Sugar Research Australia

CaneCONNECTION

Spring 2018

Contents

(Cover page) *Soldier fly larvae and adults. Picture by Manda Khudhir.*

Design: *Catherine Jorissen, SRA.*

Welcome to the Spring 2018 edition of *CaneCONNECTION*

In this edition, we have a diverse spread of articles to highlight research, development and adoption investments occurring through your Industry-Owned Company, SRA.

Inside, you'll find a mix of articles on topics including soldier fly, yellow canopy syndrome, soil health, and harvesting best practice.

With harvesting, we talk to Vince Russo at Ingham about yield monitors and mapping, and we also look at new fronts (spirals) made by EHS Manufacturing that have been fitted to three SRA harvesters. We also show you the newly rebuilt chopper test rig at Ingham.

This edition highlights innovative research into the varied living community of microorganisms that live within sugarcane. This research is discovering what microbes have been lost within sugarcane after many years of domestication and cultivation, and then learn if some of the microbes that reside within wild relatives can be put to use to help improve productivity, profitability and sustainability in the modern farming system. You can read more about this research on page 19.

Soldier fly research is also making notable progress as you can read on page 14, as is the YCS research program, on page 18.

We also hear from a number of growers in this edition and talk to them about their farming practices. We hear from Herbert growers Chris Bosworth and Walter Giordani regarding an economic assessment of Smartcane BMP adoption, and we also talk to growers in the Central Region Peter Hackett and Simon Mattsson about varieties and soil health respectively.

We hope you find this issue informative. If you have comments or suggestions, please let us know at ***communications@sugarresearch.com.au.***

Brad Pfeffer

Executive Manager, Communications

$78

The improvement in operating return, per hectare, that has come for Chris Bosworth through Smartcane BMP adoption

Page 6

1000

The number of frames per second captured by the high-speed camera attached to the chopper test rig

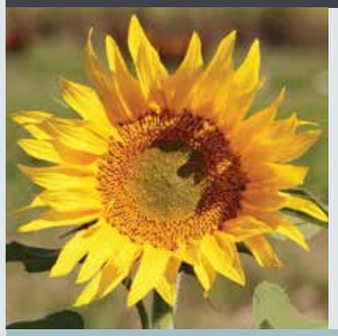
Page 8

By the numbers

3

The number of augers on a new design of spirals by EHS Manufacturing, attached to three SRA harvesters

Page 10



14

The number of different plant species used as a fallow cover crop – for future grazing – by Simon Mattsson

Page 20

20

The number of tonnes per hectare, approximately, that Walter Giordani has lifted his yield above the productivity zone average

Page 4

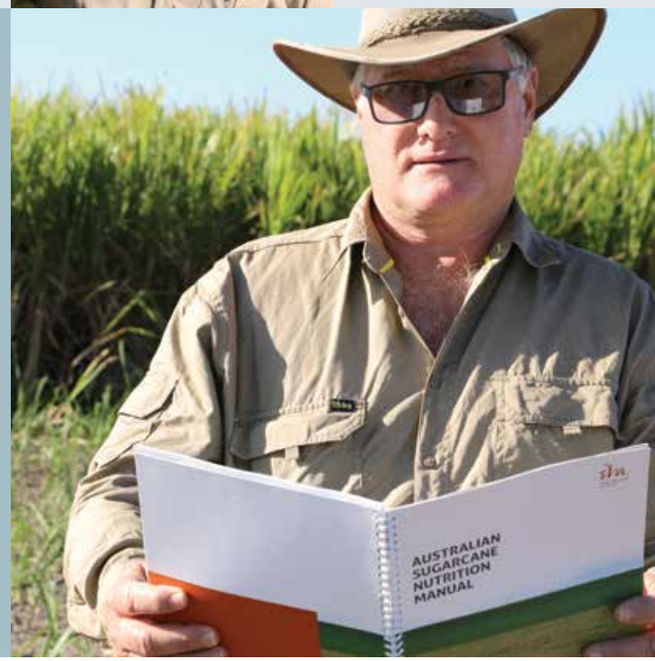
HOT OFF THE PRESS

Email or call to get your free copy!

A brand new manual provides sugarcane growers, millers, and advisors with a complete run-down on the latest research and information for growing a healthy sugarcane crop.

Called the Australian Sugarcane Nutrition Manual**, it is available free to growers, millers, and stakeholders through SRA in hardcopy and electronic formats.**

To receive your copy of the manual, contact Samantha Ryalls on
E sryalls@sugarresearch.com.au
T 07 3331 3308



BMP adoption: Saving time, increasing efficiency

The adoption of BMP has helped Walter Giordani lift his productivity above the zone average, something that he says is especially critical when sugar prices are depressed.

Walter Giordani has always had a strong connection to sugarcane growing and milling in the Herbert.

His father had grown tobacco in the region and worked in a local mill, and Walter also did his electrician's apprenticeship at one of the mills.

So when the opportunity arose in 2009 to purchase a cane farm about 20km south of Ingham, he jumped at the opportunity to get a foothold into cane growing.

The journey since then has involved a series of on-farm practice changes and accreditation to the Smartcane Best Management Practice (BMP) program.

When he bought the farm, its cane yield was about 12 tonnes of cane per hectare (TCH) below the productivity zone. He has now shifted this to greater than 20 TCH above the productivity zone average in recent years.

"When we first brought the farm, it was fairly run-down, so I was very keen from the start to get as much agronomic assistance as I could from the likes of Herbert Cane Productivity Services Limited and (SRA-predecessor) BSES," he said. "I attended many functions and had a keen interest in all the new technology coming out, always with the goal of increasing production."

Major areas of improvement included laser levelling, regular soil testing, legume fallow cropping, GPS guidance and mound planting, minimum tillage and wider row spacings to 1.8 metres.

"I have an off-farm job, so I was also looking to introduce things to make farming easier. My time is critical."

Through achieving substantial gains in the early years, he was encouraged to purchase another farm in 2013 where he is also implementing BMP.

Much of this work has been the subject of an SRA-funded project where the Queensland Department of Agriculture and Fisheries (DAF) analysed the economic impact of Smartcane BMP adoption across six different farms in the Herbert and Wet Tropics.

According to DAF economist, Caleb Connolly, the economic analysis identified cost savings from lower fuel and chemical use, reduced labour requirements and less repairs and maintenance.

"These cost savings were balanced against some additional costs from laser levelling, applying lime as a soil ameliorant and planting legumes as well as higher depreciation costs from new machinery purchases," Mr Connolly explained.

"Overall, the analysis showed the adoption of various BMP and improved practices has been worthwhile for Walter.

"Our analysis examined a yield improvement of 27 percent based on the farm's yield improvement in comparison to the productivity zone average. Even if the improvement had been only 11 percent, the investments made by Walter in laser levelling, GPS guidance, a stool splitter, bed renovator, legume planter, widening machinery and modifying a tractor for hi-rise spraying would have been profitable.

"The analysis indicated an improvement in annual farm operating return of $429/hectare, or about $38,000 per year in total, after making the practice changes."

The accompanying environmental assessment by senior lifecycles scientist, Margeurite Renouf, indicates that the changes on Walter's farm have resulted in less fertiliser application and a reduction in the potential for water quality impacts from nutrient loss.

"There has also been the added bonus of reduced fossil fuel use and greenhouse gas emissions per tonne of cane."

Since the case study, Walter continues to introduce innovations. He has started EM mapping at the farm and also brought his own mud spreader, which has been adapted to variable rate control and also used to apply gypsum.

He added that with the recent sugar price in the dumps, it was critical to maintain productivity.

"The price has forced us to put some plans on hold, but at the same time we aren't cutting back on inputs that would impact our viability. In my view there would be nothing worse than low sugar price and a low crop at the same time."

Growers are encouraged to consider their own circumstances and seek independent advice before making changes. ■

"The analysis indicated an improvement in annual farm operating return of $429/ha, or about $38,000 total."

DAF's Farm Economic Analysis Tool (FEAT) is available to help growers consider the economics of their farming business. To access FEAT and explanatory resources, visit www.daf.qld.gov.au/plants/field-crops-and-pastures/sugar/farm-economic-analysis-tool.

The six project case studies can be downloaded from www.publications.qld.gov.au/dataset/best-management-practices-for-sugarcane.

SRA acknowledges the funding contribution from DAF Queensland towards this research activity.

(Over page) Walter Giordani has successfully implemented Smartcane BMP at his Herbert district properties. (Above) Investing in equipment that delivers efficiency is critical for Walter, who also works off-farm.

BMP journey delivers economic outcomes

Adoption and accreditation of improved practices is delivering sustainability and profitability outcomes for Chris Bosworth.

Herbert region farmer Chris Bosworth has been on the journey towards improved farm practices for more than 10 years, so he saw the next step to Smartcane Best Management Practice (BMP) accreditation as a logical progression for his business.

For Chris, who farms 150 hectares supplying the Victoria Mill, he felt strongly that there would be profitability and sustainability outcomes in improving and recording his farm practices.

With BMP accreditation now achieved, his adoption of the program and additional practices has been the subject of an economic analysis conducted by the Department of Agriculture and Fisheries (DAF) as part of a project funded by SRA.

