Sugar Research Australia

Cane Matters

Autumn 2023

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(Cover page) Assistant Production Superintendent, Racecourse Mill, Kristen Nel.
Picture by: Elshonner Johnson

WELCOME TO
THE AUTUMN 2023 EDITION OF
Cane Matters

Welcome to the first quarter of 2023 and the Autumn edition of *Cane **Matters.***

Thank you for your continued support of and loyalty to SRA and our flagship magazine.

Our team has been working hard to ensure that we provide our readers with good quality content to ensure you keep ahead of the curve when it comes to industry trends and developments.

In the coming months, we will be focussing on improving engagement with our stakeholders. We will be ramping up our digital offerings, expanding our social media presence and exploring new partnerships to reach a wider audience.

In implementing our strategy we remain committed to optimising our value to industry through investment in critical areas that manage the industry's risk such as biosecurity and contributing to increased productivity through improved knowledge about our varieties and farming systems.

In this edition of *Cane **Matters***, you will find articles highlighting some of our recent achievements and innovations and the events planned in 2023.

Last year, the sugar industry launched the Sugar Plus vision and roadmap and we are excited to see some progress on this journey. The Queensland Government has announced it will partner with precision fermentation company Cauldron to develop a business case for a large-scale contract protein manufacturing plant in Mackay. Meet some of the major players in the industry.

New technology is also making a real difference in our mills. The positive results of the Crystobserver research project is just one example of the improvements in efficiency, product quality and quantity that are now within reach.

One of Sugar Research Australia's most important investment roles is in cane varieties breeding and we review a promising variety, SRA29$^{\phi}$, with excellent early growth and very rapid germination.

We introduce you to Dr Eric Dinglasan who is working hard to take genomic selection to the next level; Dr Madeleine Smith who is looking at a particular strain of bacteria and its potential role to make important cane bioproducts; and SRA's new Environmental Sustainability Scientist, Dr Simon Clarke, who is leading the Mobilising the Murray Project which has 20 demonstration sites now underway in north Queensland.

And in the Burdekin, we find out how one grower has taken back valuable time in his day by introducing an automated irrigation system under the Burdekin Irrigation Project.

Happy reading. Hope we see you at SRA's events this year.

Roslyn Baker
Chief Executive Officer

Editorial contributions by Bronwyn Venus, Christine Walker and Helen Cook. Design by Eli Lin.

EXCITING RESPONSE TO SRA RESEARCH AND INNOVATION FUND

Sugar Research Australia (SRA) will soon announce successful research and innovation funding projects that address specific industry challenges to improve the productivity and profitability of the Australian sugarcane industry.

SRA received nearly 50 applications seeking funding from SRA's Research and Innovation Funding Round 1 late last year and the SRA Board has provided in-principle approval for 23. SRA is now working hand in hand with both the Queensland Department of Agriculture and Fisheries (QDAF) and researchers to fine-tune proposals, so they deliver benefits by solving challenges quicker than before, for all industry participants

Eight pressing industry challenges were targeted in the funding round including: technology application for a step change; optimising disease, pest and weed management; biosecurity surveillance, preparedness and response; balanced nutrient management for soil health; and new products and value chains.

Successful projects will address the most pressing challenges and issues facing the industry including: mill-based biosecurity surveillance, virus-based biological control for canegrubs, development of soldier fly diagnostics and development of an artificial diet that will enable testing of novel control agents, developing automated spot and spray technology for unmanned aerial vehicles (UAVs) in weed vines, benchmarking weed distribution and severity, understanding phosphorous requirements in alkaline soils, and development of (milling) factory training modules.

SRA is working towards finalising agreements with researchers this year and announcing and commencing projects between April-June 2023.

Postgraduate student, Hannah Green is researching mill mud and ash applications for soil improvement and carbon sequestration in a project which runs until April 2025.

GROWERS ATTEND SRA EVENTS TO ENHANCE BUSINESS PRACTICES

SRA District Manager - Far North, Gavin Rodman recently hosted SRA grower events in Atherton, Mareeba, Babinda and Gordonvale.

SRA experts presenting included Pathologist, Dr Rob Magarey who gave an update on his work on Ratoon Stunting Disease; Weed Scientist, Emilie Fillols who shared initial results from aerial spraying and emerging weed trials; and Principal Agronomist, Dr Danielle Skocaj who spoke about managing legume cover crops and plant cane nutrition.

"It's important that we give growers in the district the opportunity to meet regularly with our experts," Gavin said.

"These events are great opportunities for everyone to get together, to meet face-to-face, to hear about how trials and research projects are progressing; and at the same time for growers to raise any local constraints, concerns and future opportunities. All our work is about improving business practices, productivity, and profitability for the growers. It's at events like these that we ensure our work benefits growers."

Subscribe to SRA's industry enewsletter to make sure you don't miss an SRA industry event in your district.

Or visit the Events page on the website by scanning the QR code for scheduled events.

SRA's Principal Agronomist Danielle Skocaj and Manager Translation Research Barry Salter.

SRA will be at ASSCT 2023 in Cairns from 18-21 April come and see us on Booth 31.

SRA's Meringa Station Field Day will be held on 18 April. Scan the QR code for more information, and see you there!

(Left) *Pictured at the Babinda event, growers Darryl Quabba and Charlie Di Maggio with SRA's Gavin Rodman and Paul Calcino.*

(Middle) *SRA Weed Scientist Emilie Fillols answered growers' questions on emerging weed trials.*

(Right) *An engaged audience at the Babinda event. "I always learn something when I come to an SRA event," said one grower.*

TRANSLATING RESEARCH FINDINGS INTO TOOLS **TO SAVE GROWERS TIME AND MONEY**

Developed and funded over three years by SRA and the Department of Agriculture and Fisheries (DAF) with the support and input from hundreds of sugarcane growers and contractors, *Harvest Mate* is now available to download as a smartphone app and online tool.

SRA District Manager – Northern and Agricultural Machinery Specialist Phil Patane says that *Harvest Mate* is well worth considering in future farming practices.

"*Harvest Mate* is the only decision support tool that considers the true economics in relation to both real revenue changes against the actual cost of harvesting," Phil said.

"If someone told you that using a free smartphone app could make you an extra $100 a hectare, wouldn't you give it a go?"

SRA is encouraging all growers and harvesting contractors to try out *Harvest Mate* with a roadshow of demonstration workshops scheduled in northern Queensland in the coming months.

Check the dates via the QR code for a *Harvest Mate* event near you. Join the SRA and DAF team for a step-by-step guide to using the app and learn from the people who developed it how it can benefit your business.

SRA District Manager Northern & Agricultural Machinery Specialist Phil-Anthony Patane with Tully grower Jamie Dore.

Scan here to see the *Harvest Mate* roadshow dates.

Queensland Government

SIX EASY STEPS® **GOES ONLINE**

SRA's Online Sugarcane Nutrient Management training course has been launched to reach sugarcane growers who want to refresh or up-skill their knowledge of nutrient management for sustainable sugarcane production; and do it at a time and a place that suits them.

SRA Manager Translation Research Dr Barry Salter said the new online training course is based on the popular SIX EASY STEPS® nutrient management workshops and is readily available and convenient for all sugarcane growers.

"This will improve SRA's capacity to deliver nutrient management training to the sugarcane industry using easily accessible technology," Barry said.

In response to requests across the industry from sugarcane growers and advisors alike, the training will also provide growers with the necessary knowledge to develop a nutrient management plan and create an annual nitrogen and phosphorus budget for their farms.

"A grower who successfully completes this training program can be considered an Appropriate Person under the definition of the Queensland Government's Reef protection regulations. He/she will be able to develop and verify their farm's own nitrogen and phosphorus budget (N&P budget) without needing to seek outside agronomic assistance. This applies on their own farm only," Barry said.

During its development the online program has been extensively reviewed by industry and the Department of Environment and Science. The course is now available on the SRA website.

Enroll today for SRA's free Online Sugarcane Nutrient Management program by scanning the QR code.

The online program's development was funded through the Queensland Government's Queensland Reef Water Quality Program and SRA.

Queensland Government

AUSTRALIAN SUGAR INDUSTRY SCHOLARSHIPS BUILD TALENT AND EXPERTISE FOR THE FUTURE

Applications close in March for the Australian Sugar Industry Scholarship (ASIS), 2022-23.

The scholarship is jointly funded by Australia's sugar mills, through Sugar Research Institute (SRI) and Sugar Research Australia (SRA).

It is awarded to undergraduates studying engineering - chemical/process, mechanical, mechatronics, or electrical, science or technical disciplines - in their last year of study at an Australian university or tertiary institution.

Bursary placements are also offered.

The scholarship and bursary program has been running for six years with four ASIS recipients and one or two bursaries awarded to undergraduates/graduates each year.

Twenty ASIS and bursary program alumni have started full time employment in the Australian sugar industry. Nineteen of these initially joined milling companies and one started with Sugar Research Australia (SRA) before moving on to Wilmar Sugar Australia.

The scholarship/bursary program is managed by Learning and Development Manager at Sugar Research Institute (SRI), Bruce King.

"We encourage high calibre students - either those who are academically well qualified or who are judged to have the personal attributes that the milling industry is looking for," Bruce King said.

"The recipients of the scholarship are placed at Australian sugar mills and refineries for up to three work placements of four weeks' duration. The placements take place over one and half calendar years (two placements during the crushing season and one placement during the maintenance season).

"The graduates that have taken up these scholarship/bursary opportunities have gone on to many positions and experiences in the industry," Bruce said.

During a scholarship/bursary placement, the student is under the supervision of a company staff member and completes projects and reports that are required by the company and are relevant to the student's degree.

"I am extremely grateful for the high level of support for ASIS from the milling companies.

"Every Australian milling company has taken students for work placements. The support and encouragement for these young people has been fantastic."

For each ASIS placement the student receives a living-away allowance from SRI and is paid by the host company for work of up to 40 hours per week at the Award rate. The milling company is re-imbursed for these wages at an agreed rate. Bursary recipients are paid for their work for up to 40 hrs per week at the Award rate.

"I think the outstanding success of the program is due to the students and their supervisors gaining so much from each other during a placement," Bruce said.

"It has been very enlightening and gratifying to see how much of the work students have done in projects has been incorporated into milling operations."

During each placement Bruce meets with the student and their supervisors onsite to check how things are going. Discussions about the student's input,

project(s) and report are all considered and suitable future placement or employment opportunities are investigated.

"Through their hard work and abilities, the graduates have been promoted to positions such as Production Superintendent, Assistant Production Superintendent, Shift Supervisor and Process Improvement Engineer.

"In 2023 we hope to expand the number of scholarships and bursaries on offer as the industry looks for new staff to carry on the great work of current and previous staff."

Applications must be submitted by 17 March. Successful applicants will be interviewed with ASIS recipients notified in April.

For more information visit the SRI website: **sri.org.au/australian-sugar-industry-scholarship/**

Harrison Slogrove, Production Superintendent, Pioneer Mill, Wilmar Sugar Australia

EXCELLENT PATHWAY INTO THE SUGAR INDUSTRY

"The SRI Scholarship program was my introduction to the industry," says former scholarship holder, Harrison Slogrove, now Production Superintendent at Wilmar's Pioneer Mill.

