection caught up with Ben late last year as two validation trials were being fertilised. These trials have followed extensive soil testing and data collection and will compare the growers' traditional rate to the proposed SIX EASY STEPS rate.

These trials, with more in the future, will be a driving factor to help see the local guidelines adopted on farms in the region in years to come.

In Ben's case, he is already learning more about his soils and nutrient management.

"I've been doing soil tests for about 10 years, but it has been generally just one or two samples per year. In 2019 I did seven and through this work I've learnt about the diversity of my soils and the need to understand them better," he said.

"Three years ago I was applying 180 units of N, then in 2018 it was 170, then in 2019 I dropped it to 160 units of N across the board, but with the extra phosphate and potassium that we've identified that I need.

"I've already reduced my costs, and if I can get an increased crop yield, then that will be even better."

Ben is doing other things on his farm to drive a sustainable farming system. In recent years he has made longer rows where possible and converted to dual-row 1.8 metre beds to reduce compaction and time in the paddock. The farms were previously on 1.55m.

Being a co-owner in a harvesting business, he estimates that the wider rows have reduced harvesting costs by between $1 and $1.50 per tonne.

"The saving through time in the paddock and reduced cost has been unreal for me," he said. "We are doing everything we can to get our costs down, while also changing practices to make things more sustainable as well.

"One day, if my son decides to farm, the place will be in a better condition than it is today." ■

SIX EASY STEPS®

To see a video of this project in action in the field, hover your smartphone's camera over the QR code.

The SIX EASY STEPS to improved nutrient management

1. Knowing and understanding our soils
2. Understanding and managing nutrient processes and losses
3. Soil testing regularly
4. Adopting soil specific fertiliser recommendations
5. Checking on the adequacy of fertiliser inputs
6. Keeping good records and modifying nutrient inputs when and where necessary

The concept of SIX EASY STEPS means combining a number of possible actions to ensure sustainable nutrient usage on the farm. This combination forms a 'whole system' approach to nutrient management.

(Below left) Ross Threlfall, Steve Staunton and Michelle Larsen in front of the Micro NIR instruments attached to the number five mill at Tully.
(Below left) Michelle Larsen and Steve Staunton at the mud hopper. ***(Over page)*** *Data on display as captured by the Micro NIR, measuring moisture, pol and fibre every seven seconds.*

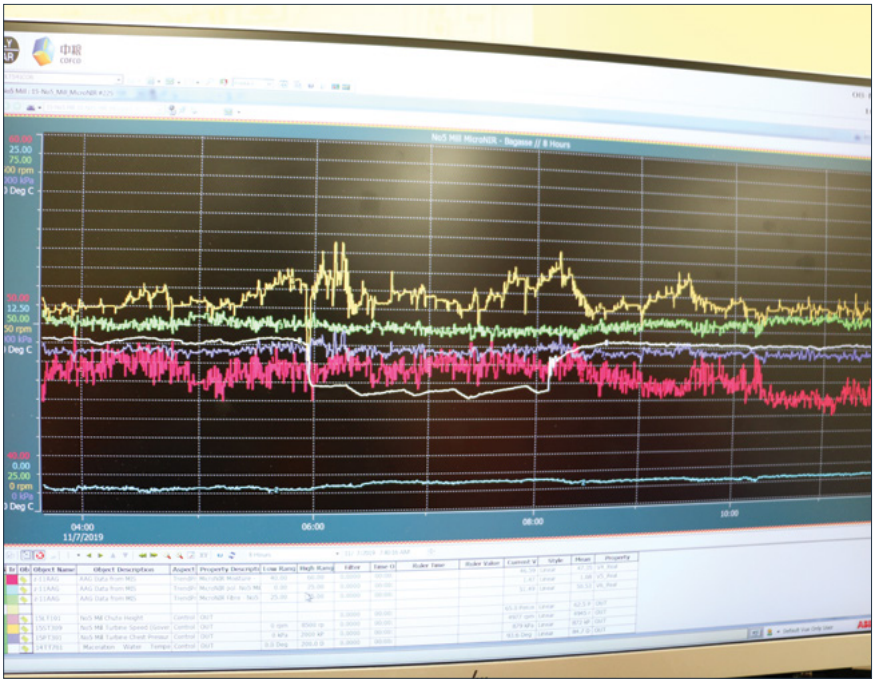
NEW OPPORTUNITIES **OPENING UP FOR NIR**

Recent advances in near infra-red (NIR) instruments and technology are creating new opportunities for Australian sugar mills.

One of these next generation NIR instruments – called a Micro NIR – fits into the palm of your hand and costs about one third of the price of its predecessor instruments.

This advance in instrumentation has prompted the Australian industry to investigate the possibilities for NIR analysis in new areas of sugar mills beyond the established applications such as cane payment.

The use of on-line NIR systems, including with support from SRA to analyse and interpret the data, is well-established in a number of Australian mills. The technology allows millers to collect data in real time and also to gather this information in situations where traditional methods are difficult or hazardous.



The smaller instruments that are now available have the potential to fit into new areas of the mill, and their lower capital cost puts the technology within a more realistic cost bracket for new applications.

It is something that Tully Sugar Limited have been keen to further understand. With the help of SRA, they have been testing two Micro NIR instruments attached to the Tully mill in recent seasons.

One of these instruments is being used to provide real-time feedback on mill-mud, via an SRA-funded research project. The other instrument is attached to Tully's number five mill and provides real-time and online feedback of bagasse, building on previous research where SRA worked with much larger instruments to assess bagasse at the Mulgrave Mill.

"The real advance now is the instrumentation," SRA's Steve Staunton said. "With the Micro NIR being so compact, it opens up new opportunities. The older systems were also difficult to install and there were challenges around sample presentation and validation.

"With this instrument we are getting information of a similar quality, and it can be done for an investment in the machine of about $50,000."

SRA provides expertise and support to ensure efficient use of the Micro NIR, and also ensures the data generated by the instrument is accurate and understandable.

TSL Operations Engineer, Ross Threlfall, said TSL was interested in the Micro NIR to see where it could enhance milling efficiency and consistency.

With the bagasse, for example, they were previously only measuring moisture content via moisture meter, whereas now the Micro NIR is providing moisture, pol and fibre every seven seconds.

"Currently bagasse quality analysis is performed by the laboratory, from samples taken over an 8hr shift. These results are only available on a daily basis," Mr Threlfall said. "With online monitoring, control or mill adjustments can be made sooner rather than later to optimise milling extraction.

"Our boiler operators are able to confirm and potentially take action earlier, in response to high moisture bagasse being received at boilers.

"It also gives us the ability to take action such as adjusting the maceration settings, or trying things like cool maceration. We have trialled different maceration settings this year, and we are still learning what we can do with the instrument."

The instrument has been attached directly to the exit chute of the mill and requires cooling due to the temperature of the bagasse (about 85 degrees Celsius or more). This is one of many issues that SRA has worked with TSL on during this season, to better understand how to best use the instrument in the tough environment of a sugar mill. There has also been a huge effort and collaboration with the TSL information technology team and engineering team.