Economists at DAF found that, since 2008, Chris's transition has resulted in an annual improvement in farm operating return of $78/ha ($11,305/yr total). An environmental assessment completed on Chris's farm by senior Lifecycles scientist Marguerite Renouf also indicated:

- Less nitrogen, phosphorous and pesticide active ingredients being potentially lost to waterways
- Annual fossil fuel use (over the cycle of sugarcane growing) reduced by 14 percent
- Greenhouse gas emissions reduced by 15 percent annually.

Chris's main changes included widening his row spacing to 1.8m to match the wheel tracks on his contractor's harvester (to reduce compaction and improve soil health), moving from conventional to zonal tillage, planting in preformed beds, adopting the SIX EASY STEPS nutrient guidelines, adopting banded mill mud application in ratoon cane, and using a variable rate spray controller installed on his high rise sprayer to improve the accuracy of his spray rate.

The economic study showed that some of the biggest savings came from the adoption of SIX EASY STEPS nutrient program and using banded mill mud (saving about $92/ha). Wider row spacing, which reduced tractor hours, as well as zonal tillage, contributed cost savings in fuel, oil and labour of about $35/ha.

Investments included a stool splitter, modifying a spray rig, purchase of ratooning discs converted to a bed-former, GPS guidance, and variable rate controller.

"Results of the investment analysis (includes capital expenditure costs) show that BMP adoption was worthwhile for Chris and has added value to his farming business," said DAF Agricultural Economist Caleb Connolly.

As part of Chris's previous work improving farm practices, he had historically been partnering with a neighbour to invest in gear and together they also bought equipment through the (then-called) Reef Rescue program. This Reef Rescue funding was not factored into the economic analysis, as the project team wanted to consider if the investments stood on their own two feet.

"I firmly believe there is scope for smaller farmers to partner together with like-minded farmers to improve efficiency of their investment," Chris explained.

"In our case, both my neighbour and I don't both need three-row stool splitters sitting in our sheds for 49 weeks of the year, and nor could we both justify the roughly $65,000 investment.

"There's a lot of scope for economy of scale, and it also proved to be a more efficient use of a government grant.

"However, it was important that the case study showed to people that while grants can help, you also don't have to have them to make it viable, which was the case for me."

Overall, Chris says he is glad for his work on BMP, not only because it has made him more profitable and sustainable, but it has made him a better farmer generally.

"Environmentally, it is also important that we continue to reduce our footprint," he said.

"The Great Barrier Reef is a critical part of our coast and we want to continue to protect it.

"It's quite simple. I'm paying for nutrients, whether it is in fertiliser or in mill mud. So why would I want it getting off the farm?"

The adoption of management practices that have been scientifically validated, such as BMP, means that an adverse impact on production is unlikely. However, results of a production risk analysis did show that in this case study profitability was highly sensitive to maintaining yield. Growers are encouraged to consider their own circumstances and seek independent advice before making changes. ■

"I believe there is scope for smaller farmers to partner together with likeminded farmers to improve efficiency of their investment."

CHRIS BOSWORTH

DAF's Farm Economic Analysis Tool (FEAT) is available to help growers consider the economics of their farming business. To access FEAT and explanatory resources, visit www.daf.qld.gov.au/plants/field-crops-and-pastures/sugar/farm-economic-analysis-tool.

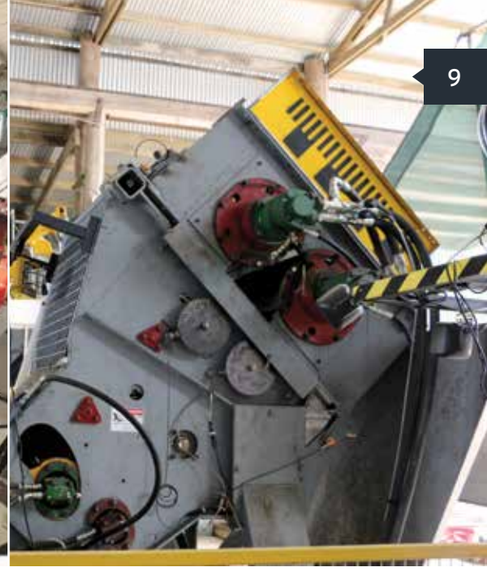
The six project case studies can be downloaded from www.publications.qld.gov.au/dataset/best-management-practices-for-sugarcane.

SRA acknowledges the funding contribution from DAF Queensland towards this research activity.

***(Above)** An economic analysis of Smartcane BMP adoption has shown Chris Bosworth's transition to BMP has resulted in an annual improvement in farm operating return of $78/ha.*

Rig gives an 'x-ray' view of harvest mechanics

The recently rebuilt chopper test rig is being put to work as a research and adoption tool to help understand sugar loss as cane makes its way through a harvester.



It is known as the chopper test rig.

Chances are that you have seen all the components of this machine before – just not in this arrangement – as it is an exact replica of the feedtrain and chopper drums of a modern sugarcane harvester.

The key difference with the chopper test rig is that it is stationary, in a shed, with all the technology attached for replicating and analysing in-field conditions of the internal mechanics of harvesting.

The chopper test rig is not new. It was first put together about 20 years ago by BSES and played an important role for research in the industry at a time when harvesters were still manufactured in Australia.

Fast forward to 2016, and harvester manufacturing had long since moved offshore, and the chopper test rig was gathering dust – and rust – at the SRA Burdekin station.

Under the leadership of SRA Agricultural Engineer Joseph Bonassi, SRA then resurrected the chopper test rig and has now put it to use as a valuable research and adoption tool for the Australian industry.

"We knew that it was too valuable of an asset to not utilise, particularly with the industry's profit margins under such pressure and the strong collaborative effort occurring across the value-chain to reduce cane and juice loss," Joseph explained. "It was a big process putting the jigsaw back together and working with a local Ingham manufacturer to get the rig back up and running, this time with modern equipment and sensors."

The machine has now been running for about 12 months and is used for a range of demonstrations for growers, contractors, and millers, as well as for research under the project Joseph leads, which is called *Increased harvest recovery: reducing sugar loss and stool damage.*

"Everything is hydraulically driven as is the case on a standard harvester, but with multiple circuits driven off different pumps so that we can jump between what comes standard out of the factory and what past research has demonstrated to be optimised, and anywhere in between.

"When new designs or templates come out we can test them to see if different settings suit these designs better, reduce losses and improve how the machine runs."

Trials this season are looking at different types of chopper drums and blade configurations such as four, five or six blades.

Each trial involves a number of replicates totalling about 2.5 tonnes of whole-stalks and trash presented to the test rig such that it replicates in-field conditions. The set-up allows he team to precisely measure how much weight is lost from the cane's passage through the rig, eliminating any variables that come with conducting trials in the field.

They also analyse billet quality, variability, and length, counting sound, damaged, and mutilated billets. Multiple sensors and cameras monitor the cane as it passes through the machine.

This includes a high-speed camera capturing video at 1000 frames per second, showing each cut in extreme slow motion and allowing the team to get a feel for losses that the human eye could never appreciate. This adds a visual demonstration to the data collected through the sensors and weight measurements.

"Photos and video don't do it justice until you stand here and feel the rig shaking the foundations. It is an accurate representation of just how tough a real harvester is.

"We have received good feedback from people who have seen it, with people who have been able to see it up close in a safe environment. It is a good discussion point to see how sticky everything is and to look at the damaged and variable billets."

Further trials this season will also look at issues comparing optimised and un-optimised feedtrains as well as dirt retention.

Joseph said that trials in the past had shown that feedtrain and chopper losses ranged from 2 percent to 8 percent, which presented a valuable opportunity for the Australian industry to recapture value and improve its understanding through tools such as the chopper test rig. ■

To see a video on the rig, visit www.sugarresearch.com.au/sra-information/media/

Contact Joseph Bonassi on
E jbonassi@sugarresearch.com.au

SRA acknowledges the funding contribution from the Queensland Department of Agriculture and Fisheries towards this research activity.

(Over page) Agricultural Engineer Joseph Bonassi with the chopper test rig. ***(Above left)*** *The rig in action.* ***(Above)*** *The rig has been fitted with a range of sensors and cameras to precisely measure losses.*

Innovation in harvesting fronts being put to the test

A significant new innovation in cane harvesting is a relatively rare occurrence, but a new design of harvester fronts is being put to the test at SRA.

BY BRAD PFEFFER

Steve Lawn and the team at EHS manufacturing knew there had to be a better way.

Through years of experience and after trawling through a back catalogue of industry research, they understood that pick-up losses from mechanical harvesting could be anywhere from 1 percent to 10 percent. They also knew that the first moment the harvester touches the cane has a cascade affect for the rest of the harvesting process, and for future ratoons.

They had seen previous innovations in front-end components such as old-design BSES fronts.

But, in consultation with SRA, they wanted to take this further.

This led to the development of their innovation called the CaneStalker, a new design with three crop lifters on each side of the cane row and with the aim of improving cane feeding through the machine.

After extensive development and testing by EHS, independent of SRA, the fronts have recently been fitted to three SRA Case IH harvesters in 2018, located at Mackay, Burdekin, and Gordonvale.

SRA Adoption Officer for harvesting, Phil Patane, said that the machines were currently being used to harvest SRA trials and had a received a thumbs-up from the crew on the ground for their feeding performance.