"After completing a placement at Millaquin Mill, I developed a strong affinity and interest in the industry, which motivated me to complete my undergraduate thesis on bagasse drying.

"From there, I started with Wilmar as a Graduate Chemical Engineer in 2017.

"The program is an excellent pathway for students entering the sugar industry and forms a massive part in developing and recruiting future leaders for our industry.

"One of my personal objectives when I decided to study engineering was to initiate my work experience in a continuous process plant environment.

"I believed this would be the best platform to gain a broad view of what drives engineering practices and processes across both the production and maintenance domains. And I was right.

"Being immersed in a visually tangible, critical end-to-end operations environment with dynamic decision-making 24/7 was, to my mind, a transformative and challenging departure point from which to build a career in any direction within engineering.

"This, in my opinion, is truly what sets the ASIS apart.

"The sugar industry offers a unique combination of a fast-paced, diverse engineering environment ranging from mechanical, electrical, chemical, process and even asset management, together with a deep and diverse range of skills and knowledge to draw from.

"As such, it has not only enabled me to gain a visual whole lifecycle perspective but also a hands-on understanding of the many interdependencies between operating elements and processes.

"It has also allowed me to gain a lived-in perspective of critical decision making and the phenomenal impact teamwork and mindset have on the successful achievement of targets."

UNLOCK YOUR OWN POTENTIAL IN THE INDUSTRY

"No single day within a mill is the same," said Kristen Nel, former scholarship holder and now Assistant Production Superintendent, Racecourse Mill.

"If you have a passion and openness to learn from each situation, project, or person it's the best place to be:

- To get your hands dirty and know that for the most part, people are your best sources of knowledge.
- To step out of your comfort zone and ask as many questions as it takes.
- To receive constructive feedback and build resilience.

"Learning how to 'fix' engineering problems is only the start. You will learn more about yourself, identify the areas where you need to grow and discover the areas where you excel to develop a career plan and steadily unlock your own potential.

"The sugar industry is an incredible community to learn from, with amazing talent and strong leadership to support you if you do your part.

"I would encourage any driven engineer to explore the opportunities, learn from the legacy makers in the industry and make it your own."

Kristen Nel, Assistant Production Superintendent, Racecourse Mill, Mackay Sugar Limited, Member of Nordzucker Group

From left to right: Lisa Ronquest-Ross, v2food, Gabrielle Munzer, Main Sequence, Anna Tao, CSIRO, Michele Stansfield, Cauldron, Jannik Olejas, Mackay Sugar, Hanh Nguyen, Nourish and Duncan Ferguson, SRA.

PRECISION FERMENTATION BUSINESS CASE **ANNOUNCED FOR MACKAY**

In a step forward for the Sugar Industry's Sugar Plus vision and roadmap, the Queensland Government has announced it will partner with the precision fermentation company Cauldron to develop a business case for a large-scale contract protein manufacturing plant in Mackay.

The Sugar Plus vision and roadmap was launched by the sugar industry last year.

The vision is to become a vibrant, transforming industry, sustainably producing sugar and bioproducts at the heart of regional communities with the potential to position the industry at the heart of Australia's future bioeconomy, enabled by supportive government policy settings and new investment.

The roadmap sets out a series of actions to strengthen and build the industry while charting a path to a bigger, bolder future.

Deputy Premier and Minister for State Development Steven Miles said the proposed Future Foods BioHub facility would provide the fermentation capacity needed to produce new food products and ingredients at scale to meet growing global demand, with sugarcane as a potential feedstock.

The Government is providing up to $528,000 in funding for the business case for a proposed $300 million facility.

SRA's Executive Manager Commercial Development, Duncan Ferguson said collaboration between industry and government was essential to unlock progress in the Future Foods area.

Meet the major players in the Australian protein business

Duncan Ferguson chaired a panel at the TropAg Conference held in Brisbane last year to discuss the new 'protein paradigm'.

Speakers on the panel included representatives of the major new players in the protein manufacturing market in Australia, including Cauldron.

The discussion centred around a significant problem for the world: that with a rapidly increasing population the global demand for protein cannot be met through meat protein alone. New products are on the market and gaining a lot of attention. However, delivering them at scale requires new science, investment, business models and collaboration through the value chain.

Partner at venture capital firm, Main Sequence, Gabrielle Munzer, spoke at TropAg about the work of the firm which was co-founded by CSIRO in 2017 and is now the largest 'deep tech' venture investor in the Asia Pacific.

'Deep tech' describes companies in the business of developing cutting edge technology as solutions to significant global challenges, such as feeding 10 billion people.

In 2021, Main Sequence, CSIRO and industry partner, Norco Dairy Co-operative, formed a new company, Eden Brew, to develop animal-free, locally made dairy that is "good for people and the planet".

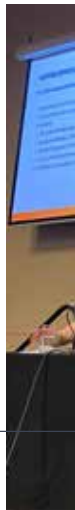
Using precision fermentation and science from CSIRO, Eden Brew aims to produce the same proteins found in cow's milk, without the cow. The product will have the same frothy, creamy, milky taste and colour, with the same protein, nutrients and calcium, but without lactose, and cholesterol.

Norco became an industry partner to "secure a sustainable future for the co-operative's 292 dairy farmer members who are shareholders of the new company", according to Eden Brew's Co-founder and CEO, Jim Fader.

Eden Brew is currently undergoing prototype testing at CSIRO's Food Innovation Centre in Victoria and is expected to be in the market with its first product this year.

"With our research partner, CSIRO, and industry and investor partners we have co-founded other food companies – v2food and Nourish," said Gabrielle.

"Through fermentation technology we envisage all sorts of new products



coming to market, including hybrid products – plant-based meats, precision fermentation meats, cellular and maybe mixtures of each, creating delicious foods at a better price for the consumer, really good nutrition and an improved planetary impact.

"The food must be delicious. To convert the consumer, we need to be able to make food taste like meat because we cook what our mum and grandma cooked – and that won't change very soon, food is very cultural.

"We need the science and the researcher, we need the infrastructure to process the product, to get the business up to scale quickly and to market, then we need retail and distribution chain partners with help for consumers to navigate this new world."

v2food Chief Science Officer Dr Lisa Ronquest-Ross spoke at TropAg about v2food's rapid development:

"In 2019 our company was formed from a collaboration between CSIRO, Main Sequence and Competitive Foods Australia.

"Our founder Nick Hazell has a long history in R&D in big food companies such as PepsiCo, Mars and Masterfoods. We reached our retail market very quickly through collaboration with Jack Cowin at Hungry Jacks.

"Within 12 months we had prototype products released to the market. We are now No. 1 in terms of plant-based meats in Australia which include products like burgers, mince, schnitzels and ready to eat animal-free meals. We are now expanding into Asia.

"The company model not only has a venture co-founder that's bringing capital and business building skills, but also a research co-founder to supercharge the science, and an industry co-founder to act as the first customer to pull product through the supply chain, accelerating its path to market. We were able to get product on the shelf in just nine months."

Innovation Manager at CSIRO, Anna Tao, drew attention to the recent Green Economy Agreement (GEA) between Singapore and Australia as a sign of the growing market demand for sustainable food products, particularly from Asia.

The GEA is a first-of-its-kind agreement which includes sustainable agriculture and food systems as one of its 17 joint initiatives. Under the GEA, Australia and Singapore will collaborate on ideas and initiatives that accelerate the transition to best practice sustainable agri-food systems.

CEO of Cauldron Michele Stansfield said there were some amazing opportunities in Australia but the whole value chain needed to be involved to benefit in a collaborative environment where everyone worked together.

"We hope to work with established companies in Mackay, creating a diversification opportunity for sugarcane and in turn cane growers as shareholders, creating new technology jobs and using the existing workforce for the new industry - we will need 10 trades people per scientist and Mackay has a wealth of skill in this area."

Head of Food Science at Nourish Ingredients Hanh Nguyen said the four-year-old start-up company was working to improve the sensory properties of plant-based and alternative proteins. "We use science and precision fermentation to make fat, not from animals but by using a microbe.

"The first generation of plant-based products was popular with vegans and vegetarians, but didn't entice or convert meat-eaters into return customers.

"With our science, we can tailor flavour profiles that precisely reproduce the same taste, aroma and mouthfeel as traditional meat and animal products. As we drastically improve the taste and nutrition of new protein products, we will spur mainstream consumer adoption.

"In the future there could be potential for Nourish Ingredients to use Mackay's sugarcane products as part of the fermentation process to make non-meat and non-dairy products taste authentic, desirable and delicious."

Mackay Sugar Limited CEO Jannik Olejas said that Mackay Sugar's purpose was to create sustainable value throughout its supply chain from the farmer to the consumer.

"Good agricultural land is a finite resource. We need to raise yields on the lands we have to meet demand.

"It all comes back to strategy. It is one thing to write a paper but you need to really live it and understand what is in each step and how we can contribute to the value creation.

"Mackay Sugar is not good at protein fermentation but we know something about processing of agricultural produce into new products. We have a role to play. We need all parts of the value chain on board to ensure everyone benefits."

Duncan Ferguson introduces the subject and speakers on the protein panel at TropAg

SRA Head of Strategy, Insights and Engagement, Bronwyn Venus, Mackay Sugar CEO, Jannik Olejas and CANEGROWERS Senior Manager Industry Burn Ashburner.

CRYSTOBSERVER PROVES ITS WORTH IN **IMPROVING RAW SUGAR QUALITY**

During a number of crystallisation stages in the factory, raw sugar crystals are grown from a minute size to about 0.9 mm.

The first stage produces crystals from finely ground sugar particles, which are typically 8 microns (0.008 mm) in size. By comparison, the diameter of a human hair can be as large as 70 microns (0.07 mm). This phase is known as the 'graining step'.

These crystals are then grown to a size of about 0.18 mm in a step known as C seed production. This is an important stage in raw sugar manufacture because the number and average size of the crystals produced influence both the quality of the final product and the quantity of sugar recovered by the factory.

"In Australian raw sugar production there has previously been no way of monitoring the development of these small crystals, other than by the pan stage operator taking proof samples from the pan and examining the samples for number and size under a microscope," QUT Research Fellow Gabriel Fraga said.

"Clearly, there is room for efficiency improvements in this process step. Tighter control of C seed production can improve sugar recovery, sugar quality, and pan stage throughput. It can also decrease steam and water consumption."

An improved method is now available following the completion of an SRA-funded project undertaken by Sunshine Sugar working with researchers at QUT. The project trialled an innovative microscope system called Crystobserver, which was installed in the C seed pan at Condong Mill in northern New South Wales to monitor the crystal development in real time.

"Crystobserver is an online High Definition (HD) video microscope that offers high resolution quality images of crystals. It is capable of measuring crystals as small as 30 microns in size," QUT's Prof. Ross Broadfoot said.

The Crystobserver is produced by ITECA, a company based in France which designs and manufactures systems that can be integrated into sugar, cement, quarrying and mining processes to provide online images and data to provide improved production efficiencies.

