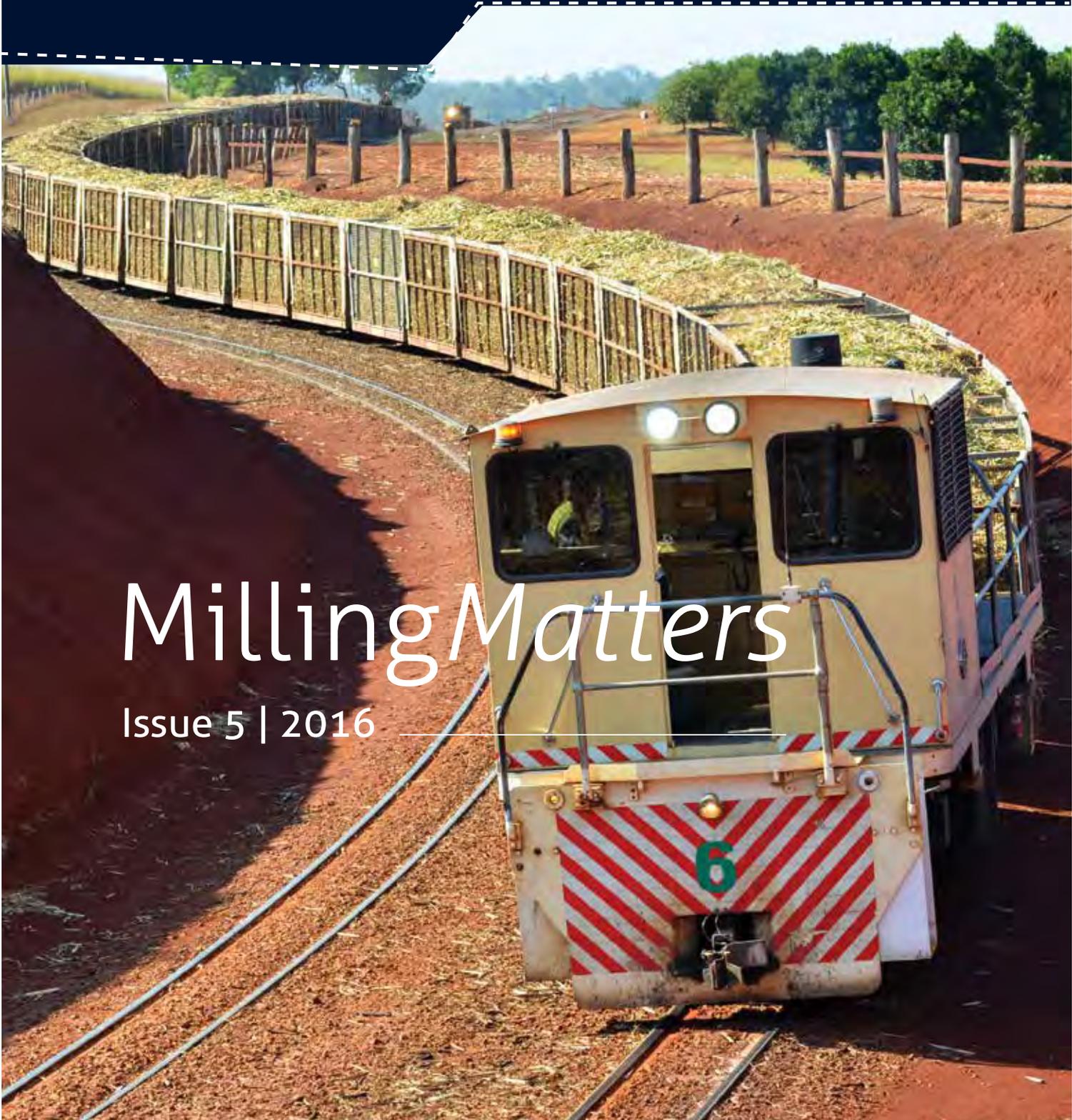


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Sugar Research  
Australia™

A yellow rail engine with a red and white striped front and the number '6' is pulling a long train of sugarcane carts through a field. The carts are filled with cut sugarcane stalks. The field is surrounded by a wooden fence and trees in the background. The ground is reddish-brown soil.