In the future, the Micro NIR and supporting programming may also be able to gather valuable data on the full milling train to help minimise sugar loss through the mill, especially when used in conjunction with their existing NIR instrument looking at cane at the number one mill.

As they continue to look for new ways to use the data, Mr Threlfall said the Micro NIR would also allow TSL to calculate the calorific value of bagasse, which could then be correlated back to cane variety information. This could be useful for cogeneration by targeting particular bagasse for storage for use in the off-season.

There are other opportunities that are also being considered. This investigation has seen SRA work with TSL engineers and boilermakers to attach a Micro NIR to the mud hopper to determine factors such as pol losses and mud quality criteria.

Mr Staunton said the research could create additional value for growers as it could lead to them being able to better understand the beneficial impacts of recycling mill mud back to their farms.

This data offers advantages to both growers and millers, and may be useful for the industry to continue to demonstrate its strong adherence to best management practices. ■

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IMIDACLOPRID APPLICATION – MEASUREMENT OF APPLIED DEPTHS

BY MATT SCHEMBRI, ADOPTION OFFICER, SRA MACKAY

In SRA's Spring 2019 edition of CaneConnection, SRA Weeds Agronomist Emilie Fillols reported on trials that showed runoff losses of imidacloprid were minimised if the liquid imidacloprid was placed at least 100mm deep and covered with soil, as per the label instructions. The key message is that imidacloprid, if placed correctly, has a low chance of being transported into local waterways. Therefore, the continuing detection of imidacloprid in waterways adjacent to sugarcane growing land suggests that the imidacloprid is not being placed correctly.

With a view to gain an appreciation of the effectiveness of current machinery to achieve the recommended depths, SRA has commenced measuring application depths of imidacloprid. To date only stool splitter liquid imidacloprid applicators have been examined. We have looked at dedicated imidacloprid units and imidacloprid/fertiliser units consisting of coulters and double disc openers or double disc opener only assemblies.

After application of the liquid imidacloprid it is difficult to clearly identify the liquid imidacloprid in the soil. Therefore, the approach taken has been to confirm that the liquid imidacloprid was being directed to the bottom of the double disc opener slot, and subsequently measuring the depth of the slot. Two measurements were taken: depth of the double disc opener slot (application depth), and depth of covering soil in the slot (covered depth), as shown below in image one. Note also that measurements were taken relative to the soil surface: i.e. any trash blanket or mill mud/compost was removed prior to depth measurements.

The double disc openers were found to be able to achieve the recommended 100mm application depth, as long as the implement was set correctly.

In many cases, while the applicator averaged 100mm depth, measurements fluctuated around the average due to inconsistent stool height relative to the inter-row space. The depth wheels running in the inter-row spaces effectively set the depth of the double disc openers, so as stool height varied so did application depths as shown in the graph. Applicator unit one (as shown in the graph) was operating in a paddock with inconsistent stool height, and as a result the measured application depths varied from 60mm to 160mm, while applicator unit two was working in a paddock with consistent stool height and consequently had less fluctuations in the depths (100mm – 140mm). Note for both units the average depth across the measurements was greater than 100mm: i.e. for applicator unit one the average depth was 111mm and for applicator unit two the average depth was 114mm.

A key message was that operators reported it was important to check the application depths in each paddock and adjust the depth wheels to achieve 100mm application depth.

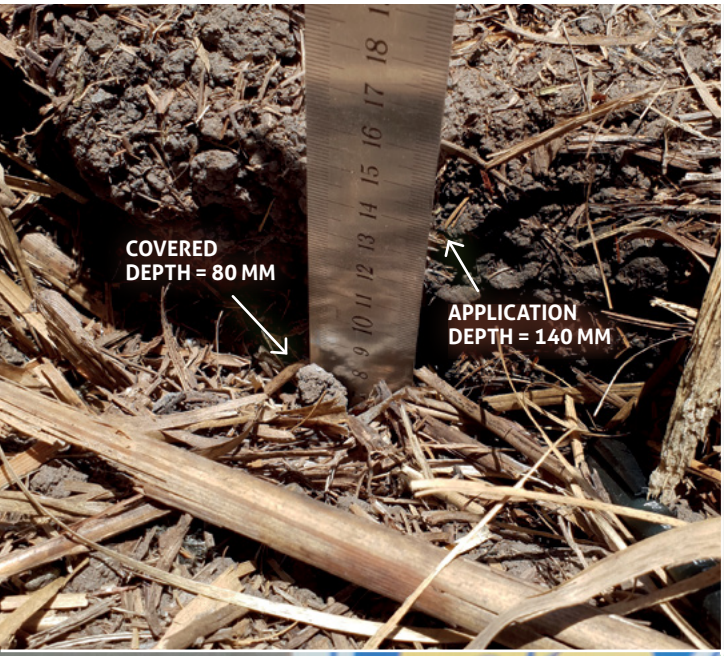
The implements with covering devices after the double disc openers (e.g. StoolZippa, press wheels) were found to consistently achieve covered depth equal to application depth. This generally did not occur for implements without covering devices or with relatively simple covering devices such as a chain. We also found that for implements without covering devices, soil type impacted depth of cover. For example, in gravelly soil conditions the soil flowed into the slot giving complete coverage, whereas if the soil had reasonable clay content or was damp, then coverage was inadequate.

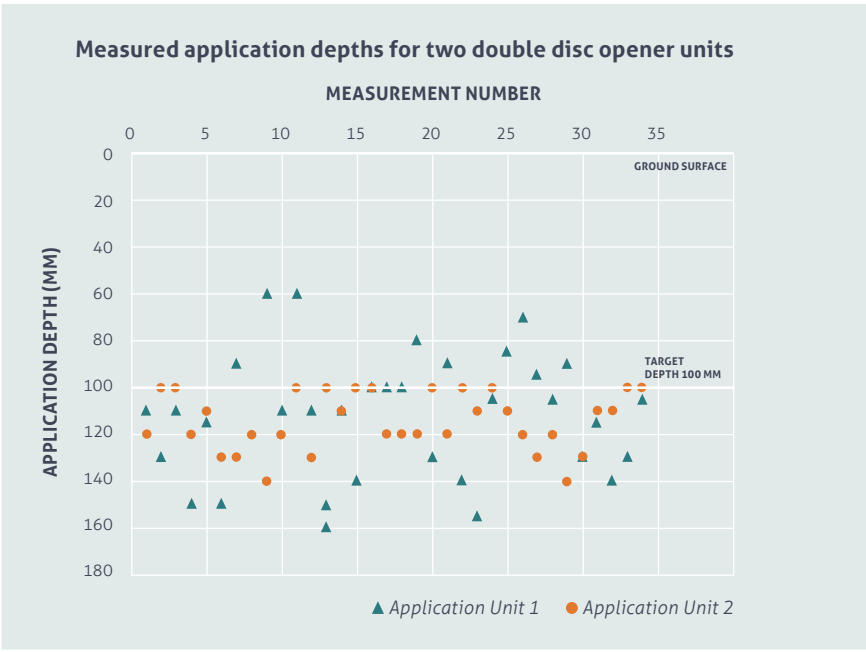
Placement of the imidacloprid in the slot is also important. The imidacloprid nozzle must be directed at the bottom of the double disc opener slot so that the jet of imidacloprid hits the bottom prior to soil flowing around the discs and covering the slot. We have observed that at times the nozzle gets bent backwards and as a result the imidacloprid is directed into the soil flowing around the discs which means that the applied imidacloprid is too shallow.