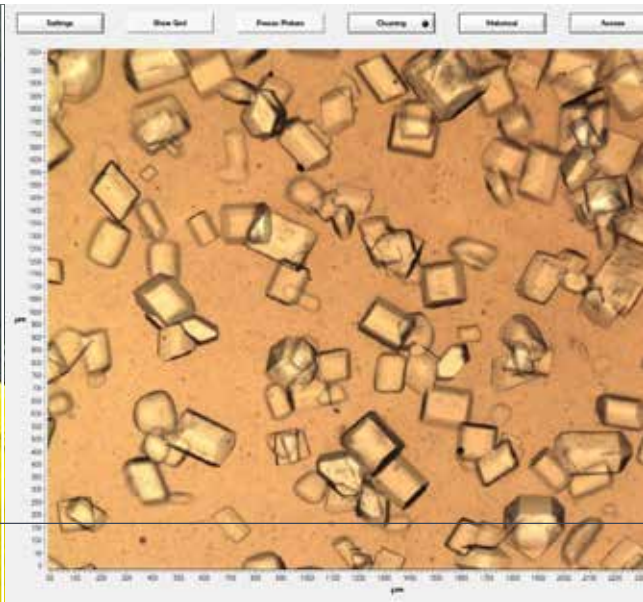
"The Crystobserver has previously been used in beet sugar production in Europe. However, as far as we know, this is the first time it has been tested in a mill processing sugarcane, and in particular in the highly coloured molasses that is present in C seed production in Australian sugar mills," Sunshine Sugar's Business Diversification Officer Kent Selby said.

"The Crystobserver was installed, commissioned and calibrated by the mill's instrumentation staff, with remote guidance from ITECA technicians," Condong Mill's Lead Process Engineer Ashley Curran said.

"The software outputs were integrated into the mill's Distributed Control System (DCS) which includes alarms that go off if the process deviates from certain limits.

Using the Crystobserver, Condong Mill's Lead Process Engineer Ashley Curran can monitor the development of sugar crystals on the computer.

A Crystobserver image of sugar crystals in the C seed production at Condong Mill.



Condong Mill's Production Manager, Aaron Baker with Ashley Curran.

The operators quickly learnt to assess the performance of the C seeding process using the analyser's outputs."

The benefits to the pan stage and factory performance were then evaluated and a cost/benefit analysis was calculated from the improved production of the C seed.

Crystobserver demonstrated its effectiveness at detecting small crystals, providing a number count through its field of view and providing reliable measurements of the size and the amount of variation in the size of the crystal population in the C seed production step.

"Pan stage operators, shift supervisors and managers in the mill were able to use the data from the Crystobserver together with other process data to troubleshoot deviations from targeted production of C seed," Condong Mill's Production Manager Aaron Baker said.

The pan operators found the system was user friendly and they were able to successfully provide reliable assessments of the quality of the graining process. They used the information to make corrections to subsequent grainings and to achieve tighter pan stage operations. One of the changes the operators made was to lower the purity for the graining which reduced conglomeration without slowing the production rate for C seed.

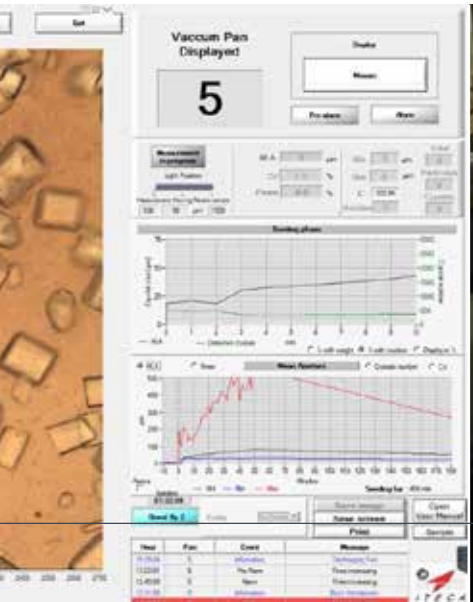
"Analysis of data was undertaken to understand the reliability of the system over long periods of operation. This demonstrated that the quality and brightness of the images was consistent. In addition, the software was able to store historical data for several crushing seasons and could analyse trends in parameters. Being able to look back at images of previous grainings was very beneficial for production staff," Aaron Baker said.

Recommendations for future applications of the Crystobserver for C seed production in other Australian factories were developed.

It was realised that the Crystobserver would be very suitable in assisting the pan stage operators during the magma preparation step which is undertaken to reduce the variation in the sizes of crystals used for making sugar in the factory.

The final results of the project will be presented to mill staff at the Regional Milling Research Seminars at five main milling districts and also published in a paper at ASSCT 2023 in Cairns.

A dedicated computer for the Crystobserver (right) was installed in the control room in Condong Mill.



INVESTMENT TO BOLSTER CLIMATE RESILIENCE

A team of weather and climate specialists is embarking on a four year program with the agricultural sector to help manage short-term climate risks and build long-term resilience.

Representatives from the Bureau of Meteorology recently visited North Queensland cane fields, to meet with growers and millers and discuss how to improve and enhance seasonal outlook services.

As the new Team Lead of Agriculture Decision Support Services with the Bureau of Meteorology (the Bureau), Claire was keen to get out in the field to see how the sugarcane industry currently uses weather forecasts and climate outlooks. She identified new opportunities to solve a range of varying needs and challenges, not only across different regions but within small geographic areas.

"Certainly, some of the questions that came up were about gaining confidence in our outlooks, and use of past records," Claire said. "I can see how we can tailor weather and climate information to help manage a range of harvesting timeframes, milling capacity, soils, irrigation and varietal changes that are important to the industry."

A meteorologist with more than 23 years of experience, Claire is passionate about communicating complex atmospheric physics in a way that is meaningful to her audience and targets their specific needs.

"I have the deep meteorology and climate experience, but I'm also able to communicate at a level that's not confusing and cuts through the jargon," Claire said.

She was accompanied on the industry visits tour by the Bureau's recently appointed Customer Lead with responsibility for the sugar industry, agriculturist Rachel Davis.

"I've come from the Brisbane Wholesale Markets, so my focus over the past 20 years has been mainly in horticulture. That knowledge, combined with what I'll learn about the sugarcane industry, will add value to our team of weather and climate specialists," Rachel said.

The pair of specialists are supporting Agri-Climate Outlooks, a four-year program to improve and enhance seasonal outlook services provided to Australian farmers, fishers and foresters.

Sugar Research Australia is an investor in the cross-sectoral program which is facilitated through Agricultural Innovation Australia (AIA) and co-funded by ten rural research and development corporations.

AIA Chief Executive Officer Sam Brown said the collaboration was ground-breaking because the RDCs are working together on a large-scale project with common goals to help growers and mixed-production enterprises mitigate the impacts of climate on their businesses.

The Bureau of Meteorology's Claire Yeo and Rachel Davis inspected cane fields when visiting industry representatives in North Queensland.

Agricultural Innovation Australia Chief Executive Officer Sam Brown.

"Climate variability is proving to have a significant and devastating impact on agricultural and food production, as we have seen with recent floods, extreme weather events and subsequent food shortages and supply chain challenges," Sam said.

"Growers need the most reliable, accurate and timely seasonal forecasting information to help them manage and adapt to changing climates. This initiative will improve the relevance, trust and ease of use of climate information in their decision-making."

The Agriculture Decision Support Services team will provide the industry with more context and interpretation of long-term forecasts, responding to insights and feedback gathered through discussions with growers and millers.

"We need a scalable and sustainable solution that adds value to the industry. We're very aware that one size doesn't fit all. A challenge for us will be to provide a service that benefits the majority," Rachel said. "We're building connections in the industry over multiple regions.

"It's been really valuable to be able to form relationships in person, so people feel comfortable popping us an email and knowing who is on the other end."

The Bureau understands that most producers place greater emphasis on week-to-week weather forecasts than on longer term climate outlooks.

"There's a real opportunity for us to increase confidence in and use of the full range of weather and climate information that's available, spanning weekly, fortnightly, monthly and seasonal outlooks," Claire said. "Through AIA's Agri-Climate Outlooks Program, we'll be listening hard and working hard to deliver weather and climate information that adds value to the most important decisions people need to make."

Do you have a question for the Bureau's agriculture experts?

Contact the team at agriculture@bom.gov.au for decision support and to share your challenges and information needs.

AIA's Agri-Climate Outlooks involves five workstreams, delivered by the Bureau of Meteorology, covering products, services, support and industry capability building. They are:

1. Establishment of a dedicated team of agri-climate specialists to provide relevant insights to support farmers, fishers and foresters (growers) with decision-making.
2. Upskilling and training for growers and their advisers to accurately interpret and utilise weather, climate and water products to inform agricultural decisions.
3. Development of easy-to-understand, decision-specific forecast products delivered via appropriate digital channels.
4. Development of methods to overlay skill on the Bureau's seasonal outlook products and promote the methods as best practice to other seasonal outlook service providers.
5. Improvements to Australia's high calibre sovereign seasonal forecasting, through improved accuracy of multi-week to seasonal forecasts. This will help ensure the future stability of the Australian agriculture sector and increase the potential magnitude of benefits delivered via Workstreams 1-4.

Agri-Climate Outlooks is a $19 million cross-sectoral investment facilitated through Agricultural Innovation Australia (AIA) in collaboration with 10 rural research and development corporations (RDCs). Participating RDCs are: Meat & Livestock Australia, Australian Eggs, Australian Wool Innovation, Dairy Australia, AgriFutures Australia, Grains Research and Development Corporation, Fisheries Research and Development Corporation, Cotton Research and Development Corporation, Sugar Research Australia and Hort Innovation.

AIA is a not-for-profit public company established by the RDCs to facilitate joint investment and collaboration in cross-industry agricultural issues of national importance.

aginnovationaustralia.com.au

(Left and below right): *Bruce Peterson shows off his thriving crop of SRA29Ф on his farm at Farnsfield near Childers.*

VERY RAPID GERMINATION AND EARLY GROWTH ARE POSITIVES FOR SRA29Ф

Bruce Peterson says SRA29Ф shows some positives for growers seeking alternative varieties in the Isis region.

Bruce is a third-generation cane farmer who has been working the family farm since 1992.

His farm at Farnsfield near Childers, which has been in the family since 1964, covers about 170 hectares producing 15,000 tonnes of cane at a CCS of about 14.

Bruce chooses the variety he is going to grow from local knowledge and his own observations.

He is on the Isis Productivity Limited Board and goes to the meetings but also learns a lot "just by chatting to people and keeping up with what's going on," he said.

It helps that his farm is one of three approved seed plots in the Isis area for the distribution of clean seed material for old and new varieties, managed by Isis Productivity Limited.

"As far as varieties go, I've got my finger on the pulse a bit more than some people are able to, I guess. I grow everything, I had no choice but to grow SRA29Φ," he said laughing.

A small amount of each variety is received as clean seed stock from SRA Bundaberg and hot water treated for planting out to bulk it up for distribution to the growers the following year.

Each September, growers come to Bruce to collect their varieties. SRA29Φ was available for bulk distribution for the first-time in 2022.

"Growers can come and get several tonnes of billets both of new varieties and the old varieties.

"It is a popular service, and we have good uptake. I think we distributed around 476 tonnes of clean seed this season including 242 tonnes of SRA29Φ.

"We mostly supply billets, but some growers take whole stalks."

SRA29Φ has not yet been commercially processed in the Isis district.