# Milling Matters

Issue 5 | 2016

# Contents

|   |    |
|---|----|
| Seed project investigates biological controls for disease             | 03 |
| Harnessing the potential from sugarcane biorefineries                 | 04 |
| Understanding the barriers to industry innovation                     | 05 |
| Harnessing cane's potential for animal feed                           | 06 |
| \$75M Green Power Station for Tableland Mill near Mareeba, QLD        | 08 |
| Pilot project looks at billet deterioration                           | 09 |
| Mill stats show the results of solid 2015 harvest                     | 10 |
| New milling research investment kicks off                             | 11 |
| New research project into sugarcane harvest losses builds momentum    | 12 |
| Climate forecasting to improve nitrogen management in the Wet Tropics | 14 |
| Milling Research Investment   | 15 |



## Welcome to MillingMatters



Welcome to the fifth edition of Milling Matters magazine. Sugar Research Australia (SRA) produces this publication twice each year to update our investors on research and other activity that is occurring for the milling sector via SRA.

These investments occur primarily as a consequence of SRA's Strategic Plan, which has identified eight Key Focus Areas (KFAs) for research investment for SRA on behalf of the Australian sugarcane industry. Within those eight KFAs, milling research investment occurs via KFA 5 (milling efficiency and technology), KFA 6 (product diversification and value addition), KFA 7 (knowledge and technology transfer and adoption) and KFA 8 (capability development and retention). Milling research is also strongly linked to the other KFAs that have a strong focus on the farming system. Holistically, more tonnes in the paddock means more tonnes over the rollers.

In this edition, we are taking a close look at one of the major research investments that is occurring via the Commonwealth Government Rural R&D for Profit programme into sugarcane value-adding. This is a major research investment where SRA has leveraged SRA levy-payer investment to secure a significant Commonwealth investment into our industry (page 4-7).

This has also occurred via a new project in this program looking at harvest losses, which also has a strong focus on milling (page 14-15).

In this edition we also look at some of the new research projects that have just commenced, and we look at two of the career-development small-scale projects that SRA invests in. The first is with Dr Jan Zhanying Zhang with QUT on biocontrol agents, and the second is with Dr Anthony O'Connell with SRA on billet quality.

We hope that you enjoy this magazine.