"Feeding-wise they are performing well, but we don't yet know how much of a reduced percentage of loss is occurring," Phil said. "The next step will be to investigate this and, after that, potentially link with existing research into the front-end components of the harvester."

A current research project is underway led by Norris ECT through the Rural R&D for Profit program looking to match front-end harvester components to groundspeed.

The team at EHS have consulted with Norris ECT on their work on the CaneStalker, and indicated that matching forward speed and spiral speed was critical.

"The front end of the harvester hasn't changed much over the years, and it is also quite poorly matched to groundspeed a lot of the time," Steve Lawn said.

"On most machines, the spiral performance is limited to 4km/hour groundspeed in really lodged crops.

"Anything faster than that and damage is occurring, so based on existing crop dividers the only way to cut really lodged cane is to slow right down.

"With our design, we wanted to be able to keep the groundspeed to at least 6km/hour for the economics of harvesting, without seeing the damage that could be occurring with existing crop dividers. We also want to be able to eliminate the use of side trim knives as these also cause some losses."

He said that when they initially began looking to reduce losses at the front-end of the harvester, he had thought an answer would come with the basecutters.

"But a lot of our simulation work showed that the problem was the crop dividers, not the basecutters, including split billets and damage to the stool.

"We haven't done any official testing, but the visuals look promising. In green cane crops in the Burdekin, where you would normally cut at say 4-5km/hour, they have been able to push faster and the CaneStalker is sorting the crop out without the need for side trim knives.

"We are hoping the feed is more uniform, which should stop glut feeding and improve cleaning. There is evidence of this already with very uniform chopper pressure. This should also assist in reducing losses at the choppers and extractor."

He said the small middle auger travelled at ground speed and its purpose was to lift the crop up, and not move it in either direction. Before the cane leaves the top of the middle pickup auger a 1 metre diameter three-point arc is created over the three augers to begin the separation. The other two augers can then lift the cane up and present it correctly for the base cutters and then feeding.

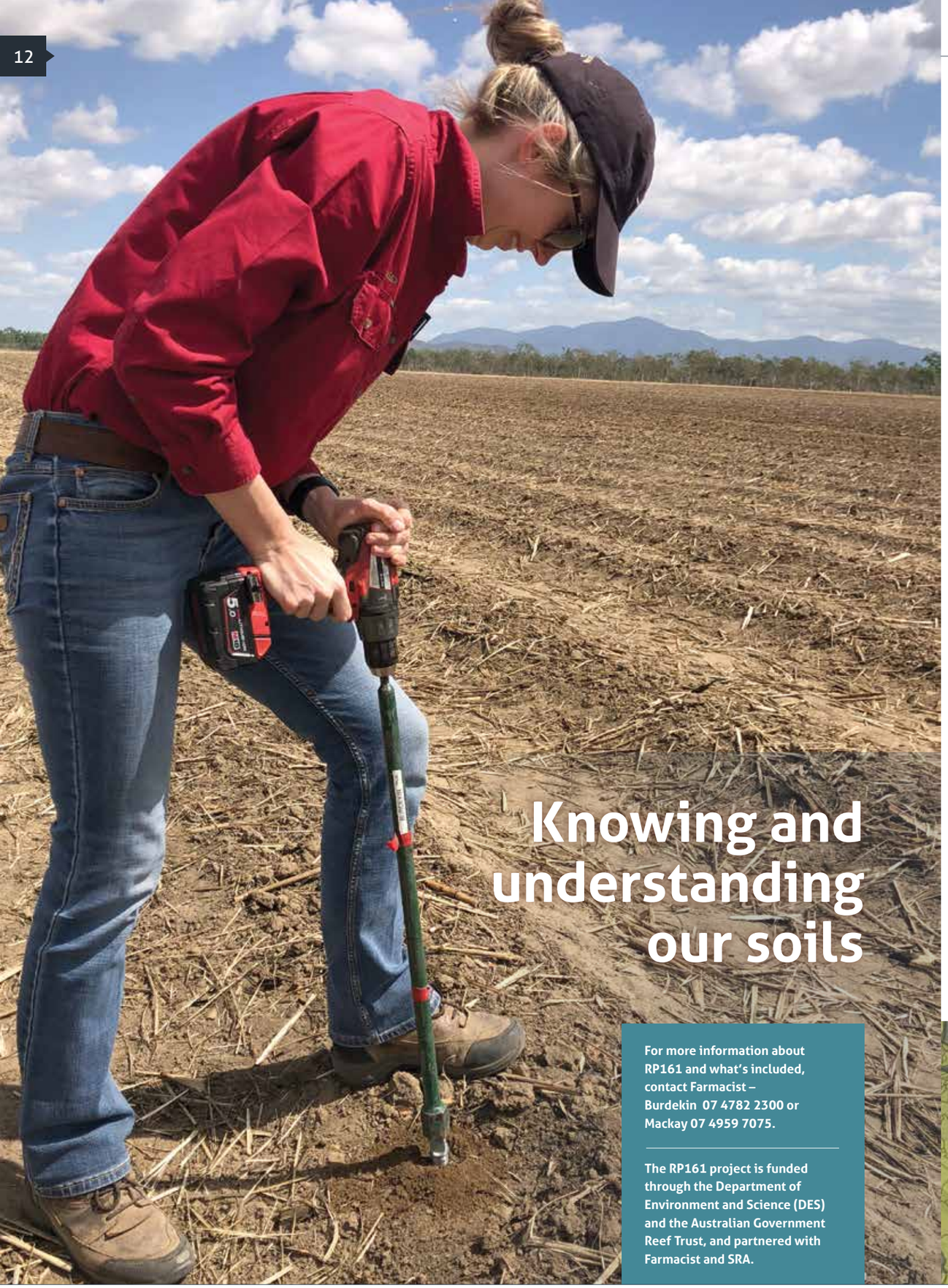
Phil Patane said it was exciting to see innovation on sugarcane harvesters.

"For any new innovation, it is critically important that SRA investigate this and assess what the gains may be. Perhaps in coming years they may become common on harvesters, but the first step is that we have to investigate." ■

Contact Adoption Officer, Phil Patane on
E ppatane@sugarresearch.com.au
T 07 4776 8202

To see a video of the CaneStalker visit www.sugarresearch.com.au/sra-information/media/

*(Over page) Steve Lawn from EHS Manufacturing checking out one of the CaneStalkers that have been fitted to three SRA harvesters. **(Right)** The fronts fitted to the SRA Mackay harvester and at work harvesting an introgression trial.*



Knowing and understanding our soils

For more information about RP161 and what's included, contact Farmacist – Burdekin 07 4782 2300 or Mackay 07 4959 7075.

The RP161 project is funded through the Department of Environment and Science (DES) and the Australian Government Reef Trust, and partnered with Farmacist and SRA.

The end of the crushing is approaching, but before blocks are ploughed-out, it's recommended to take soil samples directly after harvest while the beds are still intact. It might be the last thing on the to-do list, but getting in early has benefits. Knowing and understanding our soils, and soil testing regularly, are two of the SIX EASY STEPS.

There are various tools available to improve our knowledge and understanding of our soils to make more informed management decisions. Soil data is one of these tools which is key in understanding variability within a paddock.

Soil surveys that identify soil zones can be accessed via Queensland Globe or by downloading the dataset from the Queensland Spatial Catalogue. However, resolution is dependent on the existing dataset for the area. For example, the Jardine area in the Burdekin is considered high resolution at 1:25,000 scale as shown below which was published in 1988. In comparison to the Burdekin delta that is at a 1:50,000 scale which is deemed medium resolution.

Electrical Conductivity (EC) or electromagnetic (EM) mapping, can provide a higher resolution to soil maps. As part of the RP161 program currently running in the Central and Burdekin regions, participants can take advantage of EC/EM mapping offered through the project. These maps show the differences in electrical conductivity within blocks which is influenced by soil type, moisture and soil salinity. With effective ground-truthing through GPS referenced soil tests, areas of sodicity can be determined and prescription application of ameliorants such as gypsum can be produced to ensure cost effective applications of ameliorants. Files are produced and loaded into application equipment to allow the spreader to automatically change rates once it crosses zones.

SOIL TESTING REGULARLY

Why is soil testing important?

Soil sampling is key to:

- Identifying soil nutrients or soil chemical factors that are limiting crop growth
- Improving productivity and profitably by putting fertiliser dollars where they are most beneficial
- Increasing fertiliser use efficiency by determining appropriate nutrient application rates
- Informing decisions and management tools for your whole farm nutrient plan
- Using effective ameliorants to improve possible physical and chemical imbalances
- Measuring changes in soil fertility and record trends over time
- Improving environmental protection by preventing over fertilising.

When to soil sample?

The recommended timing for soil sampling is directly after final harvest prior to any cultivation. This will give you the most accurate determination of the soil status and will also provide ample time for test results to be received by the lab, and interpreted prior to planting. In addition, if any ameliorants are required (specifically lime and gypsum) these can be applied prior to the wet season for maximum utilisation.

Importance of sampling a representative soil

As shown in the diagram below, only 10g of soil is used for analysis by the lab. Correct sampling is therefore critical in achieving a representative sample, and furthermore results of the paddock.