Bruce has a couple of hectares of SRA29Φ planted on his farm from the distribution.

"I normally plant out large areas of all the varieties. As much as the SRA fact sheets have got all the information, you've got to trial it in the real world on your own farm, where your money is invested.

"I'm purely going on observations at this stage: what it's like to farm and whether it looks any good in comparison with the current standards.

"At this stage there doesn't seem to be any problems with it.

"It is quite an erect variety. It doesn't appear to fall over.

"It's certainly a very fast germinator, one of the quickest I've seen in recent years, and a vigorous grower. That's a plus.

"It does seem to handle dry weather quite well. We run water winches around some of the farm and the bits that have missed out on the water on the ends just seem to hang on a bit more compared with other varieties in the dry conditions. That may make it valuable for a dryland farmer."

Interestingly, the variety drops all its trash when it nears maturity.

"Harvesting should be quite good. It is almost denuded by the time it is ready for harvest. Of course, all the trash sitting on the ground may be a problem in some conditions. We'll wait to see.

"There are a few varieties that do this pre-trashing but I haven't seen any that do it quite as much as SRA29Φ."

"The millers should receive clean samples into the factory which is good.

"It also makes it easy at billet planting. It cleans up quite well and goes through the machinery quite smoothly."

The current standard in the district is Q240Φ and growers judge how varieties stack up against that.

"Isis Productivity Limited is concerned about the large percentage of Q240Φ that is grown but at the same time we realise that growers have got to make the most of what's on offer.

"Q240Φ is an outstanding variety. Sugar prices are high, growers are looking for tonnage and CCS and they are getting it from this variety," Bruce said.

"One of its stronger points is its ratoonability. Growers are able to get six or seven ratoons from Q240Φ which is worth a lot of money.

"It remains to be seen if SRA29Φ has got good ratoonability. SRA29Φ was evaluated to third ratoon in SRA trials but needs to demonstrate this under commercial conditions.

"I've got small strips to second ratoon in various soil types. It's hard to make a true judgment on that. It's a bit early. If it has good ratoonability in poor soils, that will be a big plus.

"Almost all my ground is fallowed to peanuts, which leaves the soil in a very healthy state. I also farm on 1.83m row spacings. With these two factors combined, we usually don't see many issues with ratoons. Soldier fly, a poor variety or a block of very poor soil would usually be the limiting factor in my ratoons."

Among the unknowns are how SRA29Φ will perform with smut.

"Our productivity staff are concerned by quite a significant smut outbreak across the district," Bruce said.

"We're looking for varieties that are vigorous and have got positive traits plus smut resistance.

"It has an intermediate rating from SRA, but it still needs to be tested out in the paddock.

"There is also RSD in the district, but I believe it is at low levels due to our clean seed program, the high uptake of clean seed each year and the vigilance of our productivity staff in inspecting plants.

"SRA29Φ is yet to be proven I guess. We'll be watching it closely. We are searching some viable alternatives here."

SRA29Φ FACTS

SRA29Φ was first released to growers in the Bundaberg, Isis and Maryborough districts in Spring 2021.

It is resistant to Fiji leaf gall, leaf scald and mosaic. It is intermediate-resistant to Pachymetra.

This variety achieved good productivity in trials across a range of soil types with high tonnes of cane and average CCS compared with the major standards in the region.

SRA29Φ is a variety recommended for Bundaberg, Isis and Maryborough.

It is intermediate to red rot and smut. Monitoring for smut, particularly in older ratoon blocks, should be a part of crop management practices.

It achieved an overall Tonnes Sugar per Hectare (TSH) of 15.8 after the 2014 series FATs (harvested 2015, 2016, 2017 and 2018) and 2016 series FATs (harvested 2017, 2018 and 2019). This compares with 15.0 TSH for Q240Φ and Q208Φ in the same trials.

Isis Productivity Services Officer, Anthony LaRocca.

GROWERS IMPRESSED BY EARLY PERFORMANCE OF SRA29ᵇ

Isis Productivity Services Officer, Anthony LaRocca said growers in the Isis region have a hunger for new varieties.

"Maintaining productivity is vital in a small district. That includes disease resistance, ratoonability and resilience/tolerance to a range of situations.

"Currently there is a heavy reliance on a few major varieties. For this reason, I suspect growers will continue to plant SRA29ᵇ in the next couple of years until they can make their own judgements on how it may fit into their farm rotation.

"Each region and milling area have their own uniquely specific nuances, including climatic, soil type and farming systems.

"This is even true within districts where coastal farms and the practices can vary from the more inland areas. Varieties can respond differently in different areas of the district.

"That is why the availability of a good mixture of varieties is required in a region. And why the ongoing work, that Roy Parfitt and Clare Hogan are doing at SRA with the Southern Variety breeding program, is essential to the ongoing viability of the southern region.

"I feel SRA29ᵇ will find a place based on what I witnessed in trials during the dry 2020 growing season, where it held up well against other varieties.

"Tolerance to dry weather is important in the Childers area. We have been fortunate with a good season this past year, however, nothing is surer than the next dry spell in this part of the world.

"Growers have all made comment about the variety's exceptional germination and very good early growth. It has certainly impressed us all in the early growth stage. An early canopy closure is a positive which provides a good barrier to weed germination and growth, potentially getting to the 'out of hand' stage quickly.

"Hopefully it will also prove to be a good ratooner!"

GENOMIC PREDICTION OF RATOON YIELD ROBUSTNESS

Dr Eric Dinglasan got his first taste for sugarcane as a plant pathologist inspecting imported cane in post-entry quarantine in the Philippines. Many of the varieties came from Sugar Research Australia (SRA).

While he has since worked in plant diseases and on various crops, today Eric is a crop genetics researcher for the Queensland Alliance for Agriculture and Food Innovation (QAAFI), at The University of Queensland, and once again working on sugarcane.

Eric and colleagues at QAAFI recently applied for and received an SRA Sugar Industry Research Award to 'take to the next level' the work of Professor Ben Hayes and his current SRA-funded project - *2017/002 Implementing and validating genomic selection in SRA breeding programs to accelerate improvements in yield, commercial cane sugar and other key traits.*

"Sugarcane is an extremely complex plant," Eric said.

"Ben's work in genomic selection in the past two decades has influenced plant breeding and it is exciting for us all to see this technology now being adopted in SRA's sugarcane breeding program. This is the first time in Australia that genomic selection is being looked at as part of the entire breeding perspective.

Eric Dinglasan (back) with PhD student Chensong Chen (front)

PROPOSED PROJECT OUTCOMES

Assessment of the ratoon performance and robustness of performance within the SRA breeding program will enable better parent and clonal management strategies in selecting the best clones at three main stages of selection (i.e. Progeny Assessment Trial, PAT; Clonal Assessment Trial, CAT; and Final Assessment Trial, FAT).

Insights on the ratoon performance and robustness of performance will improve parent selection within different regions and improve understanding of genotype x environment interactions, thus providing more targeted and precise crossing designs to save both resources and time in population development.

More importantly, this will also bring about a faster turn-over of potential new varieties that can be released.

"This means that from a large number of initial lines and crosses, breeders can now make early choices and predictions when it comes to 'variety parents'.

"This will not only save time in the breeding process but add confidence about these initial parent crosses that they will lead to high performing progeny," he said.

The implementation of genomic selection in SRA's breeding program was estimated by UQ Researchers Voss-Fels and others in 2021 to have the potential to double the rate of genetic gain in SRA's breeding program.

Eric explains that his work will leverage the results of the previous project and continue the working relationship with SRA to take Ben's research findings to the next level.

"I'll be working with Ben and PhD students, Seema Yadav and Chensong Chen over the next year to take what we know about genomic selection a step further," he said.

"We recognise the challenges that the sugar industry is facing, for example, in predicting the consistency or robustness of performance across ratoon crops. With this research award, we are not restricted only to parent selection – we are now in a unique position to further expand our predictions in the SRA breeding program to estimate the robustness of yield across ratoon crops in different growing regions.

"Varieties that perform really well in the first ratoon do not always hold up in the second and third ratoon. This project will allow selection for varieties that yield really well across all ratoon crops. This is termed 'robustness of yield'.

"It is our hope that we will be able to predict with precision, clonal performance for robustness of yield and fibre and sugar, across ratoon crops.

"If we can do this we would hope that the release of varieties that had good performance in the first ratoon and poor performance in later ratoons, with an associated economic penalty, could be avoided and an improved yield achieved for growers."

With extensive data provided by SRA researchers, Eric and colleagues will utilise machine learning in this project to develop genomic prediction models that can account for both additive and non-additive genetic effects.

"We are currently looking at the performance of first ratoon crops and also evaluating if they will be robust throughout later ratoon stages," Eric said.

"If we can successfully apply this technology to predict and evaluate the ratoon performance on the final assessment trial (FAT) of a chosen clone, (i.e. the last stage of what is normally a 12-year breeding program) we will be able to greatly reduce the breeding pipeline and contribute roles in fast tracking product development strategies and operational efficiency of the SRA breeding program."

The dataset includes clones distributed across different selection stages and trials in the Burdekin, Central Region, Northern Region, Southern Regions, and Herbert, and in rainfed and irrigated environments.

"Much of the project work is done on the computer but I do hope that we will be able to get out into the field and talk to SRA's breeders," Eric said. "This is research that is already transitioning into variety breeding programs and it's important for us to understand how that is working. Our goal is to be able to improve efficiency of parent selection and ultimately predict best performing clones that will go on to be the best varieties possible.

"We are grateful for this unique opportunity to be able to continue our work with SRA and ensure the work is translatable to the entire Australian sugar industry," Eric said.

Plant breeding at SRA's Burdekin Station.

TAKING THE FIRST STEPS TO PRODUCE A SMART SUGAR FROM SUGARCANE BY STINGLESS BEES

Stingless bees are a common sight in northern and eastern Australia. The special honey they produce doesn't meet current national and international food standards for honey, due largely to differences in sugar composition.

Dr Natasha Hungerford at the Queensland Alliance for Agriculture and Food Innovation (QAAFI) at The University of Queensland (UQ) wanted to know why. Working with Queensland and Malaysian researchers she set out to characterise the sugar content of a Queensland stingless bee's honey but while doing that found more than she bargained for.

Now supported by a Sugar Industry Research Award from SRA, Natasha and her team are taking the first steps to produce a 'smart' sugar from the sucrose found in sugarcane with the help of *Tetragonula carbonaria,* a stingless bee found primarily in Queensland and commonly known as the sugarbag bee.

"As a result of earlier research, and a lot of work that's been done by the Australian Native Bee Association (ANBA), an application has now gone into Food Standards Australia New Zealand (FSANZ) to adjust the food standard to include properties of stingless bee honey," Natasha said.

A ***Tetragonula carbonaria*** hive.
Tetragonula carbonaria *(previously known as* Trigona carbonaria*) is a stingless bee, endemic to the north-east coast of Australia. Its common name is sugarbag bee. They are also occasionally referred to as bush bees.*

Australian native stingless bee (Tetragonula carbonaria) on a strawberry flower. Credit Tobias Smith, UQ.

While that was a great outcome for ANBA and the local stingless bee honey industry, it is only the start of an exciting and ambitious project that Natasha and her team are now undertaking.