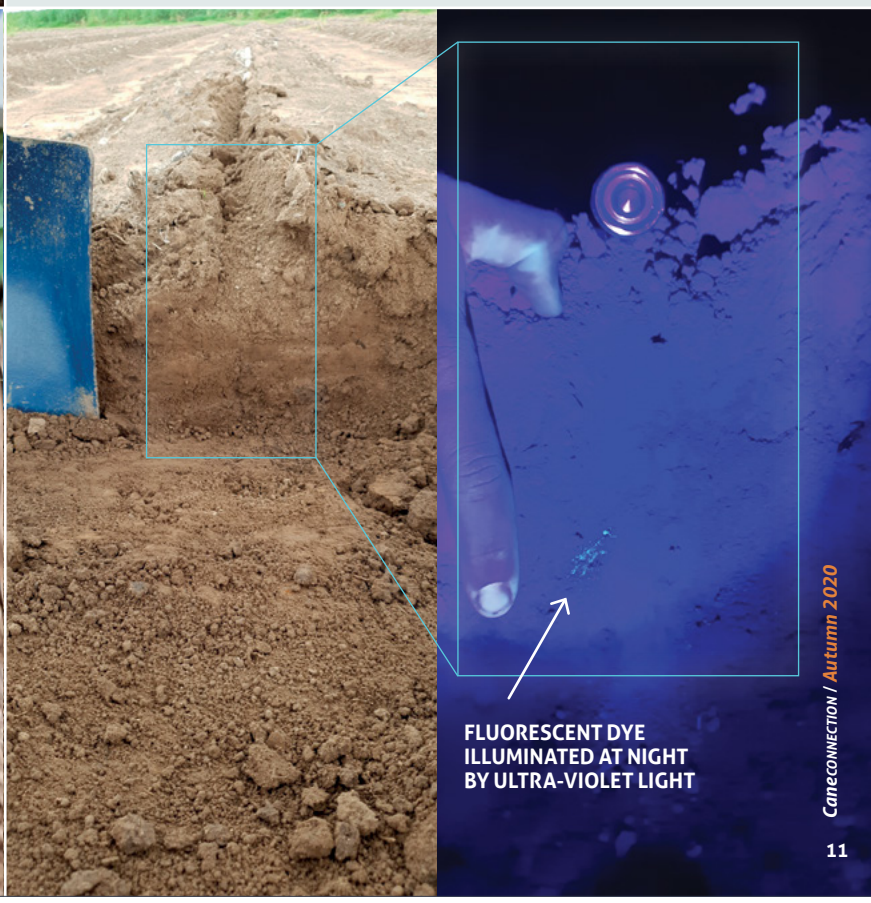
It is difficult to clearly identify the liquid imidacloprid in the soil after application. Therefore, we have recently commenced work using fluorescent dye added to the imidacloprid solution to identify the location of the applied imidacloprid. The imidacloprid and dye were applied using a double disc opener set to achieve 100mm depth with the nozzle directing the liquid at the bottom of the double disc opener slot. As shown in this example, the imidacloprid has collected at the bottom of the slot as expected. Further work is continuing to check if the double discs could potentially transport some of the imidacloprid toward the soil surface. ■

The work reported above is part of a new SRA-led project aimed at the best practice use of imidacloprid so as to ensure the industry's ongoing access to imidacloprid as a control for cane grubs. The project will consider all aspects of stewardship of imidacloprid. This includes, for example, the determination of when to use the chemical, calibration, application (including section controls) and correct placement, and using the chemical only for grub control. The project is a collaboration between SRA, the Queensland Department of Agriculture and Fisheries, CANEGROWERS, the Australia Cane Farmers Association, Bayer and NuFarm. It is funded by the Queensland Government Reef water quality program through the Enhanced Extension Coordination in the GBR project.

(Below top left): *Measurements taken for imidacloprid application.*
(Below top right): *Measured application depths for applicators working in two different paddocks.* ***(Below bottom left):*** *Image of imidacloprid jet directed at the bottom of the double disc opener slot prior to soil covering the slot.*
(Below bottom right): *Example of tracking the applied imidacloprid using fluorescent dye.*







GROWERS ENCOURAGED TO GET IN EARLY WITH PACHYMETRA SAMPLING

Sugarcane growers are being reminded to consider the crop pests and diseases that potentially could be within their paddocks, and affecting their yields, as they plan for 2020.

One of the most significant soil-borne pests of sugarcane is Pachymetra root rot, which can only be properly assessed with a soil sample analysis to determine its severity. The results from this soil analysis, which is a service provided by SRA through its Tully laboratory, provides growers with information on the appropriate management response.

"We encourage farmers to send their samples in to the laboratory for analysis early in the year," SRA Leader for Disease Management, Dr Rob Magarey, said. "This helps ensure that growers receive their results back with plenty of time before planting, which is crucial for helping them make decisions on what varieties to plant."

Pachymetra root rot can cause yield losses of up to 40 percent in susceptible varieties.

It is caused by a fungus-like organism and it reduces yield, causes gappy ratoon crops and can lead to an increase of soil in the cane supply.

It attacks the large primary roots of the sugarcane plant, stunting cane growth and reducing the anchorage of the plant in the soil.

If the yield loss impacts are not severe, significant crop losses can occur without growers noticing.

"Soil borne disease is not spectacular above the ground, so Pachymetra is not easily identified when driving around paddocks. Often crop losses are attributed to a range of factors, such as climate, poor nutrition, waterlogging, or drought," said Dr Magarey.

"Therefore, getting a soil assay done helps you diagnose the problem and manage it.

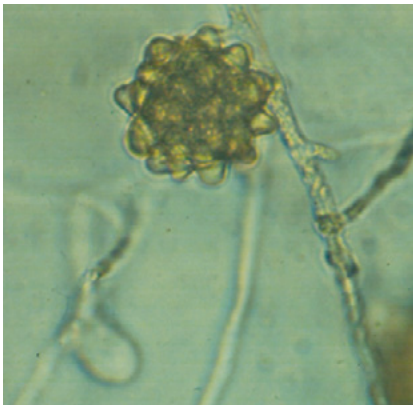
"Without an assay – unless the problem gets very severe – you are just unaware of it, even though it's impacting your productivity and profitability."

SRA Assay Lab supervisor, Ms Laura MacGillycuddy, has seen on many occasions where soil samples were submitted to the lab and testing showed very high levels of the disease.

"Often farmers are surprised to find that they have a Pachymetra problem, but they didn't realise it until they tested soil from their crops," she said.

"We encourage growers to get in early in 2020 and to sample comprehensively across their fallow paddocks, which will help them establish the best possible crop for the years ahead," she said.