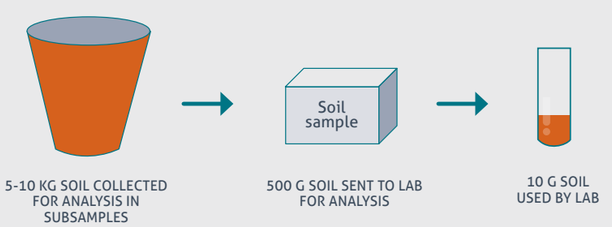
The use of the previously mentioned EC/EM generated maps can reveal the in-field variability which can assist in determining representative sample locations within in-field zones. Taking separate soil samples from these zones allows for variable rate ameliorant application, and in some cases nutrients.

Geo-referencing soil test locations allows the monitoring of specific sites over time. Additionally, the GPS position remains constant even if the block number changes in the future.

As part of the RP161, growers will have all their historical soil samples recorded spatially and displayed in Google Earth along with any EC/EM data. This data is used to make informed decisions regarding nutrient management plans based off the SIX EASY STEPS methodology.

Article supplied by Farmacist. ■

*(Over page) Farmacist agronomist Heidi Hatch soil sampling in the Burdekin. **(Below left)** Example of a soil survey. Scale 1:25,000. **(Below)** The process for collecting a soil sample.*



What's the buzz on soldier fly research

Researchers are examining solider fly in new ways, including whether the pest is creating a toxic effect on the cane, and if there are multiple different species of soldier fly.

BY BRAD PFEFFER

The above picture shows how devastating soldier fly can be. Taken from a drone at Jeff Hamblin's property at Hay Point, this photo shows an area not previously known for soldier fly, but it has recently become an example of how severe an infestation can become.

With the edge rows of the crop still in a reasonable condition, the picture also shows how difficult it can be to spot a problem until the harvester gets into the paddock.

It is also an example of where the best option for management is to fallow the block for at least a year to break the soldier fly life cycle.

With other growers in parts of the industry facing similar battles with soldier fly, SRA has recently embarked on several projects to look at this insect pest from new angles.

Soldier fly have long been the subject of research at SRA and its predecessor organisations, although many aspects of their biology and management are not fully understood.

SRA Mackay-based entomologist Dr Karel Lindsay is working on soldier fly including research looking at the differences in variety response and also chemical treatments.

These trials are occurring across the Southern and Central Regions, with the variety trials in each area looking at cultivars specific for each region. For example, the Central trials are using established canes such as Q240^{ph} KQ228^{ph}, and Q208^{ph}, as well as more recent varieties like Q250^{ph}, Q251^{ph}, Q252^{ph}, and SRA9^{ph}.

The chemical trials are refining some treatments that have shown some promise in early trials.

In addition, Dr Kathy Braithwaite in SRA's Brisbane laboratories is sequencing the CO1 gene from different soldier fly populations to determine whether individuals from different regions belong to the same species or different species. Dr Bryan Lessard from CSIRO is a soldier fly taxonomic expert and will formally identify adult specimens collected in May from the same soldier fly populations. Populations have been collected from the Atherton Tableland, Burdekin, Central and Southern Regions.

SRA is also investing in fundamental basic research about soldier fly, being led by Post-Doctoral Researcher at the University of Queensland, Dr Kayvan Etebari.

For example, there have been theories that the larvae may be causing a toxic effect on the plants whose roots they feed upon.

After all, the damage from the larvae is relatively small when compared to cane grubs, but the impact can be more severe than that caused by grubs.

The theory is that if the damage is less, but the impact so severe, there may be something more going on.

"Previous research has suggested that the larvae introduce a toxic or growth inhibiting compounds into roots when feeding, but no such compounds have been identified previously," Dr Etebari said.

Through this research, he has analysed the salivary glands of soldier fly larvae that have been feeding on cane. He found genes for venom proteins had been expressed.

"The venom proteins that we discovered are similar to those previously reported in plant parasitic nematodes and in other insects, where they have been shown to facilitate the invasion of host plants. We are currently further investigating the venom proteins identified," he said.

"In addition to the venom proteins, we have detected sequences with high levels of similarity to viruses and bacteria in soldier fly salivary glands.

"These include plant pathogenic bacteria, insect borne bacteria and insect specific viruses. Further work is required to determine if soldier fly larvae can transfer these microbes to sugarcane plants when they feed on them." ■

For more information, contact Dr Karel Lindsay
E klindsay@sugarresearch.com.au
T 07 4963 6821.

(Above) Aerial shot of soldier fly damage at Hay Point. (Over page - top left) A soldier fly larvae eating sugarcane roots. Picture by Kayvan Etebari. (Top right) A close-up of soldier fly larval mouth parts. Picture by Kayvan Etebari. *(Middle right) Hay Point Male. (Bottom) SRA Researcher, Dr Karel Lindsay, inspecting soldier fly damage at Hay Point in the Central Region. (Middle left) An adult female soldier fly.*

Trial involvement helps information flow on varieties

Plane Creek grower Peter Hackett says open communication between industry and SRA is helping to improve the variety development process.

Central Region grower Peter Hackett has always had a keen interest in new varieties making their way through the development pipeline.

Farming near Koumala, south of Plane Creek, Peter is also passionate about working with SRA's plant breeding team, and the local industry, to achieve improved outcomes for everyone.

That's why he has held Final Assessment Trials (FATs) on his property for the last 12 years.

"This farm is a fairly average soil type for the district and it was unirrigated at the time I started with the trials, so I thought the information coming from this trial would be useful for the rest of the growers in the Plane Creek area," he said. "12 years later and we are still going and it continues to be interesting to observe the trials from the high rise spray tractor and see how much variation there is between different clones."

This was one of the topics under discussion at a recent local shed meeting at a neighbour's property. At the meeting, SRA Leader for Crossing and Selection, Dr George Piperidis, spoke about new varieties for the Central Region such as SRA9^{Ф}, SRA12, and SRA13 as well as the selection process and how the team work with growers such as Peter across the region through on-farm FATs.

Peter's current variety mix mostly consists of Q208^{Ф}, Q240^{Ф}, Q183^{Ф} and KQ228^{Ф}, and an increasing amount of Q252^{Ф}.

When CaneConnection visited in July, he had completed his first cut. Blocks affected by yellow canopy syndrome (YCS) were disappointing, but other blocks were reasonable given the season, although he added that it may be a struggle to hold tonnage as the season moved on.

In the region, last year's crush ran late and then led directly into a drought across most of the summer, which stalled the growing season.

"In 2017 we had a good crush until the middle of October, and then it rained and sparked the crop off and it started looking good. But then it forgot to rain until we had about 100mm in one day late in the summer, but so far we're about 500mm below where we should be for the year."

While Peter has supplementary irrigation with hard hose irrigators supplied from a small on-farm dam, it isn't enough to keep up with the peak of the dry conditions.

He farms 150 hectares of his own country, plus an additional 35ha of lease country. He farms on 1.7 metre row spacings, with all farm work – except for harvesting – done themselves.

They green cane trash blanket as much as possible and aim for a legume crop at the end of the crop cycle, although this hasn't been possible in the last few years because conditions were too wet (summer 2017) or too dry (summer 2018).

"We have dabbled in those crops with an eye on soil health, and even though it hasn't always been successful it has been a good learning curve," he said.

"It's important to give it a go, although we also feel we are better off doing these things in a year when the sugar price is reasonable so that we aren't losing money in a year that we can't afford it.

"At the moment we are just trying to ride out the current price slump."

He is a third generation grower and has also been supplying liquid fertiliser to other growers from Wilmar Sugar for the last 32 years, which has been an important part of the farm's diversification. This has expanded this year to the purchase of a rubber-tracked machine to add to the existing three trucks that he, his son-in-law and an employee work with.

It will allow greater flexibility of nutrient application in wet conditions.

"The trucks have their limitations when it rains. Getting bogged is one thing, but we are also very mindful of compaction as we don't want to be negatively impacting the soil in that process of getting the fertiliser on."

*(Over page) Peter with the recently-purchased tracked rig for liquid fertiliser application. **(Above)** Peter and his high-rise sprayer. **(Right)** Peter pictured with this year's crop.*

Knowledge bank building on yellow canopy syndrome

SRA continues to invest in research to unravel the yellow canopy syndrome (YCS) mystery through an integrated research program. This program spanned four major projects in 2017/18, which have made the following observations and progress.

1. YCS CAN NOW BE DIAGNOSED WITH (A HIGH LEVEL OF) CERTAINTY.

There are many causes of leaf yellowing in sugarcane. YCS is a specific pattern of leaf yellowing accompanied by abnormal and lethal accumulation of sucrose and starch in leaves.

2. ADDITIONAL MAGNESIUM APPLICATION ABOVE LEVELS RECOMMENDED FOR GOOD CROP MANAGEMENT HAS NO IMPACT ON YCS EXPRESSION.

Magnesium deficiency in sugarcane can lead to yellowing of leaves. Experiments now confirm that addition of magnesium does not prevent or alleviate YCS symptoms. Plants with YCS usually have adequate levels of magnesium so magnesium deficiency is not a cause of YCS.

3. THE ROLE OF INSECTS, PHYTOPLASMAS, OTHER BACTERIA IN COMBINATION WITH ENVIRONMENTAL TRIGGERS ARE BEING INVESTIGATED.

Experimental work does not support a single cause of YCS. A number of factors need to be present for YCS to be expressed. Experimental work is focused on identifying the key factors so that management options can be progressed.