"When we were characterising the honey we found an unusual sugar, in large quantities, that we couldn't initially identify," Natasha said. "We eventually worked out that it was trehalulose, an alternative, and healthier, sugar to that commonly used," she said.

"We believe that trehalulose is beneficial because previous studies have shown that it has a low glycaemic Index (GI), and is acariogenic, which means it doesn't cause tooth decay. It also has antioxidant properties."

It is also 70 per cent as sweet as common sugar.

However, its chemical synthesis in the factory is complicated. Industrial production involves enzymes that can convert sucrose into a mixture of trehalulose and isomaltulose. The stingless bee's natural enzyme could make this process a more viable option.

"While this was a serendipitous finding, we know that stingless bees have evolved a unique capacity to efficiently change the sucrose found in nectar to trehalulose," Natasha said.

"We're now working to understand this capability for commercial benefit - ultimately to use sucrose from sugarcane juice, as an inexpensive feedstock to produce trehalulose," she said.

The first step is to understand and harness the bee's ability to make this conversion by identifying and isolating the productive enzyme. That enzyme can then be produced to convert sucrose to trehalulose.

Natasha is a Chemist and has called on the expertise of Dr Loan Nguyen, a Research Fellow at QAAFI who is an expert in long read DNA/RNA sequencing. Loan will mentor PhD student Jiali Zhang in the project. Jiali conducted experiments for his honours project to prove that when *Tetragonula carbonaria* were fed sucrose they would convert it to trehalulose. Loan will now guide Jiali in the use of state-of-the-art Nanopore technology as well as cutting edge bioinformatics techniques to take the finding further.

"Nanopore sequencing is a unique and portable technology that enables direct, real-time analysis of long DNA or direct RNA molecules," Loan said.

"By using this technology, we will assess RNA activity in the tissue glands of the bee with the aim of identifying the gene that is involved in the process that produces trehalulose."

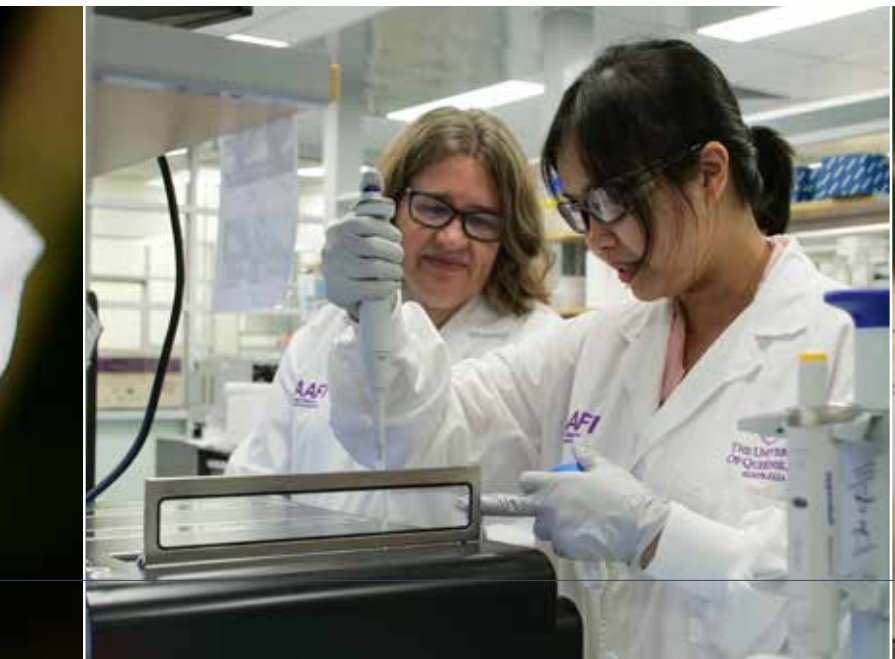
Natasha adds that the expression of the isolated gene would yield an enzyme to produce pure trehalulose directly from sucrose - a more efficient way to produce a smart sugar.

"During the lifetime of this initial 12-month project, supported by SRA, we hope first to purify the RNA and then identify the gene/enzyme that controls this special conversion of sucrose to trehalulose," she said.

"Ultimately it is our hope to conduct fermentation trials to see how efficiently we can produce trehalulose. Then potentially, further on down the track, we will work on optimising the process for converting sucrose to trehalulose at scale.

"Sucrose is produced in such big amounts by sugarcane. It would be a pretty amazing transformation if in the future we could turn it into trehalulose," Natasha said.

Dr Natasha Hungerford (left) with Dr Loan Nguyen.



PhD student Jiali Zhang.

"Microbial fermentations to produce biochemicals from waste biomass are a route to diversify and add value to the sugar industry," Madeleine Smith said.

SKILLING FOR, AND DIVERSIFYING, **THE FUTURE OF THE SUGARCANE INDUSTRY**

Dr Madeleine Smith is a biological scientist. In 2020 after graduating with a bachelor's degree from the Queensland University of Technology (QUT) she began her master's degree working under the supervision of Prof. Robert Speight and Dr James Behrendorff, supported by a research grant from SRA.

Last October (2022) Madeline completed her master's project - *Engineering Pseudomonas Putida for Valorisation of Sugarcane By-products* - and has spent the last few months writing up her work and submitting scientific papers.

She's now looking forward to working with the sugarcane industry where she can see research like hers being translated to commercial outputs.

"QUT has a strong relationship with the sugarcane industry," Madeleine said.

"Potential research projects are proposed by supervisors, but that research can then take shape dependent on your specific interest.

"During an undergraduate degree you're not taught how to manage a project, and you don't have to. But for a master's at QUT you do, it's a 'masters-by-research' that requires hands-on experience.

"I'll admit this was overwhelming at first, but I soon found I was able to direct my own research, and enjoyed the opportunity."

The key motivation for Madeline's two-year project was to create product, with a higher commercial value, from waste products produced in the sugarcane industry.

"The sugar industry, in Australia and globally, is the source of one of the most prolific natural biomass resources on the planet," she said.

"Sugarcane by-products such as bagasse and molasses are a wealth of carbohydrate-rich biomass.

"In their simplest forms these resources are a goldmine of fermentable sugars that have the potential to be turned into second-generation biofuels, biomaterials, biochemicals and other high value bioproducts."

In response to global demand for these products, Madeline's project explored the well-characterised industrial strain of the bacteria, *Pseudomonas putida (P. putida)* and how it might be successfully engineered to break down both cellulose and sucrose.

"So, the issue with targeting cellulose, as opposed to just targeting the sugar itself, is that there are a lot of other elements to it," Madeline said.

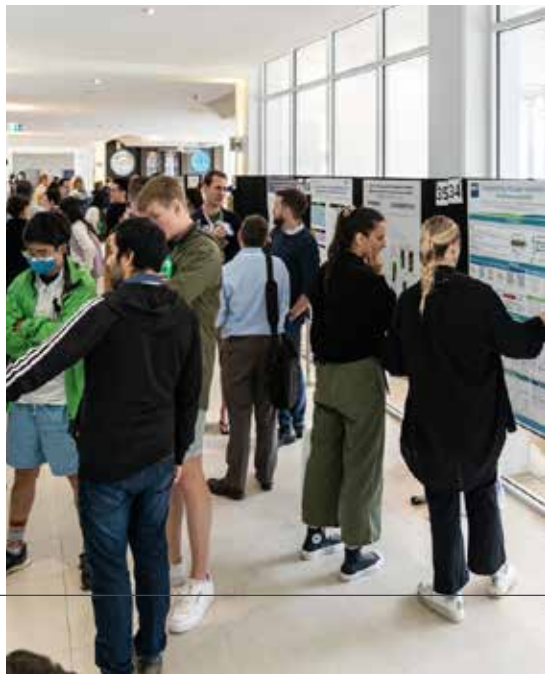
"You need organisms that can effectively handle all the different components of sugar-rich by-products, or bagasse, while still creating that higher value product.

"*P. putida* is a bacterium with high tolerance to the toxic aspects of lignin and has the potential to be engineered to produce valuable chemicals," she said.

Madeline has been able to demonstrate that the bacteria will also grow on sucrose and could be used to produce high value chemicals from molasses.

"Given there are currently no universal processes for scaling up this study, there is more work to be done before the outcomes from my work could be commercially ready," she said.

"But I am happy to have been able to add to the repertoire of organisms and tools that will be able to support the sugarcane industry as it continues to diversify," she said.



Madeline (pictured far right) presented a poster of her work at the Australian Research Council Centre of Excellence in Synthetic Biology's 2022 Annual Conference.

New Environmental Sustainability Scientist Dr Simon Clarke.

THINKING ABOUT OPPORTUNITIES FOR SUSTAINABILITY

The new Environmental Sustainability Scientist at SRA is Dr Simon Clarke who started work at Indooroopilly in January.

Dr Clarke's principal responsibility is to oversee a growing number of projects that aim to assist sugarcane growers to reduce the nitrogen and agricultural chemicals coming from cane farms in Great Barrier Reef catchments, while maintaining farm productivity and profitability. In addition, his role is to help identify and assess sustainability opportunities for the industry.

"I was excited to take on the role because it combines my interest in sugarcane, background in plant sciences, and my expertise in life cycle thinking - from farm to outputs and wastes and beyond," Simon said.

Simon is a plant physiologist who obtained his PhD at the University of Wollongong.

"Sugarcane is very efficient at producing sugar, as the high yields along Australia's Queensland and northern NSW coastlines attest. However, the crop also produces a huge amount of biomass - the leaves, stalks, roots and trash, very efficiently. When you combine this with the scale of the industry, it presents great opportunities to contribute to a more sustainable economy.

"I'm interested in what the raw sugar supply chain can deliver in the current transition to an increasingly green and circular economy. Cane farms and mills already have a long history of being great examples of sustainable production. For example, mills are largely water and energy self-sufficient; and mill mud and ash are recycled on-farm, which reduces the need to buy fertilisers.

"It would be rewarding to help the supply chain to improve efficiency, to explore ways to supply green products to the economy, and for the industry to obtain credit for environmental contributions made on-farm.

"I hope to be part of a system that provides cane growers with information on the impact of their management practices both on- and off-farm, so they can be increasingly confident about the decisions they make and how these will boost their sustainability, productivity and profitability."

SRA Agronomist Nancy Rincon and Bilyana grower Frank Hughes calibrate a fertiliser box for a demonstration site that compares different nitrogen fertiliser application rates with SIX EASY STEPS® recommendations.

GROWERS IN THE MURRAY ARE MOBILISING **TO DRIVE PRODUCTIVITY AND DELIVER IMPROVED WATER QUALITY**

In early 2022 Sugar Research Australia (SRA) partnered with Terrain Natural Resource Management (NRM), in the Mobilising the Murray Project funded through the Australian Government's Reef Trust.

The project is a hands-on initiative to drive productivity and efficiency gains for cane growers in the Murray Catchment in northern Queensland, while also delivering water quality outcomes.

SRA Environmental Sustainability Scientist, Dr Simon Clarke, is leading the Murray Project and after 12 months says growers' support for demonstration sites, events and activities has been strong with beneficial outcomes for both growers and the environment.

"The Murray project is unique in its ability to ask the farmer what their issues and constraints are, and to then be able to respond with expert advice backed up by trials and support for critical infrastructure, equipment or services," Simon said.