"Getting in early ensures growers have their results back before the rush of sampling later in the year and that they have plenty of time to understand the results before making their planting decisions." ■



For more information on sending soil samples for analysis, growers should contact their local productivity services organisation; or Laura MacGillycuddy on
T 07 4088 0712
E assaylabtully@sugarresearch.com.au

TESTING HELPS TACKLE PACHYMETRA PROBLEM

Herbert region cane grower Ian Kemp knew there was something not right with one of his blocks on his farm, with productivity steadily declining.

No matter what variety he selected for the paddock, and despite a range of improvements to his farming system that he had introduced, production was well below par.

This was about five years ago, and after a discussion with Herbert Cane Productivity Services Limited (HCPSL), he sent soil samples to the SRA Tully laboratory for analysis for Pachymetra.

"The tests showed that I had a serious Pachymetra issue," he said. "The only sign was the yield. I knew about Pachymetra but at that time I didn't know much about its prevalence in the district or that I had a problem."

Since then, there has been extensive work in that region – and other regions – on tackling Pachymetra as a productivity constraint.

For Ian, he shifted to a resistant variety and said that the result was a notable improvement in yield – as much as 30 tonnes of cane per hectare.

Five years later, he now regularly sends samples to the Tully assay lab for analysis and has identified other hotspots on his farm.

"The key issue is getting suitable Pachymetra resistant varieties," Ian said. "Some of the new ones look promising but also needed to be tested on my farm. Last year I chased down SRA14 and I will also have a look at the new variety WSRA24."

He said that there was a growing awareness in the grower community of Pachymetra as an issue.

"There is plenty of demand at the SRA end for samples, so it is good to get in early sending them off."

Ian has also been proactive in improving his farming system and soil health over the years, going back as far as being an early adopter of green cane trash blanketing in the district in 1981.

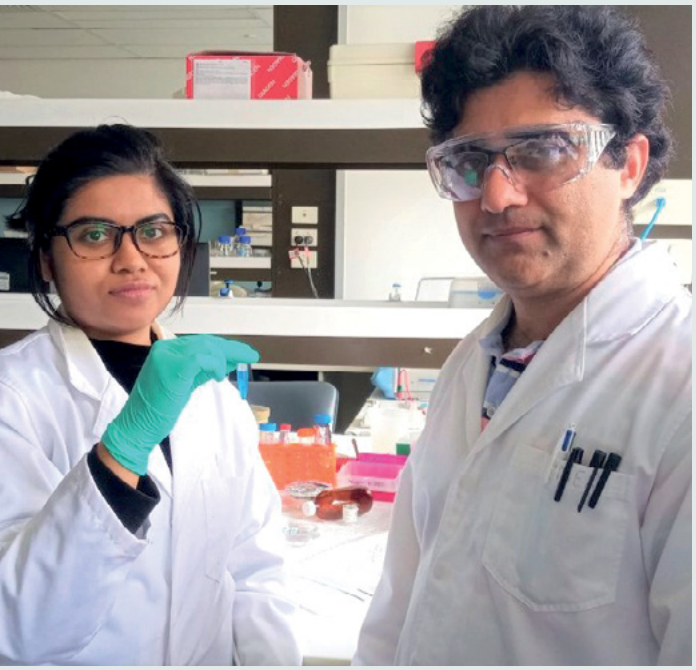
Today, he farms on 180cm rows and grows legume crops in the fallow period. He has adopted controlled traffic, minimizes tillage through the crop cycle, uses liquid fertiliser, and also uses softer chemistry as much as possible.

He has also been involved as a paired site through a collaborative research and extension project called *Measuring soil health, setting benchmarks and driving practice change in the sugar industry.*

He said that all his changes were about maintaining viability.

"I am aiming for a long ratoon length – eight to 10 years – for profitability, which is another reason why getting on top of Pachymetra is a big issue for me."

(Over page) *Herbert grower Ian Kemp said Pachymetra can be a sleeper issue creating significant productivity losses.* ***(Above)*** *Pachymetra under magnification.*



NEW TECHNOLOGY COULD MEAN A LEAP FORWARD IN ON-FARM DISEASE DETECTION

Every year plant diseases cause huge economic losses to the sugarcane industry. Combating them, however, is no easy task. While the key to management of diseases is their early diagnosis, in some cases methods currently in use haven't been upgraded for over a decade. Hardly any of these methods are useful for rapid on-farm disease detection in a cost-effective way.

SRA's Principal Research Scientist Dr Shamsul Bhuiyan is working with experts from Griffith University to address these challenges.

"The aim of this work is to use recent advances in nanotechnology for development of disease diagnostic devices for human diseases, and apply them to the sugar industry," Dr Bhuiyan said.

Dr Muhammad J. A. Shiddiky, the Griffith expert leading this project, said that the methods currently used for diagnosis of various sugarcane diseases rely on sophisticated instrumentation located in centralised laboratories far away from farms.

It usually takes several days for the samples to travel to laboratories and the results to be communicated back to farmers. The delays may hamper timely adoption of steps on farm to manage the disease.

"What we are trying to achieve here is to develop a simple to operate portable disease sensing device which can be packed in a small box and transported to farms," he said.

"So instead of samples traveling to the laboratory, we want to develop a system where the laboratory travels to samples, without compromising on the sensitivity of the device or involving high costs.

"Our proposed device may be cheaper or comparable to the current methods."

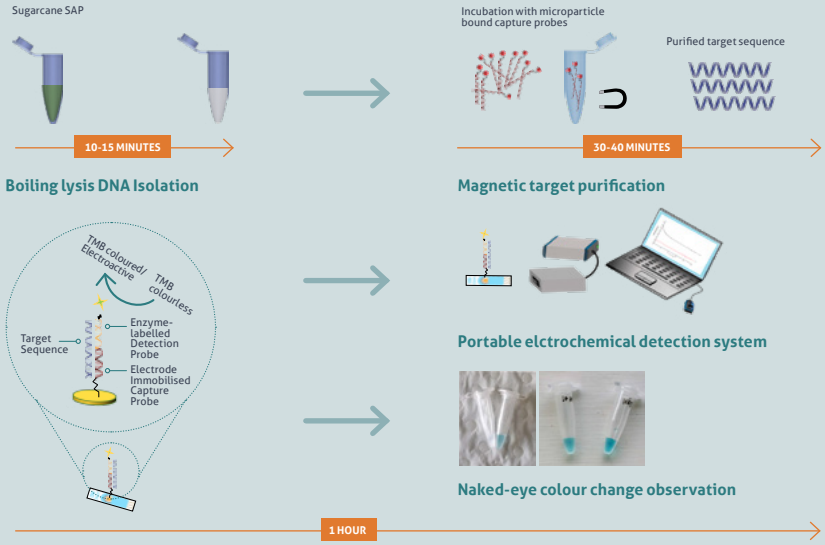
Using leaf scald disease (LSD) as a model, Dr Bhuiyan and Griffith researchers Ms Nahian Binte Aziz, Dr Muhammad Umer and Dr Muhammad JA Shiddiky have recently developed a method which can provide both colorimetric and electrochemical capabilities for detection of LSD causing bacteria.