4. AN INDICATOR TOOL KIT FOR SRA, PRODUCTIVITY SERVICE ORGANISATIONS AND INDUSTRY ADVISORS FOR IDENTIFYING YCS IS AT AN ADVANCED STAGE OF DEVELOPMENT.

This is a significant step as any approach, experimental or commercial, needs to correctly identify the problem so that researchers and industry can respond appropriately.

5. A CHEMICAL OPTION IS UNDER INVESTIGATION WHICH IN MOST CASES PREVENTS YCS SYMPTOM EXPRESSION UNDER EXPERIMENTAL CONDITIONS.

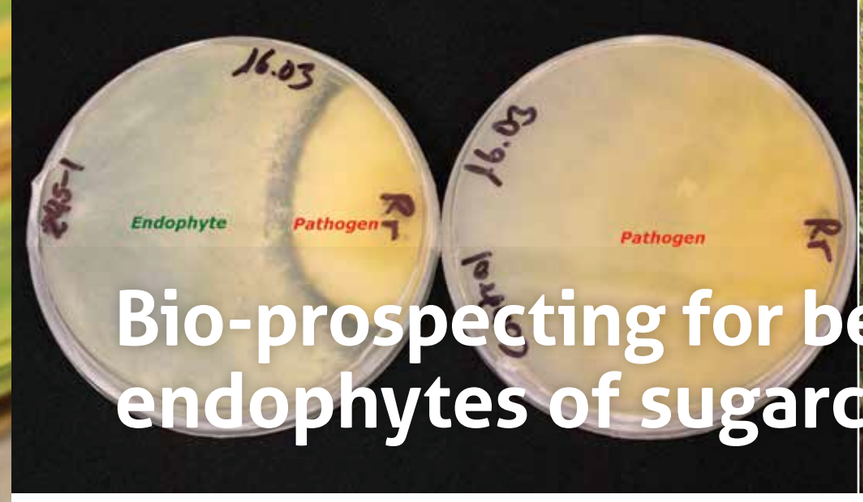
This is a vital step if researchers are to develop management options for industry. These trials have used a broad-spectrum insecticide at high doses as an experimental tool to confirm or eliminate the role of an insect in YCS. This is not a test of the suitability of these chemicals as a management option.

6. THIS OPTION IS ENABLING US TO QUANTIFY THE IMPACT OF YCS ON YIELD AND IDENTIFY POTENTIAL CAUSES.

This means that researchers now have the capacity to manipulate YCS symptoms. ■

If you have questions in relation to the above, contact the SRA YCS Strategic Initiative Program Leader, Dr Frikkie Botha at FBotha@sugarresearch.com.au.

SRA acknowledges the funding contribution of the Queensland Department of Agriculture and Fisheries towards this research activity.



Bio-prospecting for beneficial endophytes of sugarcane

Ask someone what the most valuable thing is inside a sugarcane plant and the obvious answer is sugar.

But if you ask what other valuable things are inside sugarcane, the answer is far less obvious.

However, new research is examining the vast array of microscopic organisms within sugarcane to discover if some of these microbes can be used to create improved productivity, profitability and sustainability outcomes for growers and millers.

This research is part of an SRA-funded project called *Bio-prospecting for beneficial endophytes of sugarcane*, where researchers from SRA and AgResearch are analysing the living communities of organisms within the sugarcane plant.

This living community – called a microbiome – consists of organisms such as fungi and bacteria.

Just like there are good and bad bacteria within the human body, there are also good and bad micro-organisms living within sugarcane.

"We have known for many years that plants can harbour pathogenic micro-organisms, but in the last few years it has become clear that plants contain large populations of both pathogenic and beneficial microbes," explained Dr Priya Joyce, SRA Leader for Molecular Genetics. "The beneficial microbes could help with productivity constraints by improving disease resistance, nutrient uptake, or promoting plant growth."

This research is investigating the microbiome of sugarcane (to go 'prospecting' to have a look what is inside), and then determine if these beneficial organisms can be exploited to help the industry.

With bio-prospecting, scientists are seeking out that valuable and elusive nugget of 'gold', but are doing so using advanced techniques such as DNA sequencing.

In the first part of the project, researchers isolated DNA from leaf, stalk and roots of commercial sugarcane varieties and wild relatives, and compared the microbiome between the two. By looking at more than 15 wild relative species, they found that the microbial communities varied between tissue type, geographical location and to a lesser extent by host species.

The research team has also discovered that the microbiome of modern sugarcane varieties is significantly different to the microbiome of wild sugarcane. Over time, through modern breeding and cultivation, our sugarcane varieties have lost parts of their microbiome. Some of these "lost microbes" are likely to confer beneficial traits to their host plants.

"Therefore, there is an opportunity to isolate beneficial microbes from wild relatives and introduce them into commercial varieties," Priya said.

The early results are promising. From the large pool of fungi and bacteria that they have isolated, they have already seen some that may have a positive impact.

A large collection of these bacteria and fungi from sugarcane plants has been screened against common fungal diseases such as red rot and pineapple sett rot. Of those screened, just over 12 percent inhibited the growth of at least one of the pathogens. Furthermore, some of these selected isolates also showed potent inhibitory activity against both root knot nematodes and root lesion nematodes.

In particular, some of these fungi were able to completely inhibit activity of both parasitic nematodes within 10 minutes of exposure. The next step would be to assess if these microbes have the same inhibitory effect when present within the plant, as they did in the petri dish.

"This testing of promising microbes has begun at the SRA Woodford research station, with the hope that we will see the same beneficial effect," Priya said. Encouragingly, preliminary data suggests that the first of these isolates can effectively control pineapple sett rot under glasshouse conditions, and further experiments are underway to confirm this result.

They are also assessing variations between regions and ecological factors such as soil type.

SRA Postdoctoral Researcher, Dr Stephen Mudge, said that the research could lead to a positive control mechanism without chemicals or genetic modification.

"We hope that this research will translate into ecologically sustainable solutions for challenges faced by the sugar industry," he said.

Once beneficial microbes are confirmed, future work will focus on optimal formulations for commercial delivery of this technology to growers. ■

For more information, contact Dr Priya Joyce on
E pjoyce@sugarresearch.com.au
T 07 3331 3375

(Above left) *An example of a fungal isolate that inhibits the growth of a sugarcane pathogen. In the Petri dish on the right the sugarcane pathogen Colletotrichum falcatum (which causes red rot) has grown enough to completely cover the plate. The dish on the left, however, contains an endophytic fungus from sugarcane which is inhibiting the growth of the pathogen. A zone of inhibition can be seen between the two fungi.*
(Above right) *Harvesting wild relatives of sugarcane in PNG, from which endophytic microbes were isolated.*

Piecing together a soil health jigsaw puzzle

Marian cane grower Simon Mattsson is looking to plant diversity – and now animal diversity – to improve soil health on his farm.

BY BRAD PFEFFER

It was 15 years ago when Simon Mattsson started to seriously question his soil's organic carbon levels.

He had been green cane trash blanketing (GCTB) for a decade and remembered the initial promises with GCTB: it would retain moisture, suppress weeds, and increase organic carbon.

"We had been an early adopter of green cane trash blanketing, starting in 1986, but there was nothing happening with our soil," he said. "If anything, our soil carbon levels were going backwards."

Striving for the answer to this question, and to find a better way to run the family's Central Region cane farm, has led to a long journey that involved a Nuffield Scholarship, travel to about a dozen countries, countless trials, scientific publications and collaborations, and an ongoing passion for sharing the message on soil health.

One of the major turning points came when he was thousands of kilometres from home, in a field in North Dakota.

He was on a grain farm and talking to the farmer about both plant diversity and animal diversity, and he quickly realised that the principle applied all the way back home to Marian.

"In talking to farmers overseas, I saw the power and necessity of plant diversity," he said. "Without plant diversity you will not have biological diversity, which enables nutrient cycling.

"In the sugar industry, there is a big focus on compost, mill mud and ameliorants, which work if you can afford them, but I saw live roots as the answer for addressing biological function."

In 2015, that led to multi-species fallow crops (eight) and intercropping with crops such as sunflowers.

Having worked on that process for a few years, he is now taking the next step that he saw overseas. In 2018, his fallow had an electric fence around it, and inside were 33 grown cattle and five calves going through high-intensity rotational grazing and enjoying the mixed-species fallow crop.

He'd grown up with cattle and had seen the process at work overseas, but had also considered other options such as pigs, sheep and goats.

He decided on cattle for ease of management and processing, and for this same reason opted to breed for the store market.

"If I were to buy weaners and fatten them, most of the time I would be buying animals that have never seen an electric fence," he said. "So I'd be retraining animals all the time, and good neighbours might quickly turn into cranky neighbours if my cattle escape into their paddocks.

"The cattle – Droughtmaster cross – have developed a good respect for the electric fence and respect it far more than they would barbed wire. I've only had one escape, and she just waited on the other side for me the next morning."

The electric fence is also much easier to put up and take down for the cane cycle.

The fallow is about 26 hectares and the cattle are in a section of about 80 square metres for each graze. The idea is that they will go over a section three times, and after the third round the biomass will be almost fully grazed before the ground goes back to cane in the spring. Using a small area ensures even grazing and spread of manure.