"The project has delivered 20 demonstration sites, with more planned, and we're already seeing encouraging results for both increased industry capability and water quality outcomes," he said.

All demonstration sites have been on commercial farms. A variety of treatments including nutrient inputs, pest exclusion fencing, and the use of crop growth regulators and legume cover crops have all been explored.

SRA's Tully-based agronomists Nancy Rincon and Erin Headon have worked closely with growers to put together demonstration sites and support nutrient management planning.

Kennedy cane farmer, Adrian Bush, was attending an SRA workshop in Tully in July when he first heard about the Mobilising the Murray project.

"I went along to the workshop to hear about managing canegrubs," Adrian said.

"Erin approached me at the end of the workshop, and we arranged for a meeting at my farm where Nancy and Erin explained the project to me.

"I'm continually looking to make productivity improvements on the farm and at that time I had a few ideas in the pipeline. It made sense to consider how we could leverage those ideas with support from the Murray project," he said.

In the last seven months, Nancy and Erin have been running different demonstrations sites on Adrian's 330 ha Kennedy cane properties. These have included accounting for nutrients contained in mill mud products; adjusting plant crop nitrogen rates following legume crop cover crops; and monitoring the effectiveness of pest exclusion fencing to reduce yield loss from animal damage. Most recently a trial managed by the project has been estimating nitrogen contributed by a legume cover crop and adjusting plant cane nitrogen fertiliser rates.

All growers participating in a demonstration trial are given a project report. Some of these are then distributed to other growers via case studies to share local experiences, lessons learnt and potential benefits.

Thanks to the nitrogen demonstration trials, growers like Adrian say they now have a better understanding of how much nitrogen is available in the soil following a legume crop, giving them confidence not to top-dress following a legume crop.

"And that means I've used less fertiliser and saved money," Adrian said.

Adrian has also been supported with incentives to upgrade farm equipment, fencing and nutrient management plans.

"I've be able to add a new GPS to an old tractor, with support from the project," he said.

Financial incentives have been provided for a range of activities that have met the criteria of improving both productivity and water quality. These have included the upgrade or construction of farm machinery, fertiliser rate controllers, legume planters, mill mud/ash spreaders and high clearance spray rigs. Legume planters have also been modified to apply inoculant.

A range of services are also supported, including Pachymetra tests, constraint mapping, soil analyses, and nutrient management plans, as well as the installation of pest-proof fencing.

"Fencing is a big expense, but it's one we can now consider thanks to the Murray project," Adrian said.

The project is also seeing growers working together.

"We've been excited to see small groups of growers combine project incentives with their own money to purchase or upgrade farm machinery," Simon said. "This is evidence the Murray Project is a great catalyst for practice change."

There are approximately 70 sugarcane growers (100 farms covering 16,500 ha in the Murray and Kennedy districts) who are eligible to participate in the project.

"We hope we will attract even more growers this year to our events, to meet with Nancy and Erin to discuss individual constraints and to see how we can increase productivity and profitability and benefit the catchment," Simon said.

Growers in the Murray catchment area who are interested in being involved in the Mobilising the Murray Project can contact Nancy Rincon at: nrincon@sugarresearch.com.au

Subscribe to SRA's eNewsletter to be kept informed of all workshops and events relevant to you in your district.

(Top) Kennedy grower Adrian Bush installed a new GPS guidance system on his tractor supported by incentives from the Murray project.

(Left) SRA Graduate Agronomist Erin Headon works on a Warrami demonstration site.

(Right) SRA Principal Agronomist Dr Danielle Skocaj delivered a workshop to Murray growers on fertilising late harvested ratoons; and a productivity constraints workshop to Tully growers, funded by the Mobilising the Murray project.

The Mobilising the Murray Project is funded by the Australian Government's Reef Trust and delivered by Terrain NRM in partnership with Sugar Research Australia.

Field radio is used to transmit data from advance sensors so irrigation progress can be monitored remotely on Steve Pilla's BIP demonstration site.

THE BURDEKIN IRRIGATION PROJECT: **REDUCING WATER AND ENERGY COSTS**

BY SRA PROJECT OFFICER – IRRIGATION, ARMIN WESSEL

Steve Pilla is a Burdekin canefarmer, who runs both his own hectare farm and his mother's farm some 14 km away, on his own.

In the past he had a farmhand to help him with daily operations but finding reliable labour and covering the cost of that labour got harder and harder.

Burdekin sugarcane grower, Steve Pilla.

When he heard about the Burdekin Irrigation Project (BIP) he was stretched. Irrigation was too often run on the side while he concentrated on getting other time-critical farm-work completed.

But Steve understood that the BIP would take some of the repetitive irrigation work out of his daily schedule and help him reduce water and energy costs while maintaining or improving productivity. He was also hoping to avoid the need to change irrigation sets at night and on weekends. So he made time to get involved.

Automation benefits

Now that the irrigation system is automated, he doesn't want to go back to the old ways. Steve can plan a whole irrigation sequence in advance when he has spare time. He chooses the pumps that are needed to supply the water and the sets he wants to irrigate in his new sequence. IrrigWeb (irrigation scheduling and record keeping software) tells him when to set a start time for each sequence and the run times for each set.

When it is time to irrigate, the WiSA base station sends radio signals to the equipment on farm so the pre-planned irrigation event can be executed. Integrated safety features like pressure sensors make sure that either an alarm is sent to Steve or the system is immediately shut down if any hardware fails and system pressure goes beyond pre-set limits. When he used the system for the first time, Steve went out to check in the paddock that everything went to plan but soon accepted that his automation system was keeping a closer eye on things than he could. In the past he would notice if something went wrong when he started the irrigation system manually but if the fluming burst during the day he would only notice the damage when he got back to change a set. Now the automation system constantly monitors and can shut down the system or send alarms to Steve when he is elsewhere.

Crop demand model

The need for irrigation is determined by IrrigWeb that tracks crop demand, uses local rainfall, soil and weather data and calculates when the next irrigation should be applied. The software then records the applied irrigation and starts the calculation process for the next irrigation.

Once a week, Steve receives an automated Irrigweb email with a list of the sets that will require irrigation over the next seven days, so he can set up irrigation sequences accordingly.

Set durations are optimised using end of row sensors to minimise tailwater loss. Start times are planned with the help of Irrigweb. The planning process is done at a convenient time by Steve or his daughter while the automation system executes the commands when the crop needs irrigation.

Gone are the days where a strict 12-hour shift system was the norm and irrigation tasks were constantly interfering with daily routines.

Steve and his daughter use a cloud-based platform to access their fully automated WiSA irrigation system from their home office but could do so from any computer or phone in the world that has an internet connection.

Armin Wessel, SRA Project Officer – Irrigation, marks cane stalks and prepares them for daily growth measurements on a BIP demonstration site.

BIP demonstration site

Steve has a history of trial involvement with SRA, loving to learn first-hand from the outcomes.

He was happy to host a BIP demonstration site, wanting to understand how he could improve his practices and share the knowledge gained in the process. Replicated strip trials were set up on his farm to demonstrate differences between irrigation volumes and scheduling.

Measurement of irrigation volumes, irrigation progress, runoff loss and soakage are measured by smart tools including advance sensors, tensiometers, and flumes. The data is then analysed by the BIP team. The economic outcomes of different irrigation treatments will be evaluated at the end of the project.

Deep drainage losses

Steve hopes to learn how to minimise deep drainage losses.

He has had to install subsoil drainage in the past to combat wet spots caused by shallow localised groundwater tables. One of his blocks was partially deep ripped a decade ago and ever since has a history of excessive deep drainage losses. This localised problem might be lessened with higher inflow and shorter duration irrigation events.

With the use of automation, shorter irrigation durations with higher flows do not upset the daily farm routine. And water is no longer draining through a leaky profile and adding to rising groundwater tables.

Help with irrigation

Since the irrigation system has been automated, Steve`s daughter has been able to help on the farm while not being physically present.

She has just finished her Bachelor of Business and is now working off farm. However, to help Steve out, she has the flexibility to plan and set up whole irrigation sequences online, at a time to suit her. As a result, she is able to become part of the farming team from anywhere in Australia (or the world). Steve is then able to respond on farm, if alerts flag something that needs attention.

Life changing

After using the new irrigation system for a couple of months and overcoming initial teething issues, Steve has confidence that the system will do the right thing.

"We included pressure sensors as safeguards, just in case," he said. "I trust that it all works and if there is an issue, I will receive an alert on my phone.

"I no longer need to check the irrigation daily, and that's saved me valuable time. It's changed my working day."

Burdekin Irrigation Project

Scan to read Burdekin Irrigation Project FAQs

The Burdekin Irrigation Project is funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation with collaboration between Sugar Research Australia, Farmacist, AgriTech Solutions, Burdekin Productivity Services, Burdekin Bowen Integrated Floodplain Management Advisory Committee, James Cook University, the Queensland Department of Agriculture and Fisheries and NQ Dry Tropics.

If you would like to learn more about the activities of the Burdekin Irrigation Project please contact SRA District Manager for the Burdekin, Terry Granshaw, email: tgranshaw@sugarresearch.com.au or SRA Environmental Sustainability Scientist Simon Clarke, email: sclarke@sugarresearch.com.au

SOLVING THE MYSTERY OF YCS IN SUGARCANE - ARE INVERTEBRATES THE MISSING LINK?

Yellow Canopy Syndrome (YCS) was first observed in Australian sugarcane in 2012 in Cairns. It has since spread as far south as Maryborough.

YCS can impact cane in several ways. This can range from yellowing in the mid-canopy region (leaves 3-7), accumulating carbohydrate starch in the leaves and shortening internodes.

Depending on the degree of symptom, crop growth can be compromised with potential impacts on final yields. Growers have reported YCS symptoms that 'come and go' in waves through the season.

Sugar Research Australia continues to invest in research to fully understand what causes YCS and how it may be managed. Current work is focusing on the potential association between invertebrates and YCS.

Hang (Hank) Xu is in the third and final year of his PhD. He is based at SRA's Meringa research station working under the supervision of SRA Entomology Leader, Dr Kevin Powell, and Professor Gavin Ash and Dr Bree Wilson and Dr Jacob Humpal from the University of Southern Queensland (UniSQ), Toowoomba.

Previous research studies have identified that YCS does not appear to be due to pathogens or nutrient deficiency. However, it is influenced by weather conditions and some insecticides under experimental conditions reduce YCS expression.

"Once we identify the cause of YCS, we can start to investigate what on-farm management strategies we could use to monitor and effectively treat the syndrome," Dr Powell said.

Hank's research topic - *Advancing Techniques for Diagnosis of Yellow Canopy Syndrome* - is investigating if invertebrates are the missing link.

Hank prepares for a YCS Induction trial in the UniSQ glasshouse in Toowoomba.

Hank used yellow pan traps in YCS-affected sugarcane fields to collect invertebrates for identification, molecular testing and to monitor their dispersal.

Hank spoke with cane growers about his work at the FNQ Growers Agriculture Research and Development Field Day in Mareeba, July 2022.

"I began this research in January 2021. I am specifically looking at the role that invertebrates (which include insects and mites) may play in YCS and hoping to narrow down which group of invertebrates may be associated with the syndrome.