Reagents when mixed with the sample change colour from colourless to blue if the target organism (i.e. LSD-causing bacteria) is present and the intensity of blue colour gives a somewhat arbitrary indication of level of bacteria in the sample (severity of disease).

"This colorimetric test is easy to use and could be performed by farmers. Such a test will be useful for first-pass rapid screening," Dr Bhuiyan said.

The test is essentially based on detection of specific DNA sequences of LSD causing bacteria and uses sugarcane xylem sap or small punched-out pieces of leaves as

***X.albi.* Detection in Field Samples**



starting sample materials. Researchers have used a simple boiling-based DNA extraction method to streamline their downstream colorimetric and electrochemical detection.

The pivotal component of this project however is the use of novel nanomaterials which are highly stable in routine weather conditions and their cost of production is also very low.

In addition to the colorimetric screening, the same sample can be used for further sensitive electrochemical quantification. Although electrochemical testing requires skilled personnel, the instrument is still portable and can be easily carried in a laptop sized bag.

Dr Shiddiky said that the whole process takes less than two hours and can be easily modified to test several samples in parallel or to test for two or more diseases simultaneously.

The team has so far been able to successfully test their method in a range of samples collected from SRA experiments.

"We tested both susceptible and resistant varieties at SRA Woodford Pathology Station and were able to accurately match the susceptibility or resistibility of any particular sugarcane variety based on bacterial DNA levels," Dr Bhuiyan said.

"So far, our detection limit is a few hundred to a thousand bacterial cells. Building upon these proof-of-concept results, the team aims to further expand this work to other important sugarcane infectious diseases.

"We are aiming to develop a device which can rapidly detect multiple sugarcane diseases in a large number of samples in a short span of time and without extensive sample processing. Our ultimate aim is to develop a platform whereby farmers can rapidly screen their crops for any suspected infections. If needed, further sensitive quantification can then be provided by trained staff," Dr Shiddiky said. ■

This project was jointly supported by SRA through Innovation Catalyst Project (INNOVA 06) and Griffith University ESC Research Support Scheme 2018.

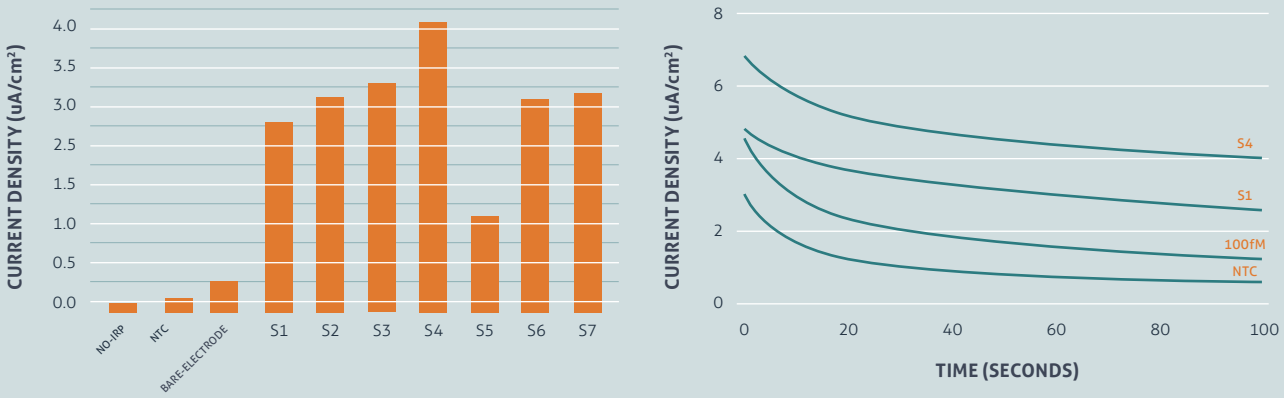
For further information contact Dr Shamsul Bhuiyan at E sbhuiyan@sugarresearch.com.au

KEY FEATURES OF THE ASSAY:

- **INTEGRATION OF SIMPLE AND RAPID DNA ISOLATION**
- **PORTABLE SYSTEM FOR ON-SITE APPLICATION FOR DISEASE DETECTION**
- **COLORIMETRIC AND ELECTROCHEMICAL DETECTION OF SUGARCANE DISEASES**

(Over page) *Detection of leaf scald 'colour change', Griffith University Researchers Ms Aziz and Dr Umer.* ***(Above)*** *Sample collection from leaf scald infected sugarcane from SRA Woodford Pathology Station Dr Shiddiky (Griffith Uni) and Dr Bhuiyan (SRA).*

***X.albi.* Detection in Field Samples**



- *The assay successfully detected* X. albi. *in sap collected from field sugarcane samples*
- *Our results matched with the field susceptibility data (operator blind experiment)*
- ***(Fig. 2)*** *Density bar and chronoamperogram for plant xylem saps collected from SRA Woodford leaf scald screening trials. Samples were collected and supplied to the Griffith University laboratory labelled with random numbers (S1 to S7). Note: sample S5 was highly resistant variety showing lowest current density, NTC=no target control, Bare electrode = no electrode immobilised capture probe.*

USING CLIMATE FORECASTING FOR NUTRIENT MANAGEMENT

SIX EASY STEPS®

The Australian sugarcane industry continues to improve its understanding of nutrient management through a range of research projects.

This includes research to fine tune the SIX EASY STEPS nitrogen (N) guidelines for specific soils, farming systems, harvest times and climatic conditions.

A recent project funded by SRA and the Department of Environment and Science, led by researchers at James Cook University, investigated how climate forecasting might be used to refine N management in the Wet Tropics, specifically at Tully.

This work was conducted by Associate Professor Yvette Everingham (JCU) with the research team of Professor Bernard Schroeder (USQ), Dr Danielle Skocaj (SRA), Dr Peter Thorburn (CSIRO), Mr Jody Biggs (CSIRO) and Mr Justin Sexton (JCU).

The project was titled: *How much N does that crop need? Incorporating climate forecasting to improve nitrogen management in the Wet Tropics*.

Justin Sexton from the project team said that Tully was chosen because this allowed the project team to build on existing research into the impact of seasonal climatic conditions on N requirements completed by Dr Danielle Skocaj through her PhD for a specific soil type and harvest time.

Nitrogen management is important in the Tully region because of the extreme climate variability experienced. Climate variability, especially rainfall and radiation, influences crop responsiveness to applied N and makes the task of applying the right amount of N to maintain productivity and profitability whilst minimising N losses challenging.

"This project looked at the potential to use steps 5 and 6 of the SIX EASY STEPS program to refine N inputs," Justin said. "There is scope within these steps to adjust nutrient management guidelines for specific situations, but we also know that farmers need more information to support these decisions."

Justin said that, importantly, the project incorporated the potential risk to growers of under fertilising, if using climate forecasting to inform N management.

He said in this regard, a key element of the project was close engagement with the Tully sugar industry, in particular through a local consultative group.