The cattle are moved generally every day, but may be left a little longer on the third round to ensure the cover crop is grazed down. The grazing starts in March, and finishes around July/August, which was when CaneConnection visited.

Including the solar, batteries, fencing, and other equipment, the investment was in the order of $30,000. He also has a portable water source that is moved with the cattle so that they aren't creating pads.

He said that it was a way of capturing value, and helped avoid some of the seasonal risk that came with a single crop of legumes.

There are 14 different species in the fallow crop in the paddock, plus some volunteer cane. "I am looking for plants that are palatable and also serve a biological function with soil health.

"Sunflowers aren't as palatable as other species, but they are definitely in the mix because they are a very good host of mycorrhizal fungi, which help their host plant take up phosphorous."

PLANT DIVERSITY

We've all seen the spectacular photographs in farming magazines: arrow straight rows, not a weed in sight, and a bright-green crop that looks like the top of a billiard table.

For Simon Mattson, he knows that those crops look impressive, but they don't necessarily pay off the mortgage in the long term.

He is much more worried about what looks good under the surface with a microscope than what looks good on top.

Getting things right underneath will lead to getting things right on top, he says.

When he points to the hills overlooking his property, he makes the point that nowhere in nature do plants look like they do on the cover of a farm journal.

"After my Nuffield Scholarship, I started with adding plant diversity and I knew that in the sugar industry it is now common to find agricultural soils with less than one percent carbon content."

He'd seen the effects of a monoculture for himself.

"This place has ground that has been farmed for over 100 years and was some of the earliest to be opened up for the Marian Mill. It also has country that I opened up 30 years ago. That new country grew good cane at first, but it has now become pretty much as bad as the country growing cane for 100 years."

This has been a topic of discussion at recent Soil Health Masterclasses, which were funded by SRA across the industry, and Simon presented at, along with others including Dr Graham Stirling, Dr Anthony Young, Dr Jay Anderson, and southern region growers, Mr Ashley Peterson and Mr Tony Chapman.

The Masterclasses discussed topics that Simon is passionate about, digging deeper into the biology, chemistry and physical properties of a healthy soil.

Similar work, separate to that which Simon has undertaken on his farm, is continuing under an integrated soil health research program at SRA, spanning across multiple research projects. This includes research that will examine issues such as companion cropping and mixed-species fallow crops, as well as looking for strategies to reduce the competition effects that may reduce cane yield.

For Simon, he is continuing with his mixed species fallow crops, and also intercropping with sunflowers to continue with the diversity into the crop cycle, in the quest to improve soil biology and health.

In a paper that Simon co-authored with Dr Graham Stirling for the Australian Society of Sugarcane Technologists (ASSCT) conference this year, they found that three years of eight-species intercropping increased soil carbon levels by about 15 percent, although this effect was not statistically significant.

"The nematode and carbon results suggest that long-term benefits are likely to be obtained by incorporating multi-species intercropping into the sugarcane farming system," they wrote in their paper.

They also found that where sunflower was the intercrop species, DNA tests on the soil showed the soil was more heavily colonised with a more diverse range of mycorrhizal fungi.

"Collectively, these results suggest that intercropping improves the biological health of sugarcane soils. However, long-term field trials are required to substantiate the benefits obtained; assess the impact of intercropping on sugarcane yield; confirm that intercropping improves soil carbon levels; and fully evaluate its effects on soil biodiversity," they wrote.

Some of the work in this trial through Dr Graham Stirling was supported through an SRA-funded research project.

In summary, Simon says improving soil health is a long-term equation that involves complex factors all working together.

He cites an example for some of his country moving from 5.5-6 pH to now 6.5 pH, as well as organic carbons between 0.8 and 1.5, whereas previously they were less than 1.

There is also current work underway between SRA and the NSW Department of Primary Industries working with mixed species fallows and looking at the impacts on soil indicators: chemical, physical and biological.

NSW-DPI will be measuring soil carbon pools to try and understand what is happening at different sites.

Also, SRA is investing in a project with CSIRO on a diagnostic for root health to measure the size and functional root systems in sugarcane associated with soil health/cover cropping sites, and SRA Researcher Dr Rob Magarey will be using the PreDicta platform to look at soil health issues.

"Yes, I am making a difference, but it is also difficult to clearly demonstrate that it has reliably translated into yield increases," Simon said.

However, he is particularly proud of one example in 2017, where a crop of plant cane Q240[d] on single-row two metre centres yielded 171 tonnes per hectare at 12.2 PRS cut in early July, marking his best ever crop.

"We are starting from a low base in the sugar industry and some of what I am doing is controversial, but I am truly passionate that plant diversity to influence soil biology is the key and offers huge potential for our industry." ■

For more information, contact Simon Mattsson
E mattsson@mcs.net.au

(Over page - left) Not something you see often on a cane farm – high intensity cell grazing in fallow paddocks. (Over page - top right) All this work is in the interest of improving soil health. (Middle) Intercropping of sunflowers with cane. (Bottom right) The electric fencing, including solar and batteries, cost about $30,000.

SRA Woodford: 21 years of delivering outcomes for the industry

SRA's Woodford Research Station celebrates 21 years in operation this year. Work undertaken here gives the industry a much better understanding of disease resistance ratings of new varieties and it provides a critical function in the overall biosecurity and plant breeding picture.

BY SAMANTHA RYALLS

Our Woodford site was purchased in July 1997 and this year celebrates 21 years in operation.

The site was purchased specifically for use as a pathology farm, with the primary purpose being to screen potential new sugarcane varieties for resistance to diseases. The first disease-resistance screening trials started there in 1998. The site was chosen because it was a reasonable distance from existing cane farms, reducing the risk that disease may spread from the station to commercial crops.

Work undertaken at the Woodford Research Station gives our researchers a much better understanding of disease resistance ratings of new varieties, information that is presented within our annual variety guide publications and online via QCANESelect®. Woodford provides a critical function in the overall biosecurity / plant breeding picture.

Pathology testing to develop disease resistance ratings is a carefully controlled and resource intensive process, and therefore has been focussed upon the late stages of the breeding program. However, following recent improvements that SRA has made to the breeding process, SRA is also working towards discovering more detail about disease-resistance earlier in the plant breeding cycle. This strategy is designed to maximise the number of clones promoted to Final Assessment Trials (FATs) that meet minimum disease standards, which in turn allows greater selection pressure and genetic progress for yield and CCS (commercial cane sugar). Woodford, along with Pachymetra screening at SRA Tully, is a critical component of this work.

Our Woodford site is also occasionally used as a teaching centre by our leading researchers including courses for both introductory and advanced diseases workshops, allowing the learnings to happen in a hands-on environment.

In 2012/13, the smut resistance screening (previously in Bundaberg since the smut incursion in 2006) was moved to Woodford which saw Shamsul Bhuiyan bring his expertise to Woodford and brought their staff numbers to five. Nicole Thompson moved to Woodford in October 2017, after 11 years at Indooroopilly, and she now lives on site.

The longest standing staff member at Woodford is Principal Technician Andrew Greet, who has been at this site since it first opened. He has been with our organisation for 26 years, commencing in Tully in 1992, transferring to Eight Mile Plains in 1997 and to Woodford in 1999.

The other full time staff are Chris Watson (Farm Technician) and Kylie Garlick (Technician). It is currently their busy time of year (May – late October during trials) so there are also up to four casual staff helping. The team have some regular casuals who have several years' experience assisting with the processes required.

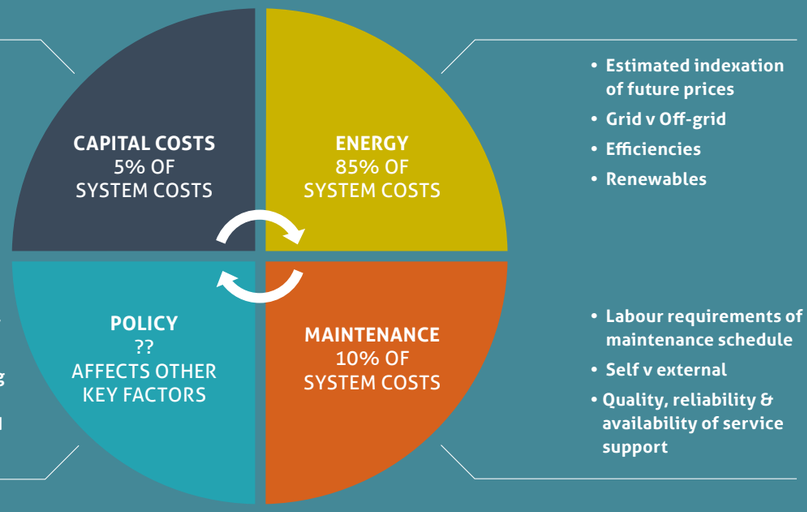
From about mid-May to mid-August, they receive around 400-600 clones every two weeks for processing and preparation for disease resistance trials.

In September they begin the field planting. The trials have different designs and replicates, depending on the disease being assessed. Assessment for disease resistance also varies for each different disease, but they try to be as efficient as possible and produce results for the plant breeding team to use in their selection programs.

Best wishes to the team at Woodford as they celebrate their 21st year in operation. ■

(Over page) Technician Lucy Gibbs and Principal Researcher Nicole Thompson in the field.
(Above left) Principal Researcher Nicole Thompson inspecting samples in the germination chamber.
(Top right) Technician Lucy Gibbs collecting punch samples.(Bottom right) Stephen Houtsma cutting the cane into one-eye-setts.