"I will then develop a molecular-based diagnostic tool for early detection of the target species, or multiple species, in the field and a remote sensing based method for YCS symptom surveillance," Hank said.

Working with Dr Powell and the entomology team in Meringa, Hank initially identified 10 invertebrate groups representing multiple species that are found in YCS-affected cane fields. Utilising a range of trapping methods, he monitored these groups over two seasons and gathered hundreds of samples for identification.

Hank has now narrowed down his research focus to three invertebrate groups: mealybugs, mites and whiteflies.

Through an ongoing monitoring program, including glasshouse trials at the University of Southern Queensland (UniSQ) in Toowoomba, Hank is now hoping to validate if one or more of these invertebrates are involved in YCS.

"The first two years of the research involved detailed seasonal studies in cane fields at Aloomba, FNQ. Additional trapping was undertaken in collaboration with SRA Industry Service staff and growers in Ingham, Mackay and the Burdekin," Hank said.

"This took time and a great deal of effort, as we know from previous research that YCS is inconsistent depending on the season. But now we're able to start the next phase of the project which focuses on detection.

"This year I will introduce these three invertebrate species to sugarcane I have grown from seedlings in the Toowoomba glass houses, to try and induce YCS under experimental conditions.

"I have also started a pilot study to be able to detect the invertebrates using molecular techniques and at the same time detect YCS yellowing through remote sensing techniques."

Until now YCS has only been detected by eye, and it can appear one day and disappear the next.

"If we know what invertebrate causes the YCS, we can develop a molecular test to identify it early.

"If the yellowing can be picked up early using remote sensing that will be another good detection tool," Hank said.

And this will mean an early warning system for growers.

Hank gathers invertebrates from the canopy of sugarcane in an Aloomba field site.

The project is supported by Grains R&D Corporation, through funding from the Australian Government Department of Agriculture, Water and the Environment as part of its rural R&D for profit program and Cotton R&D Corporation, Horticulture Innovation Australia, Wine Australia, Sugar Research Australia and Forest & Wood Products Australia.

Sugar Research Australia

UniSQ

GRDC Grains Research & Development Corporation

Australian Government Department of Agriculture, Fisheries and Forestry

EEFs MAINTAIN PRODUCTIVITY AND PROFITABILITY AND PROVIDE ENVIRONMENTAL BENEFITS

Doug Hardwick's family has been farming cane in the Mulgrave district since 1948. He has been an active participant in Sugar Research Australia (SRA) trials for many years.

Doug provided his farm and time most recently to research trials conducted as part of the '*Support of cane farmer trials of enhanced efficiency fertiliser (EEF) in the catchments of the Great Barrier Reef (EEF60)*' project; and then its extension '*Cane farmer trials and modelling of EEFs*' funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.

Enhanced efficiency fertilisers (EEFs) have been designed to control the release of nitrogen fertilisers.

They (there is more than one type) have been proposed as a tool sugarcane growers might consider to increase nitrogen use efficiency on their farms, while providing water quality benefits.

With support from project partners, including growers like Doug, EEFs were tested over four seasons on 74 sugarcane farms located between Mossman and Bundaberg.

The results from extensive field trials were evaluated by SRA and economists from the Department of Agriculture and Fisheries (DAF) in regions across the catchments of the Great Barrier Reef. The results show that when high nitrogen loss conditions are likely, EEFs are a good option.

Doug supports these findings but is the first to admit that there are growers who find it hard to change established farming practices and might need more encouragement to trial EEFs.

SRA Agronomist Julian Connellan and DAF Economist Matthew Thompson have been part of the project since its inception in 2017.

"We are pleased that we have been able to provide industry with simple guidelines which can be adopted by growers to improve their nitrogen use efficiency while maintaining productivity and profitability," Julian said.

CSIRO recently released modelling which provided more evidence to support the findings of the extensive field research. The investigation looked at climate, soil and crop start interactions across the Wet Tropics.

The Agricultural Production Systems sIMulator (APSIM) farming systems model was used to investigate when and where EEF use could reduce nitrogen losses to the environment. It indicated that the risk of nitrogen losses was mostly associated with late season fertiliser application in drier regions and mid-late season fertiliser application in very wet regions of the Wet Tropics.

Both field trials and modelling showed EEFs were more effective when high loss conditions were experienced, particularly late in the season.

Doug encourages other canegrowers to consider trying EEFs.

"Old habits die hard in all industries. But I believe there are other ways, and must be new ways, of doing things," he said.

"With the high price of fertiliser, the last thing we want to do is waste what we put on our crop, and if we're able to reduce what we use in the first place, then all the better," he said.

Calibrating a fertiliser box

Measuring surface water nitrogen losses in sugarcane.

DAF Economist Matthew Thompson and SRA Agronomist Julian Connellan (both pictured standing) have been engaging with growers at SRA events to share the findings of the trials and answer any questions about EEFs.

"I was curious about enhanced efficiency fertilisers, keen to see if there would be any benefits, and I believe in the right conditions, there are.

"The takeaway for me, is that by using EEFs on late ratoons, late in the growing season and at the start of the wet season, up here in the Wet Tropics, I will be able to grow the same amount of cane with 20 per cent less fertiliser. That means, I'll come out on top.

"This has been an intensive, worthwhile project. The agronomic and economic research has been precise, and I fully support the recommendations that have come from it," Doug said.

For growers interested in utilising EEFs, consider the following recommendations:

- For DMPP and blended CRF products (20% CRF 80% Urea), using an N rate 20% below the SIX EASY STEPS® recommendation has been shown to maintain productivity and profitability.
- Limit use of CRF blends with a higher proportion of CRF (greater than 20%) as this results in lower grower profitability due to higher fertiliser costs.
- Use EEF products when high N loss conditions are expected, particularly late season fertiliser application. In very wet regions, growers could target mid-late fertiliser application times.
- Use of EEFs at the lower N rate is generally applicable to most growing conditions and with experience growers could expand their use. However, application of EEFs early in the season is less likely to provide benefit as N losses are not as likely.
- Take advantage of the improved cost-competitiveness of the new nitrogen inhibitor, 3,4-dimethylpyrazole phosphate (DMPP), and blended controlled release fertiliser (CRF) products (applied at 20% less N) when urea prices are higher than average.
- It is recommended that any change in management is tested on-farm. This will build confidence in both the new nutrient rates/products but will also aid the process of fine - tuning a nutrient management program as part of STEPS 5 and 6 in SIX EASY STEPS®.

The results and recommendations from the EEF60 project and additional modelling have now been added to the SIX EASY STEPS® Toolbox and can be found on the SRA website by scanning the QR code below.

Scan to view the EEF60 Project web page.

The on-ground testing and modelling of the effectiveness of enhanced efficiency fertilisers in the Wet Tropics catchments of the Great Barrier Reef project was funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation with support from a collaborative partnership between Sugar Research Australia, Department of Agriculture and Fisheries, CSIRO, CANEGROWERS, productivity services and cane farmers.

Growers from Rocky Point recently visited SRA Woodford as part of activities in the Southern district plan.

DISTRICT PLANS CONNECT AND INVOLVE INDUSTRY WITH RESEARCHERS

SRA's District Productivity Plans are developed by the Industry Services team through consultation and engagement with industry partners across the sugar industry supply chain.

Reviewed annually, to identify current constraints impacting productivity and profitability, the plans are delivered by District Managers.

"Each plan highlights specific local issues with proposed solutions and actions to address them and drive investment in the region. These plans connect and involve industry with SRA researchers, trials and training," SRA's Executive Manager Industry Services Hywel Cook said.

"Engagement is critical for us to share and explain what can be complex science and technology, through a product or service, that is relevant at a local level.

"We have an extensive calendar of events, including field days, scheduled for 2023 across all our districts. I encourage all cane farmers and industry partners to attend one of these events early in the year to hear directly from our researchers, put questions to them and discuss individual needs.

"We exist to support a productive and profitable industry and the best way for us to do that is by meeting face-to-face with growers and understanding those drivers," Hywel said.

"Constraints identified through this process last year, have been used in developing SRA's research priorities for this year's funding round."

Scan to view the 2023 District Productivity Plans.

CURRENT PRIORITIES BY DISTRICT

INITIATIVE	COLLABORATORS	PROPOSED OUTCOME	STATUS – March 2023
Far North District Manager: Gavin Rodman grodman@sugarresearch.com.au 0476 807 355.			
Mulgrave and Mossman CCS Improvement Projects	CANEGROWERS Cairns Region, MSF Sugar and Mulgrave growers. CANEGROWERS Mossman, Far Northern Milling Pty Ltd, Mossman Agricultural Services and Mossman growers.	Improve CCS through monitoring and measuring crop indicators. Development of new datasets. Identification of management strategies. Identify the impact of current practices on CCS, including those impacting upon extraneous matter.	Mulgrave on-farm review complete. Pachymetra and row profile sampling in Mulgrave and Babinda ongoing. Data review ongoing. Mossman project commenced in February.
Development of application parameters for ripeners	MSF Sugar, Far Northern growers.	Develop in-field parameters to support successful applications of sugarcane ripeners to improve profitability.	Year 1 results shared with Far Northern industry at SRA March update events. Industry support for second year of trials confirmed. 2023 sites selected and monitoring underway. Strong linkages to CCS improvement projects.
Strategies for emerging weeds	Nufarm, Queensland Department of Agriculture and Fisheries, Federation University and Far Northern growers.	Investigate efficacy of herbicides registered for vine control and aerial application. Identify and develop germination protocols for itch grass to support pot trials. Develop management strategies for post-emergence of balsam pear, itch grass and navua sedge.	Year 1 results shared with Far Northern industry at SRA March update events. Balsam pear trial #3 underway. Aerial chemical trial underway. Navua sedge monitoring ongoing with proposed field walk in May.
North District Manager: Phil Patane ppatane@sugarresearch.com.au 0431 818 482			
Local Expert Analysis (LEA) South Johnstone	Innisfail Babinda Cane Productivity Services, Innisfail CANEGROWERS, local growers, MSF Sugar, Cassowary Coast Reef Smart Farming Project and local industry organisations.	A lift in productivity through improved management of Pachymetra root rot, RSD, plant nutrition (including Calcium, Silicon) and increased adoption and exploitation of higher yielding resistant varieties.	Meetings to be conducted with local industry to present progress of the LEA.
Local Expert Analysis (LEA) Tully	Tully Cane Productivity Services Ltd, Tully CANEGROWERS, Tully Sugar.	Improved profitability through balanced crop nutrition, targeted use of mill by-products, automated mill alerts for poor yielding crops, better disease management, improved use of NIR to indicate crop status, and validation of Harvest Mate for optimising harvesting economic outcomes.	Currently conducting stakeholder engagement meetings to review action plan.