At multiple meetings, this group was able to identify tasks to be performed to improve their understanding and trust in the project methodology. Interactions with the consultative group also provided the project team with valuable feedback to refine research activities.

THE KEY FINDINGS OF THIS PROJECT INCLUDE:

- There are two distinct climatic subregions in Tully (e.g. wetter northern zone and drier southern zone).
- N guidelines vary with many different combinations of soil x location x climate x harvest date.
- Crop modelling can be used to help improve the understanding of these complex interactions.
- N guidelines are likely to differ between wet and dry years and climate models can provide knowledge if the year is likely to be wetter or drier.
- It is advisable to assess different forecasts from multiple leading, international climate forecasting models.

FOR TULLY, THIS INVESTIGATION REVEALED THAT:

- For most soils, more N may be needed in wet years for blocks cut early (e.g. July). This is especially the case for blocks in the drier southern Tully climate zone where radiation tends to be higher and rainfall less than the northern wetter region.
- For most soils, less N may be needed in wet years for blocks cut late (e.g. November).
- For some poorly drained soils, less N may be needed in wet years for blocks cut midseason (e.g. September).

The project developed a prototype 'app' to present modelled N requirements for different soil x harvest time x location x climate (wet/dry years) combinations. Field validation of the modelled N requirements, as per steps 5 and 6 of the SIX EASY STEPS program, is required.

Similar investigations are currently being conducted in the Herbert district. ■

You can read the report from this project in the SRA elibrary, available via *sugarresearch.com.au*

SUGAR INDUSTRY WORKING TOGETHER TO MANAGE FALL ARMYWORM RISK

Fall armyworm (*Spodoptera frugiperda*) has been found on Erub and Saibai islands in the Torres Strait and at Bamaga on Cape York Peninsula.

This is an invasive moth pest that has been recorded on more than 350 plant species (including 80 crops), causing damage to crops such as maize, rice, sorghum, sugarcane and wheat, plus other horticultural crops and cotton.

The Australian sugarcane industry, through CANEGROWERS and SRA, is working with governments and industry groups to manage the threat posed by fall armyworm and respond appropriately, but the community, industry and agronomists are encouraged to report any unexpected symptoms in the field by phoning the Exotic Plant Pest Hotline on 1800 084 881.

CANEGROWERS (Mick Quirk) is the industry representative organisation for the response, and SRA has assisted with specialist knowledge via Key Focus Area Leader for Pest Disease and Weed Management, Dr Kevin Powell; and Principal Researcher, Disease Management, Dr Nicole Thompson (SRA Woodford). Kevin is based at SRA Meringa and has experience with this pest.

Work is underway to determine the likely distribution of the pest and a response strategy. The level of impact of the pest for different crops will depend on the strain or strains of armyworm that are present.

Growers should have on-farm biosecurity measures in place to protect their crops from pests and diseases.

Fall armyworm larvae are light coloured with a larger, darker head. As they develop, they become browner with white lengthwise stripes and develop dark spots with spines. Adult moths are 32mm to 40mm in length (wing tip to wing tip) with a brown or grey forewing and a white hind wing.

Native to tropical and subtropical regions of the Americas, it was first detected outside its native range in early 2016, spreading to Africa, the Indian subcontinent, China and Southeast Asia. A strong flier, fall armyworm is believed to have covered most of its geographical range through natural dispersal, but can also spread through the movement of infested plant material. ■

(Top right) Fall armyworm moth.
(Bottom right) Fall armyworm larvae.

2019 HERBERT HARVESTING DEMONSTRATION PROJECT

BY PHIL PATANE, HARVESTING ADOPTION OFFICER, SRA

The 2019 season saw the industry's first month long harvest demonstration round conducted in the Herbert region. The aim of the study was to put into dollar terms to the industry the benefits of using harvesting best practice.

The concept of the harvesting field demonstration was brought about by a small group of innovative growers and contractors in the Herbert region. The group had been involved in many harvesting trials but they wanted to observe the situation on a commercial basis. The key points that the group wanted addressed through the harvesting field demonstration included:

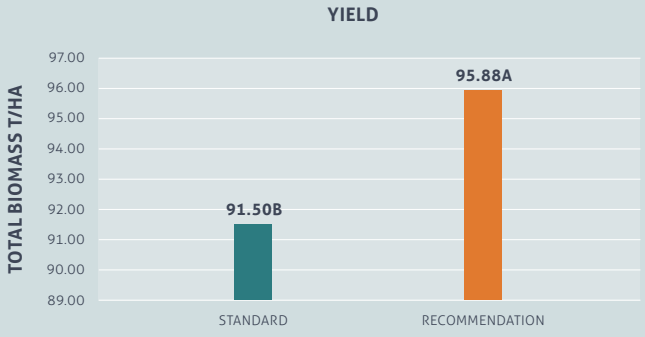
- Yield gain is possible without a spike in extraneous matter (EM)
- Growers and contractors identified increase in revenue (anecdotal)
- The clear message from a group that travelled to the Isis region was to demonstrate fiscal advantage (Show me the money)

Two Herbert harvesting contractors took part in the demonstration that compared their standard harvesting practices to harvest best practice (HBP). This was conducted through randomised and replicated treatments (standard compared to HBP) in which at the siding a full rake was collected per treatment so the grower could be paid according to the product he delivered.

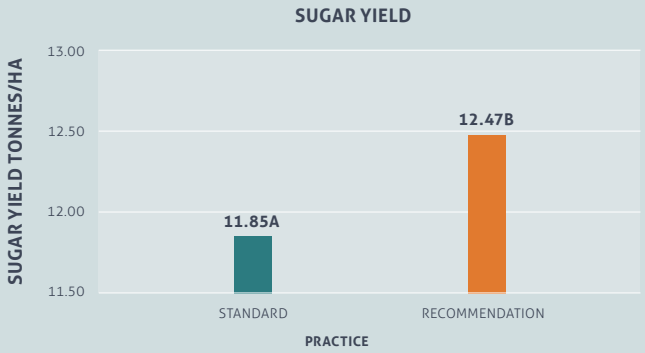
The demonstration involved a harvester alternating between current practice for that harvester and SRA harvesting best practice; altering fan speed and ground speed according to the condition of the crop. The harvester distance travelled in the paddock, tonnes of cane and CCS levels (individual fibre) were all measured to calculate the total tonnes of sugar per hectare produced for each practice.

The data collected allowed both contractors and growers to see if HBP delivered more tonnes of sugar per hectare, and therefore more revenue for the industry.

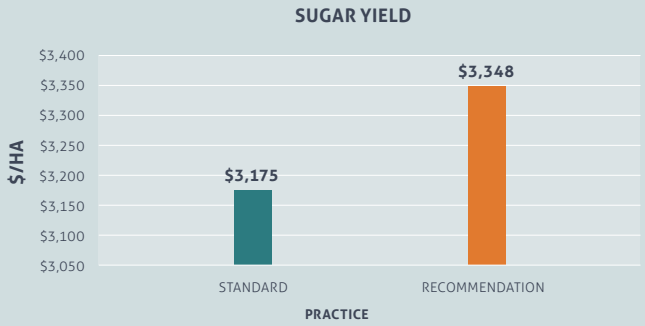
The results identified an increase in yield by 4.8 tonnes per hectare with no additional increase in extraneous matter (EM).