"Woodford provides a critical function in the overall biosecurity / plant breeding picture."



Capital costs equate for only 5% of total system costs, indicating it should not be the key consideration

- **Estimated indexation of future prices**
- **Grid v Off-grid**
- **Efficiencies**
- **Renewables**

- **How likely is a legislation change that will affect the other factors?**
- **The deeming period for claiming STCs and LGCs is winding down each year to 2030. Now is a good time to invest.**

- **Labour requirements of maintenance schedule**
- **Self v external**
- **Quality, reliability & availability of service support**

Electric vs Diesel pumps: is there a clear winner?

Leading agricultural economists at Ag Econ say there are four key considerations for irrigators looking to invest in new diesel or electric pumps: capital costs, maintenance costs, energy costs and the affect of government policies.

CAPITAL COSTS

Capital costs account for 5 percent of overall irrigation system expenditure and therefore should not be the primary factor in determining which energy source is right for a farm. However, if electricity infrastructure is not already in place, the capital costs of installing electric pumps may be prohibitive, making diesel the more attractive option.

MAINTENANCE COSTS

Maintenance costs account for 10 percent of overall system expenditure. Electric pumps are the clear winner when it comes to maintenance, requiring less servicing than diesel pumps.

However, it is also important to consider whether the maintenance can be done by the farmer (often the case with diesel pumps) or needs to be done externally, and how readily available the off-farm service support will be.

ENERGY COSTS

Decisions on the capital costs (good design) and maintenance costs (efficiency) in turn influence the energy costs which make up the bulk of the lifetime costs.

Electric pumps are 50-85 percent more efficient than diesel pumps. However, diesel pumps become more competitive as the size of the pump increases (efficiency increases as horsepower increases).

Electricity pricing has become a major issue for irrigators with price increases flowing onto higher per-megalitre pumping costs.

For irrigators using diesel pumps, exposure to fluctuations in the world crude oil price, exchange rates and the unlikely removal of the diesel fuel rebate are all risks to energy price stability.

GOVERNMENT POLICY

The dynamic nature of Federal and State government policy initiatives makes economic modeling complex. The National Renewable Energy Target and Climate Change Fund are expected to increase energy costs at an average annual rate of over 16 percent to 2019-20.

One benefit of electric pumps is that solar can be integrated into a grid-connected electric pump relatively easily. New regulations to solar "feed-in-tariffs" means that in some cases, the excess power fed into the grid can also offset installation costs. Installation of solar may also enable access to the Renewable Energy Certificates which are credited to the capital costs of the purchase. ■

Ag Econ are undertaking an SRA-funded research project called Productivity Improvements through energy innovation in the Australian sugar industry**.**

Contact Jon Welsh on M 0458 215 335.

SRA acknowledges the funding contribution from the Queensland Department of Agriculture and Fisheries towards this research activity.

Collaborative effort delivers new sugarcane variety for Burdekin region

A new sugarcane variety approved for growers in the Burdekin region has been named after its joint developers – Wilmar Sugar and Sugar Research Australia (SRA).

The new Burdekin variety is called WSRA17 and it is the first to carry the 'WSRA' prefix since the naming convention for new sugarcane varieties changed in 2015.

The W signifies Wilmar's contribution to the variety through its early-stage breeding program. Wilmar's work synchronises with SRA's breeding program as potential new varieties make their way toward the Final Assessment Trial (FAT) stage.

SRA Variety Officer for the Burdekin, Catherine Kettle, said WSRA17 produced good tonnes per hectare when compared to standard commercial varieties in trials (Q183$^{\phi}$, Q208$^{\phi}$ and KQ228$^{\phi}$). Its commercial cane sugar (CCS) was slightly lower than comparison varieties in trials, it was resistant to leaf scald, and was intermediate/susceptible to sugarcane smut.

Burdekin Productivity Services Manager Rob Milla said from the data seen to date, the variety had good commercial prospects due to its yield performance and leaf scald resistance.

Mr Milla added that local industry would continue to keep a close eye on WSRA17's response to smut in the Burdekin, which so far had been reasonable. This local response has seen the Burdekin Regional Variety Committee approve the release of the variety, while also noting the importance of continuing to monitor its response to smut.

According to Wilmar Sugar Technical Field Officer Terry Morgan, the variety has shown promise in field trials and through its development, and was special because both parents were commercial varieties that had been created in the Burdekin.

WSRA17's parents are Q208$^{\phi}$ and Tellus$^{\phi}$. Q208$^{\phi}$ was the most popular Australian variety in 2017 and represented 30 percent of the entire Australian sugarcane crop.

"WSRA17 is unusual because it came from a cross that occurred under field conditions in a block of commercial cane," Mr Morgan said. "We really mined that cross. We grew in excess of 3,000 seedlings from the cross, and that is where this new variety came from." ■

***(Above)** SRA Variety Officer (Burdekin) Catherine Kettle and Wilmar Sugar Technical Field Officer Terry Morgan. Picture by Leanne Oliveri, Wilmar Sugar.*

Yield monitoring a useful tool to inform harvest best practice

Using a yield monitor is delivering potential to improve harvesting practices, as well as for lifting productivity through precision agriculture.

BY BRAD PFEFFER

Yield monitors and mapping are common in the Australian grains and cotton industries.

But in the Australian sugarcane industry, it is a different story.

With the huge mass of billets passing through the harvester, plus extraneous matter with little to no sugar, it has taken longer for yield monitors to make their presence widely felt in the Australian industry.

However, this has been changing in recent years, with major manufacturers offering yield monitors for their machines, which adds to the range of after-market products that have also been available in different forms over the last 20 years.

Herbert River district farmers and contractors Vince Russo and Steve Guazzo own Hamleigh Harvesting.

They cut over 120,000 tonne each year including their own cane and the cane of four other growers, covering a bit over 1,200 hectares.

When they decided to purchase a John Deere CH570 in 2017, they were eager to investigate the additional value that could come with the yield monitoring equipment and mapping software available through John Deere.

The Harvest Monitor works when high-resolution stereoscopic optical sensors scan the flow of cane as it passes through the elevator. The sensors can differentiate cane volume from trash while four light-emitting diode lights illuminate the sampling area to ensure visual clarity is uninterrupted.

"The monitor measures yield, pour rate and extraneous matter in real time, providing very powerful information," Vince said. "We are happy with its accuracy and see that it is providing data that can inform a range of management decisions."

Vince has been heavily involved in a range of activities locally – and across the industry – to improve sugarcane harvest efficiency, and he saw the information from the yield monitor and the easy-to-use multilayer maps and graphics as another tool that could help deliver optimum harvest outcomes.

He has been involved with in-field trials with SRA, which have been looking to find the sweet spot for reducing sugar losses. These trials see growers, contractors and millers collaborating to extract more value for the industry.

Through the trials, it is well understood that there will always be some sugar and cane lost through the mechanical harvesting process. Every cut, every moving piece of machinery, and the fans on the harvesters create various amounts of losses of cane and juice.

The variety, the size and shape of the field, the weather on the day, the size of the crop, and even the time of day all have an impact on recovering sugar. On top of that, the harvester comes into the equation: its forward speed, its pour rate, and the speed of the fans and other components all have an impact.

Harvesting contractors also face considerable economic pressure in getting the job done, and also in trying to match the cane harvested to the supply of bins.

This all results in a complex equation where operators are balancing the economics with the conditions of the day and delivering the best job possible.

The trials with SRA, which also include an economic assessment by the Queensland Department of Agriculture and Fisheries, are aiming to determine just how much of the value can make its way back into the pockets of the value chain.

For Hamleigh Harvesting, the yield monitor is helping them enhance the information received through the trials. One of their benchmarks for maximising sugar recovery is running at a 90 tonne per hour pour rate through the machine at a fixed fan speed of 710 rpm.

By sticking to these parameters, their driver then regulates his ground speed accordingly, which Vince said they believed was delivering the best result.

"The machine is capable of much greater throughput, but we believe 90 tonnes per hour pour rate is a good benchmark."

He added that the monitor also helped form a clear picture of the cost of harvesting. For example, the monitor helps highlight how paddock factors such as row length and crop class impact the cost of harvesting such as through fuel use.

Beyond that, he added that yield maps had significant management potential through precision agriculture.

"For example, you can layer a yield map with an elevation map to look at areas where poor drainage could be impacting productivity," he said.

"And if it is not a drainage problem, it also gives you the chance to go in with soil sampling and see what else is going on, and then take action accordingly," he said. "The yield map really gives a better picture of what is happening in the field, and the next step is making the most of that information."

He also hopes that a better harvesting result will lead to improved profitability through extending ratoon life, by lifting productivity in low-yielding areas and improving harvest efficiency.

"We want to be maximising our investment and ensuring our plant crop leads to as many healthy and good-producing ratoons as we can get. The yield-mapping can help to improve the consistency across a block for that." ■

SRA has also invested in recent research into precision agriculture, which included work on yield monitors, as part of a project called Delivering precision to users of Precision Agriculture in the Australian Sugar Industry – Yield Monitoring**, led by Troy Jensen at the Centre for Agricultural Engineering at the University of Southern Queensland.**

The in-field trials are part of a project funded by the Department of Agriculture and Water Resources Rural R&D for Profit program. This program is also supported by the Queensland Government Department of Agriculture and Fisheries.