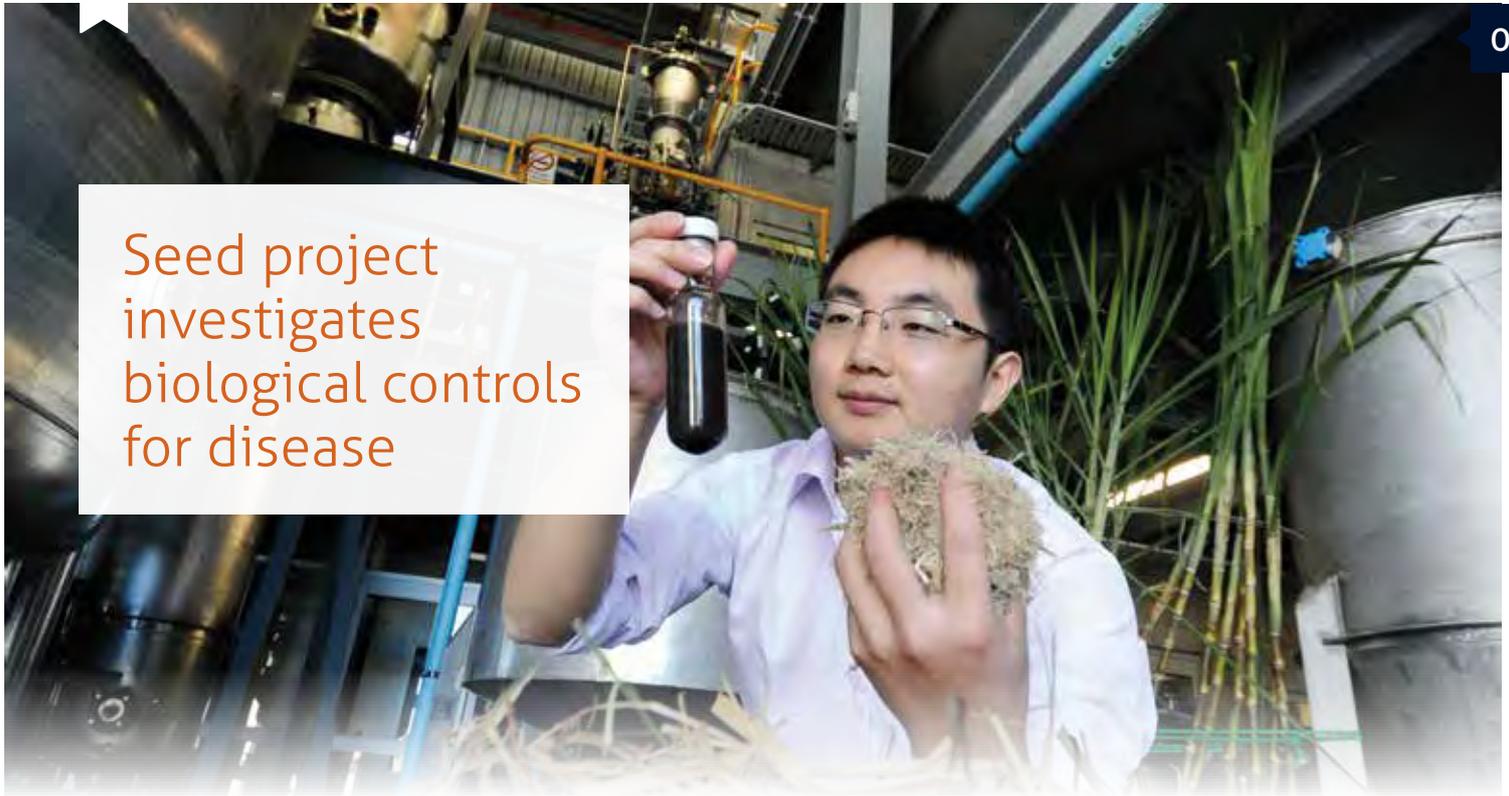
**Brad Pfeffer**

*Executive Manager, Communications*

**Above:** The SRA Board visited the Tableland Mill as a guest of MSF in August 2016.



## Seed project investigates biological controls for disease



*A new small-scale research project is investigating the use of biological controls in sugarcane that could help encourage growth and reduce the impact from some diseases.*

The project is part of Sugar Research Australia's investment in career development opportunities through its Early-Career and Mid-Career Researcher Awards.

These awards are aimed at assisting researchers within the industry to develop innovative and transformative projects that benefit sugarcane growers and millers.

As part of that program, QUT Researcher Dr Jan Zhanying Zhang is working on a project called *Enhancing sugarcane growth and yield by biocontrol agents / biofertilisers*.

Research has been conducted into biocontrol agents, including organisms called Trichoderma, in some overseas cane-growing countries, but limited work has been done in Australia.

Dr Zhang said it is thought that biocontrol agents have the potential to inhibit diseases within sugarcane such as pineapple disease and red rot.

"The results will depend on the interaction between the biocontrol agent and the targeted sugarcane pathogen," he said. "It is hoped that the biocontrol agent can inhibit the incidence of disease."

The project will also be preliminarily assessing whether the biocontrol agents could be produced in a commercially useful way. This will investigate whether the agents could be grown on low cost substrates for example by using bagasse or mill mud.

The use of biocontrol agents is also promising because it would present an environmentally-friendly control option when compared to traditional chemical pesticides.

The project began on July 1 2016 and is scheduled to run to May 2017.

The ECR / MCR Awards are available for diverse activities, including for researchers who may require initial results or a proof of concept prior to developing a larger project, and who want to expand their skills and build collaborations in pursuit of an innovative initiative.

### Key Focus Area

Capability development, attraction and retention

### Project name

Enhancing sugarcane growth and yield by biocontrol agents / biofertilisers

### Project number

2014/402

### Project leader

Jan Zhanying Zhang

### Project end date

May 2017

For information on the 2017 funding round for the ECR / MCR Awards, please visit the SRA website, [www.sugarresearch.com.au](http://www.sugarresearch.com.au).

**Above: Dr Jan Zhanying Zhang.**



## Harnessing the potential from sugarcane biorefineries

A new research project is looking at the potential for harnessing the potential of agricultural residues and turning them into valuable revenue streams for primary producers and processors.

This project was announced in 2015 as part of the Australian Government's Rural R&D for Profit programme and is a collaboration between SRA, QUT, Forest and Wood Products Australia Limited, the Cotton Research and Development Corporation, Australia Pork Limited and Southern Oil Refining.

It also has support from NSW Department of Primary Industries and the Queensland Government Department of Agriculture and Fisheries.

It forms a \$6 million investment, the majority of which is from SRA and the Commonwealth, making it the largest and most comprehensive research activity into value adding that has occurred within the sugarcane industry.

The research program being led by QUT is now occurring in the field and in the lab, split into several focus activities. These activities are to:

- Develop new technologies for the use of sugarcane products as animal feed ingredients

- Develop new technologies for the use of enzymes to enhance nutritional characteristics of sugarcane products
- Develop technology for the production of pharmaceutical precursors from cotton waste
- Develop technology for the production of fermentable sugars from cotton gin trash
- Develop technology for the production of advanced fuels from sugarcane biomass and animal waste residues
- Assess factors influencing innovation and adoption in the Australian sugar milling industry
- Develop biorefinery innovation in the forest and wood products industries
- Extension and communication.