INITIATIVE	COLLABORATORS	PROPOSED OUTCOME	STATUS – March 2023
Variety observation plot and CCS maturity profiling	SRA Plant Breeding.	Variety demonstration plot and CCS maturity profiling.	Two agronomic assessment trials planted on the Herbert SRA station and Abergowrie sub-district. Completion of CCS maturity curve analysis for standard varieties, newly released varieties, and accelerated clones for 2022 season. Data to be presented at the 2023 RVC meeting and published in the Herbert Variety Guide.
Sterilisation unit for harvesting	Fire Suppression Services QLD PTY LTD.	Prototype automatic spray unit to clean a commercial harvester to minimise RSD transmission.	Unit installed and tested during the 2022 harvest season. Modifications will be made. If successful a second unit will be installed for the 2023 season.
Refining nutrient recommendations for ratoon crops following application of surface banded mill by-products to manage the effect on yield and CCS	Wilmar Sugar Australia.	Improved understanding of nitrogen requirements to manage CCS following application of mill by-products.	One trial implemented at the Orient - mud/ash was subsurface banded in fallow at 80 wet t/ha and then planted in 2021. Second trial to be implemented in the 2023 season, banded application on ratoon cane.
Herbert temporal nitrogen trial	University of Southern Queensland.	Generating cane yield and nitrogen uptake response curves for different enhanced efficiency fertiliser (EEF) products.	Data compiled and to be presented during the offseason at a farming systems workshop.
Herbert harvesting demonstration trials	Queensland Department of Agriculture and Fisheries, CANEGROWERS Herbert River, Agrifutures and Clevvi.	Validating best economic harvest practice utilising Harvest Mate.	Results will be presented on 22 March at the Herbert Harvest Mate workshop, the first in a Northern Harvest Mate Roadshow.
Burdekin District Manager Terry Granshaw tgranshaw@sugarresearch.com.au 0457 650 181			
Burdekin Irrigation Project (BIP)	Burdekin Productivity Service (BPS), Agritech Solutions, Farmacist, Burdekin Bowen Integrated Floodplain Management Advisory Committee (BBIFMAC), James Cook University, Department of Agriculture and Fisheries, North Queensland Dry Tropics, Wilmar and growers. In-kind from Sunwater.	Reduce energy costs, improve water costs and irrigation efficiencies. Measure water quality benefits. Modernisation of farming systems e.g. smart farming technology. Improve productivity/ profitability which has a direct effect on environmental outcomes.	Three demonstration sites selected across different soil types and water sources. All demonstration sites completed with fully installed infrastructure and replicated strip trials measuring differences between flows, scheduling, and energy use. BIP internal staff field walk completed. Drone imagery completed on one site.
Reducing herbicide usage on farm with precise weed control	Autoweed, James Cook Univeristy, Queensland Department of Agriculture and Fisheries.	Reduce herbicide use by comparing efficacy of weed control and evaluate economic savings.	Secured funding to build on existing trials. Planning underway for new trials. Mounting of infrastructure to new spray rig with dual pesticide capacity. Imagery completed of new trial area with a focus on invasive grass species.
Burdekin phosphorous response trial	Wilmar and Burdekin Productivity Services.	Investigate P management for sugarcane crops growing in alkaline soils.	Six -month biomass sampling completed.
Mill mud/ash trials in outer regions of the district	Queensland Department of Agriculture and Fisheries	Measuring economic impact of applying low rates of mill mud/ash.	Trial plan developed, growers engaged, and mill mud ash pads established.
Central District Manager Dylan Wedel dwedel@sugarresearch.com.au 0490 029 387			
Increasing irrigation utilisation	Productivity services companies, growers, Mackay Sugar, local water boards, government bodies.	Increase utilisation of irrigation to increase profitability and productivity. Note: Seeking more growers to work with in the irrigation space.	Established a remote start and automatic off flood irrigation controller demonstration in Proserpine – field walk planned early 2023. Undertaken several system assessments/benchmarking using CaneCalcs. Provided advice on irrigation system design/operation and ongoing support with irrigation scheduling. Working with stakeholders to develop a major irrigation utilisation project in the region.
Supporting complementary fallow cropping	Productivity services companies and growers.	Improve productivity by breaking the monoculture and profitability with a complementary cash crop.	The SRA soybean planter has been returned to service and is available to growers to trial complementary fallow crops. Several paddocks have been successfully planted to date – through trash, ratoon drills and cultivated beds.
Variety observations	Productivity services companies.	Improve knowledge of varieties, particularly regarding early CCS and the impact of soil moisture on CCS.	Data gathered in 2022 currently being analysed.
Ripener trials	Productivity services companies and growers.	Improve CCS when cane is harvested earlier in the season.	Preliminary results from 2022 trials have shown economic returns for growers. The data will now be analysed alongside trial results from the Far North and shared with growers when available.
Southern District Manager Lisa Devereaux ldevereaux@sugarresearch.com.au 0456 590 497			
Local Expert Analysis (LEA) Bundaberg/ Wide Bay	Productivity boards and mills.	Identification of unrealised industry constraints.	Initial phase underway. Working with stakeholders to obtain nutrient management data.
Rocky Point Pest and Disease Management Surveys	Rocky Point Canegrowers.	Reduced impact of RSD on farm. Further, extend and promote benefits of clean seed scheme and farm hygiene.	RSD Management Plan report completed. Recommendations being prioritised for action in early 2023.
Increase adoption of the cane loss monitoring system (SCHLOTLive)	NSW Agricultural Services.	To maximise returns through decrease harvesting losses.	Project on hold until 2023.

RESEARCH PROJECT INVESTMENTS

PROJECT IDENTIFIER	TITLE	CHIEF INVESTIGATOR	RESEARCH AGENCY	END DATE
Research Mission 1: Continuous improvement in farming and milling profitability				
2017/002	Implementing and validating genomic selection in SRA breeding programs to accelerate improvements in yield, commercial cane sugar, and other key traits	Ben Hayes	The University of Queensland	1/10/2023
2018/005	Genetic analysis and marker delivery for sugarcane breeding	Karen Aitken	Commonwealth Scientific and Industrial Research Organisation	1/05/2023
2018/012	Pan design and operational changes to suit Australian pan stages operating on low pressure vapour	Ross Broadfoot	Queensland University of Technology	1/05/2023
2019/005	Improved strategies to process soft canes	Floren Plaza	Queensland University of Technology	1/05/2023
2019/007	Eliminating roll arcing	Geoff Kent	Queensland University of Technology	1/02/2023
2020/003	Maximising cane recovery through the development of a harvesting decision-support tool	Phil-Anthony Patane	Sugar Research Australia	1/06/2023
2022/202	Optimising milling train extraction through added water control using online NIR cane and bagasse data	John Edwards	Tully Sugar Limited	1/06/2023
2022/401	Harnessing the SynBio potential of Australia's stingless bees, the first step.	Natasha Hungerford	The University of Queensland	14/03/2024
2022/402	Genomic prediction of ratoon yield robustness	Eric Dinglasan	The University of Queensland	14/03/2024
Research Mission 2: Position the industry to stay ahead of climate, environmental and biosecurity threats				
2017/809	Modern diagnostics for a safer Australian Sugar Industry	Chuong Ngo	Sugar Research Australia	1/02/2023
2017/901	Rural RnD4Profit - Forewarned is forearmed: managing the impacts of extreme climate events	Tom Davidson	Meat & Livestock Australia	29/04/2023
2018/010	Moth Borers - how are we going to manage them when they arrive?	Kevin Powell	Sugar Research Australia	2/01/2023
2020/002	Developing an integrated device for on-farm detection of sugarcane diseases	Muhammad Shiddiky	Griffith University	21/03/2024
2020/004	Beyond Imidacloprid - Chemical and Biorational Alternatives for Managing Canegrubs	Kevin Powell	Sugar Research Australia	31/01/2024
2020/007	Environmental DNA Technologies and Predictive Modelling for Rapid Detection and Identification of Sugarcane Priority Pests and Diseases	Andrew Weeks	EnviroDNA Pty Ltd.	1/06/2024
2020/008	Transformational crop protection – Innovative RNAi biopesticides for management of sugarcane root feeding pests	Neena Mitter	The University of Queensland	30/06/2024
2021/401	Research Award - Risk assessment for the newly discovered parasitic nematode *Pratylenchus parazeae* in the Australian sugarcane industry	Shamsul Bhuiyan	Sugar Research Australia	31/03/2023
2021/402	Towards more sustainable pest control strategies through a metagenomic survey of viral entomopathogens in canegrubs populations	Kayvan Etebari	The University of Queensland	1/05/2023
2022/002	Updating the Sugarcane Industry Biosecurity Plan	Stuart Kearns	Plant Health Australia	1/06/2027
2022/901	Agri-climate outlook	Danielle Skocaj	Agricultural Innovation Australia Limited	30/12/2024
2022/101	A novel biosensor device for on-farm sugarcane disease diagnosis	Simon Strachan	Griffith University	29/02/2024
Research Mission 3: Capitalise on changing consumer preferences, and the growing bio and green economies to develop diversification opportunities				
2020/101	Engineering bacterial enzyme secretion for cellulose utilisation	Madeline Smith	Queensland University of Technology	31/01/2023

PROJECT IDENTIFIER	TITLE	CHIEF INVESTIGATOR	RESEARCH AGENCY	END DATE
Research Mission 4: Position the Australian sugarcane industry as leaders in profitability, environmental sustainability and resource-use efficiency				
2020/001	Environmental Risk Assessment & Life Cycle Assessment of the Raw Sugar Manufacturing	Stephen Wiedemann	Integrity Ag & Environment Pty Ltd	28/02/2023
2020/017	A Common Approach to Sector-Level GHG Accounting for Australian Agriculture	Michelle Ford	Agricultural Innovation Australia Limited	27/02/2023
2020/802	Mackay Whitsunday Cane to Creek	Simon Clarke	Sugar Research Australia	31/10/2023
2020/804	Reducing herbicide usage on sugarcane farms in reef catchment areas with precise robotic weed control	Emilie Fillols	Sugar Research Australia	30/06/2024
2020/805	Increasing Industry Productivity and Profitability Through Transformational, Whole of Systems Sugarcane Approaches that Deliver Water Quality Benefits	Simon Clarke	Sugar Research Australia	30/06/2024
2021/008	Develop a Sustainability Framework for Australian Sugarcane and Sustainability Report in collaboration with stakeholders	Ingrid Roth	Roth Rural Pty Ltd	1/05/2024
2021/804	Mobilising the Murray	Simon Clarke	Sugar Research Australia	30/06/2023
2021/805	Soil specific management for sugarcane production in the Wet Tropics	Danielle Skocaj	Sugar Research Australia	23/04/2024
2021/806	DES122685 Sugarcane Nutrient Management Training	Lisa Devereaux	Sugar Research Australia	30/06/2023
Research Mission 5: Support the development of an adaptable, professional, commercial and entrepreneurial industry and research community				
2018/015	Sugar Milling R & D Capability Building Program	Geoff Kent	Queensland University of Technology	30/09/2023
2019/102	PhD Scholarship - Genetic solutions for determining fibre quality traits in sugarcane	Angela O'Keeffe	The University of Queensland	30/06/2023
2019/806	Advancing techniques for diagnosis of yellow canopy syndrome	Kevin Powell	Sugar Research Australia	25/06/2023
2021/101	Optimising mill mud and ash applications for soil improvement and carbon sequestration	Hannah Green	James Cook University	30/04/2025
2021/102	Systems biology for sustainable agriculture: evaluation of plant growth-promoting bacteria to produce high-performing biofertilisers	Ian Petersen	The University of Queensland	30/04/2025

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