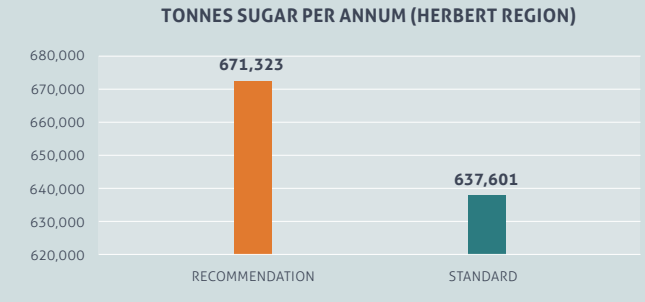
The increase in yield with no significant affect in EM in turn increased tonnes of sugar per hectare by 627/kg per hectare.



The increase in sugar per hectare resulted in an increase in grower gross revenue by $173/ha.



Over the entire Herbert region this highlighted an extra 34,000 tonnes of sugar for the region which would result in an additional $13 million in gross revenue.



As the demonstration was a commercial operation the results were compared to the 95 replicated trials conducted by SRA in 2017 and 2018. It is interesting to note that the results for both Herbert demonstration round and the industry wide trials follow a similar trend.

PER HECTARE	2019 HERBERT DEMONSTRATIONS		2017/2018 INDUSTRY TRIALS (95 TRIALS ACROSS THE AUSTRALIAN SUGAR CANE INDUSTRY)	
	Recommended Practice	*Standard Practice*	*Recommended Practice*	*Standard Practice*
Yield (Tonnes)	95.88	91.50	99.2	94.4
Sugar (Tonnes)	12.47	11.85	14.40	13.71
Grower Gross Benefit	-	**$173**	-	**$181**
Harvesting Costs	-	TBC	-	**$61**
Grower Net Benefit	-	TBC	-	**$120**

The next stage of the program is to conduct a harvesting cost analysis with both harvesting contractor groups to identify the "true cost" of harvesting. This will be reported on in a future edition of CaneConnection.

Thanks to all the people involved in delivering on this important work, the demonstration involved a significant level of investment from SRA, Herbert Cane Productivity Services Limited, the Queensland Department of Agriculture and Fisheries and Wilmar Sugar Australia.

Herbert River CANEGROWERS Chairman Michael Pisano said that while it is a difficult challenge, the increased revenue with the adoption of change was vital to the local sugar industry.

"The data shows that there is money to be made by adjusting harvesting practices. Now that we have the results growers are keen to work with industry groups to drive adoption," Mr Pisano said.

Two Herbert harvesting contractors took part in the demonstration that compared their standard harvesting practices to best practice methods. We are grateful for the extra effort these two harvesting companies provided to gather this important data. The work they have done will assist in communicating the benefits in real terms.

"These have been really interesting trials and we are pleased to provide economic information that can be used to inform better decisions on recommended harvesting practice", said Brendon Nothard, Agricultural Economist with DAF. ■

***(Over page)** SRA Harvesting Adoption Officer, Phil Patane with Sally Lakeman and Carrie Barclay during the trial. **(Below)** Ollie Rowan (front) in the harvester with Damien Morelli.*

AQUATILL: A NEW METHOD TO MINIMUM TILL

IMPROVED CANE TRASH RETENTION AND THE ABILITY TO TILL IN A WIDE RANGE OF CONDITIONS, GREATER SOIL HEALTH AND MOISTURE CONSERVATION AND REDUCED SOIL EROSION: THIS IS JUST THE BEGINNING OF WHAT A NEW MINIMUM TILLAGE SYSTEM, AQUATILL, MAY BE ABLE TO PROVIDE. *BY HANNAH RUSSELL, GRADUATE ADOPTION OFFICER*

The green cane trash blanket (GCTB) is important within the Australian sugarcane industry, owing to the potential for agronomic gains and improved farm sustainability. Harvesting green cane and retaining the trash blanket as groundcover leads to greater moisture conservation, weed suppression and surface soil stability.

For decades, growers have used the traditional steel disc coulter which comes with its own challenges such trash pinning, reduced disc penetration to required depths in adverse conditions and balling of clay and trash under damp conditions.

AquaTill, an innovative minimum tillage system using ultra-high-water pressure jets to slice through cane trash, has been already tested and proven in cotton and grains and demonstrated in the sugarcane industry. Initially conceived by Greg Butler from the South Australian No-Till Farmers Association (SANTFA), AquaTill was brought to the Southern Region sugar industry in late 2017 through collaboration with SRA's James Ogden-Brown.

Isis canegrower, Don Halpin, has been heavily involved in the project to understand the potential for this technology for the sugar industry and he said he can see a huge advantage to AquaTill in his peanut fallow.

"Previously we tried to plant peanuts through the trash blanket, but we have to make sure we can separate the trash and get good soil to seed contact. I see that AquaTill has a lot of possibilities in that space in particular," Don said.

AquaTill utilises a PTO-powered pump and pressurises water through nozzles to produce a 50,000psi waterjet. This jet has the capability to slice cleanly through the thick GCTB in circumstances where traditional mechanical devices fail. With the addition of a secondary pump, the implement also has the capacity to place products such as fertilisers and insecticides under the trash blanket and into the soil, decreasing the potential for off-site movement and improving input efficacy.

Isis canegrower, Tony Chapman, also sees potential benefits of the pioneering system.

"It looks to be a great implement that has potential for us placing chemicals and fertilisers under the trash in all conditions, whether it be wet, dry, even if you had sticky clays," Tony said.

AquaTill will undergo further development, modifications and demonstrations in 2020. ■

***(Above left)** A close-up look at the work of Aqua Till in the paddock. **(Above top right)** An Aqua Till rig ready for work in the Southern Region. **(Above bottom right)** The 50,000 psi waterjet.*

This project was supported by Australian Government Landcare Program.