Australian Government
Department of Agriculture and Water Resources

(Over page) Vince Russo says that yield monitoring equipment and software opens up a range of management options.

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	01/05/2019
Exploiting introgression for the development of productive & regionally adapted varieties for NSW	2013022	Sunshine Sugar	Roy Parfitt	01/05/2020
Applying the genome sequence for variety improvement: validation and implementation	2013030	CSIRO	Karen Aitken	01/08/2020
Licence to Farm: Nitrogen use efficient varieties to meet the future environmental targets	2016044	SRA	Prakash Lakshmanan	01/07/2019
Improving early stage selection of SRA breeding program by indirect selection of plant vigour	2016028	SRA	Jaya Basnayake	01/07/2019
Leaf sucrose: The link to diseases, physiological disorders such as YCS and sugarcane productivity	2015016	SRA	Gerard Scalia	30/06/2019
Optimising productivity, variety recommendations and mill operations through analysis of mill data	2016032	SRA	Jo Stringer	01/02/2021
New approaches to identify and integrate Pachymetra resistance genes from Erianthus into SRA breeding program	2016039	SRA	Nathalie Piperidis	31/12/2019
Implementing and validating genomic selection in SRA breeding programs to accelerate improvements in yield, commercial cane sugar, and other key traits	2017002	UQ	Ben Hayes	01/07/2022
Compendium of sugarcane traits and their associated genes	2018001	CSIRO	Donna Glassop	01/06/2019
Validating root system traits for enhanced nutrient capture in challenging environments	2018002	CSIRO	Anne Rae	01/09/2021
Impact of stool architecture on ratooning: extending current trial to 4R to strengthen correlations	2018004	CSIRO	Anne Rae	01/03/2021
Genetic analysis and marker delivery for sugarcane breeding	2018005	CSIRO	Karen Aitken	30/06/2022
Selecting high value chromosomes from Saccharum species - extension to 2015/026	2018006	CSIRO	Karen Aitken	30/06/2020

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability)				
Strategies to manage soil-borne fungi and mitigate sugarcane yield decline	2013101	CSIRO	Paul Harvey	01/09/2018
Improving NUE for sugarcane crops with constrained yield potential	2015065	SRA	Danielle Skocaj	15/0602018
More profit from nitrogen: enhancing the nutrient use efficiency of intensive cropping and pasture systems	2015907	CRDC	Multiple	30/06/2020
SIX EASY STEPS - continuing perspectives in time and space	2017004	USQ	Bernard Schroeder	01/02/2022
Measuring soil health, setting benchmarks and driving practice change in the sugar industry	2017005	SRA	Dave Olsen	01/08/2022
Unravelling the impact of climate and harvest time on nitrogen fertiliser requirements	2017009	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	2017014	UNSW	John Triantafilis	01/10/2020
Decision support for choice of enhanced efficiency fertilisers - Herbert catchment pilot study	2017015	CSIRO	Kirsten Verburg	28/02/2019

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 2 (Soil health, nutrient management and environmental sustainability - *continued*)				
Implementation of root system diagnostics to deliver a field-based measure for root health	2018003	CSIRO	Anne Rae	01/08/2021
Greenhouse gas emissions from sugarcane soils: strategies for increasing NUE and reducing environmental pollution	2018007	QUT	Peter Grace	30/06/2021
Establishing sugarcane farming systems to improve soil health	2018008	SRA	Barry Salter	01/03/2023
Complete nutrient management planning for cane farming (**Funding provider:** Queensland Government DES)	2016804/ RP161	SRA/Farmacist	Jayson Dowie	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	01/05/2021
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	2014049	SRA	Dave Olsen	30/06/2019
Using Remote Sensing to improve canegrub management in North Queensland cane fields	2015038	SRA	Kevin Powell	01/12/2018
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with the existing product	2016003	SRA	Andrew Ward	01/01/2020
Investigation of biotic causes of yellow canopy syndrome	2016064	UQ	Andrew Geering	01/12/2019
Keeping our chemicals in their place - in the field	2017008	SRA	Emilie Fillols	01/07/2021
Delivering solutions for chlorotic streak disease	2017010	SRA	Kathy Braithwaite	30/06/2020
Development of commercial molecular biological assays for improved sugarcane soil health and productivity	2018009	SRA	Rob Magarey	30/06/2021
Moth Borers – how are we going to manage them when they arrive?	2018010	SRA	Andrew Ward	01/08/2021
Key Focus Area 4 (Farming systems and harvesting)				
A non-pneumatic cane cleaning system with no cane loss.	2014035	QUT	Floren Plaza	01/06/2019
Increased Harvest Recovery: Reducing sugar loss and stool damage	2014048	SRA	Joseph Bonassi	01/05/2019
Assessment of new management strategies for marginal soils	2015007	SRA	Barry Salter	31/12/2019
Bio-prospecting for beneficial endophytes of sugarcane	2015051	AgResearch	Stuart Card	01/02/2019
Sugar from space: improved data access, yield forecasting and targeted nitrogen application for the Australian Sugar industry	2016062	UNE	Andrew Robson	01/01/2020

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 4 (Farming systems and harvesting - *continued*)				
Understanding Interactions Between Basecutters and Other Forward-feed Components with the Cane Stalk, and Determining Practical Strategies to Minimise Damage as Harvester Speed Increases	2016952	Norris ECT	Chris Norris, Phil Hobson	01/04/2020
Commercial Scale Economic Evaluation of Post-Harvest Cane Cleaning to Maximise the returns to the Supply Chain	2016953	QDAF	Stephen Ginns	30/06/2019
Adoption of practices to mitigate harvest losses	2016955	SRA	Phil Patane	30/06/2019
Southern Sugar Solutions	2017012	DAFQ	Neil Halpin	01/01/2021
Improved irrigation system selection and operation for increased sugarcane productivity and profitability	2018011	USQ	Michael Scobie	01/04/2019
Key Focus Area 5 (Milling efficiency and technology)				
Real time harvest and transport system	2014037	QUT	Geoff Kent	01/09/2018
Investigation into modifying pan boiling techniques to improve sugar quality	2015013	QUT	David Moller	30/05/2019
Increasing capacity to undertake cane preparation research through modelling and experimentation	2015018	QUT	Geoff Kent	01/04/2019
Online analysis systems to measure the available nutrients in mill mud	2016019	SRA	Steve Staunton	01/03/2020
Reducing boiler maintenance costs and deferring capital expenditure through improved technology	2016020	QUT	Floren Plaza	01/07/2020
Evaporator Liquor Brix Sensor	2017003	Wilmar	Robert Stobie	31/12/2018
Managing aspects of raw sugar quality in the Australian sugar industry Part II	2017006	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	2017007	QUT	Darryn Rackemann	01/12/2020
Pan design and operational changes to suit Australian pan stages operating on low pressure vapour	2018012	QUT	Ross Broadfoot	01/10/2021
Evaluation of the Neltec Colour Q for measuring the purity of magma from C centrifugals	2018201	Isis Central Sugar Mill Company Ltd	David Pike	01/05/2019
Improving the impact of evaporator calandria noxious gas bleeding arrangements on evaporator rate and condensate quality at Racecourse Mill	2018202	Mackay Sugar Limited	Brett Bampton	14/05/2019
Understanding the cause of high colour sugar - intrinsic cane colour, extraneous matter or factory practices?	2018203	Wilmar Sugar	Robert Stobie	01/04/2019
Activated Sludge Plants – Optimising Operations and Technology	2018204	Wilmar Sugar	Robert Stobie	01/04/2019
Key Focus Area 6 (Product diversification and value addition)				
A profitable future for Australian agriculture: Biorefineries for higher-value animal feeds, chemicals and fuels	2015902	QUT	Ian O'Hara	01/02/2019
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

PROJECT TITLE	PROJECT NUMBER	R&D PROVIDER(S)	CHIEF INVESTIGATOR	END DATE
Key Focus Area 7 (Knowledge and technology transfer and adoption)				
Protecting our chemicals for the future through accelerated adoption of best management practice	2016002	SRA	Belinda Billing	01/08/2019
Development of an Intelligent Tool to allow real time evaluation of harvesting practices as part of a framework for improved harvester payment systems	2016951	Norris ECT	Stuart Norris, Rob Crossley	30/06/2019
Productivity improvements through energy innovation in the Australian sugar industry	2017011	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: Characterisation of a selected sugarcane germplasm for transpiration efficiency and high biomass production for the sugarcane growing regions in Australia	2014102	UQ	Sijesh Natarajan, Shu Fukai	15/10/2018
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	2014109	JCU	Justin Sexton	01/02/2019
Combining controlled release and nitrification inhibitor properties to deliver improved fertilizer nitrogen use efficiency in high risk environments	2016101	UQ	Chelsea Stroppiana	31/03/2020
Development and modelling of novel controlled release fertilisers for improved nutrient delivery efficiency	2016102	UQ	Ian Levett	01/09/2020
Integrated standardised competency based training for Sugar Milling operations	2017103	QUT	David Moller	01/12/2019

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

T 07 3331 3333 **F** 07 3871 0383
E sra@sugarresearch.com.au
W **sugarresearch.com.au**