For more information, contact James Ogden-Brown
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RESEARCH PROJECT INVESTMENT

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 1 (Variety Development)				
Exploiting introgression for the development of productive & regionally adapted varieties for NSW	2013/022	Sunshine Sugar	Roy Parfitt	30/06/2020
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
Validating root system traits for enhanced nutrient capture in challenging environments	2018/002	CSIRO	Anne Rae	01/09/2021
Impact of stool architecture on ratooning: extending current trial to 4R to strengthen correlations	2018/004	CSIRO	Anne Rae	01/03/2021
Genetic analysis and marker delivery for sugarcane breeding	2018/005	CSIRO	Karen Aitken	30/06/2022
Validating high-throughput phenomics technologies for sugarcane clonal selection	2019/002	SRA	Sijesh Natarajan	30/09/2022
NIR calibrations for fibre quality	2019/001	SRA	Roy Parfitt	30/06/2021
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability)				
More profit from nitrogen: enhancing the nutrient use efficiency of intensive cropping and pasture systems	2015/907	CRDC	Multiple	30/06/2020
SIX EASY STEPS - continuing perspectives in time and space	2017/004	USQ	Bernard Schroeder	01/02/2022
Measuring soil health, setting benchmarks and driving practice change in the sugar industry	2017/005	SRA	Danielle Skocaj	01/08/2022
Unravelling the impact of climate and harvest time on nitrogen fertiliser requirements	2017/009	SRA	Danielle Skocaj	04/03/2022
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	01/10/2020
Implementation of root system diagnostics to deliver a field-based measure for root health	2018/003	CSIRO	Anne Rae	01/08/2021
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	01/03/2023
Development of commercial molecular biological assays for improved sugarcane soil health and productivity	2018/009	SRA	Rob Magarey	30/06/2020
SIX EASY STEPS Tool Box development for refined on farm nutrient management	2018/013	SRA	Barry Salter	01/05/2020
Complete nutrient management planning for cane farming (**Funding provider:** Queensland Government DES)	2016/804/ RP161	SRA/Farmacist	Jayson Dowie	30/12/2020
Improved water quality outcomes from on-farm nitrogen management (**Funding provider:** University of Queensland)	2016/805/ UQ_NESP	SRA	Danielle Skocaj	10/12/2020
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 / SRA	Barry Salter	31/12/2021
Improving NUE for sugarcane crops with constrained yield potential	2015/065	SRA	Danielle Skocaj	15/06/2020
Australian sugar industry soil health benchmarking in the Central region of Qld - increasing profit and transforming soil health practices through cooperative industry research, extension and adoption	2019/903	Various	Phil Ross	31/10/2021

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability) *continued*				
Australian sugar industry soil health benchmarking in the Wet Tropics region of Qld - increasing profit and transforming soil health practices through cooperative industry research, extension and adoption	2019/904	Various	Marguerite White	31/10/2021
Key Focus Area 3 (Pest, disease and weed management)				
Soldier fly management	2015/804	SRA	Kevin Powell	31/12/2019
Feeding behaviour of Soldier fly	2017/808	SRA	Kevin Powell	11/12/2019
Modern diagnostics for a safer Australian Sugar Industry	2017/809	SRA	Nicole Thompson	01/06/2022
Solving Yellow Canopy Syndrome	2014/049	SRA	-	30/06/2020
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with the existing product	2016/003	SRA	Kevin Powell	01/01/2020
Keeping our chemicals in their place - in the field	2017/008	SRA	Emilie Fillols	01/07/2021
Moth Borers – how are we going to manage them when they arrive?	2018/010	SRA	Kevin Powell	01/08/2021
RSD detection at the sugar factory – disease detection blueprint	2019/003	SRA	Rob Magarey	30/06/2022
Leaf sucrose: The link to diseases, physiological disorders such as YCS and sugarcane productivity	2015/016	SRA	Gerard Scalia	01/06/2020
Investigation of biotic causes of yellow canopy syndrome.	2016/064	UQ	Andrew Geering	01/02/2020
Key Focus Area 4 (Farming systems and harvesting)				
Assessment of new management strategies for marginal soils	2015/007	SRA	Barry Salter	31/12/2019
Sugar from space: improved data access, yield forecasting and targeted nitrogen application for the Australian Sugar industry	2016/062	UNE	Andrew Robson	15/05/2020
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	01/05/2020
Southern Sugar Solutions	2017/012	DAF	Neil Halpin	01/01/2021
Development of commercial molecular biological assays for improved sugarcane soil health and productivity	2018/009	SRA	Rob Magarey	01/06/2021
Smarter Irrigation for Profit Phase 2	2019/901	Cotton Research and Development Corporation	Multiple	20/06/2022
Harvester losses assessment by real-time Machine Vision Systems	2019/004	University of Southern Queensland	Cheryl McCarthy	01/01/2022
Adoption of practices to mitigate harvest losses - Phase 2.	2019/951	SRA	Phil Patane	01/05/2020
Key Focus Area 5 (Milling efficiency and technology)				
Investigation into modifying pan boiling techniques to improve sugar quality	2015/013	QUT	David Moller	01/06/2020
Online analysis systems to measure the available nutrients in mill mud	2016/019	SRA	Steve Staunton	01/06/2020
Reducing boiler maintenance costs and deferring capital expenditure through improved technology	2016/020	QUT	Floren Plaza	01/06/2021
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	01/03/2022

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	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	01/11/2021
Evaluate the performance of the falling film tube evaporator at Bingera Mill	2019/201	Bundaberg Sugar	Neil Sichter	22/05/2020
Evaluate the suitability of the fixed element crystalliser for widespread adoption in Australian sugar factories	2019/202	Sunshine Sugar	Daniel Rojo	22/05/2020
Reducing surging in shredders	2019/204	MSF Sugar	Peter Chohan	22/05/2020
Australian Sugar Industry Training – Development of factory training modules – Phase 2	2019/006	QUT	David Moller	30/06/2022
Milling R&D Program Development	2019/008	Lazuli	Eris O'Brien	15/12/2019
Strategies to minimise impacts of processing existing soft cane varieties, and industry cost/benefit analysis	2019/005	QUT	Floren Plaza	01/05/2021
Key Focus Area 6 (Product diversification and value addition)				
Biorefineries for Profit – Phase 2 (R&D for Profit Round 4)	2019/902	QUT	Ian O'Hara	29/10/2020
Key Focus Area 7 (Knowledge and technology transfer and adoption)				
Productivity improvements through energy innovation in the Australian sugar industry	2017/011	AgEcon	Jon Welsh	01/07/2020
Pathways to water quality improvements in the Myrtle Creek sub catchment (**Funding provider:** Queensland Government Department of Environment and Science)	2017/810/ EHP17066	SRA	Phil Ross	17/05/2020
Cane to Creek 2.0. **Funding provider:** Partnership between Australian Government Reef Trust, Great Barrier Reef Foundation with support from SRA.	2018/803	SRA	Belinda Billing	31/03/2021
Optimising productivity, variety recommendations and mill operations through analysis of mill data	2016/032	SRA	Jo Stringer	01/02/2021
Sugar milling R&D capability development program	2018/015	QUT	N/A	30/09/2023
Key Focus Area 8 (Collaboration and capability development)				
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	01/09/2020
Integrated standardised competency based training for Sugar Milling operations	2017/013	QUT	David Moller	01/12/2019
Re-evaluating the biology of the sugarcane root system: new knowledge allows for assessment of production impacts and implications for yield decline	2017/101	Southern Cross University	Anders Claassens	30/06/2020
Microwave sensors for sugarcane sugar analysis	2017/102	UQ	Scott Thomason	30/06/2020
New approaches to quantifying nitrogen fluxes in enhanced efficiency fertilisers in Australian sugarcane soils	2018/101	UQ	Aidan Chin	01/06/2022
Characterising nitrogen use efficiency in sugarcane	2018/102	UQ	Anoma Ranagalage	01/06/2022
Developing a marker system to measure dosage of alleles for use as a selection tool in the sugarcane breeding program	2018/402	CSIRO	Meredith McNeil	01/12/2019

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