In this edition of *MillingMatters*, we take a look at the early research occurring in two of these activities.

These are the assessment of animal feed ingredients from cane products (page 6-7), and also the assessment of factors that influence innovation and adoption in the milling industry (opposite page).

If this technology became widely adopted, it would stand to create significant benefits for agricultural industries and regional communities and economies.

A Deloitte Access Economics and Corelli Consulting study in 2014 indicated that the establishment of rural and regional bio-refineries could generate over \$21.5 billion in extra revenue over the next 20 years and create 6640 new full-time jobs.

Diversification is an important strategy for ensuring the long term profitability of the sugar industry.

This project is targeted toward capturing this opportunity for the sugar industry, delivering practical research outcomes on a number of fronts, and linking it closely with research into adoption as well extension and communication.

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





## Understanding the barriers to industry innovation

*The new Biorefineries for Profit project is looking further than just research into value-add products from farm by-products, and is also researching the next steps of seeing innovation translated into real-world commercial outcomes.*

In doing so, it is enlisting the help of researchers within the QUT Business School to better understand the barriers to and processes around implementation of new technology.

The project has a strong focus on research into options for farmers and processors of agricultural products, but this major component of the project is also looking at the broader environment that exists around new innovations.

Dr Stephen Cox at QUT is leading this part of the project and said that this work occurred in the context of ensuring the project able to deliver results on the ground and not "sit on the shelf".

"With diversification around agriculture residue products, whether that be bagasse or other products, the technology and ideas have been around for a long time," Dr Cox said.

"But the amount of activity in Australia, particularly compared to some other countries, is relatively small.

"We know there is goodwill in parts of the industry, as we have seen investments in technology for cost reduction, but there is also something blocking some other investment from happening.

"Our part of the research is looking at what might be blocking those opportunities from being realised."

According to Dr Cox, they are looking at a range of constraints and factors that influence the uptake of technology.

These include, for example, the economics such as the sugar price and the Australian dollar; the weather's impact on the crop; politics; and policy.

For example, various governments in recent years have had varying levels of policy support for initiatives such as biofuels, ethanol, and renewable energy.

But when the market for a product – such as ethanol – appears dependent on government legislation and support and could therefore change, then investors in the past have also trod carefully, wary of such government support changing in the future.

These are all issues that will feed into the research, which is also using surveys and face-to-face contact, as well as investigating the experience of overseas to see where investments in innovation have worked well.

He added that internal capability within a particular business was also a big factor for driving investment, given that the investment often came with risk.

"Whether that investment occurs on an individual farm or a sugar mill, you need the capability to implement it, and you need sufficient scale for it to be applicable."



### Key Focus Area

Product diversification and value addition

### Project name

Biorefineries for higher-value animal feed, chemicals and fuel

### Project number

2015/902

### Project end date

01/04/2019

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



## Harnessing cane's potential for animal feed



*When sugarcane growers and millers talk about animal feed, the first thought is typically molasses. But a major collaborative research project is looking far beyond molasses and investigating a range of other possibilities for turning sugarcane by-products into practical and affordable animal feeds and feed-additives.*

It is all about capturing the value of the sugarcane biomass and putting this into the context of other important competitive advantages that currently exist for the Australian sugarcane industry.

The research forms one part of the major Commonwealth Government Rural R&D for Profit Programme as part of a project called *A profitable future for Australian agriculture: bio-refineries for higher-value animal feed, chemicals and fuel.*

Other aspects of the project are investigating other potential value-add products that can be created from sugarcane by-products, as well as by-products from other industries such as cotton and forestry.

SRA is the lead agency for the project with funding from the Australian Government Department of Agriculture, along with Forest and Wood Products Australia Limited, the Cotton Research and Development Corporation, Australian Pork Limited, and the Queensland Government Department of Agriculture and Fisheries.

Queensland University of Technology (QUT) is leading the research with support from NSW Department of Primary Industries and Southern Oil Refining.

One of the goals of the project is to look at each product from a sugar mill and develop chemical and biological tools that could be used to turn them into animal feed products.

The project is focused on feed products for the pork industry, but is also looking closely at the beef industry because of the potential benefits that the cane and beef industries share through their proximity.

Dr Mark Harrison from QUT's Centre for Tropical Crops and Biocommodities is leading this part of the project and he said tremendous potential already exists within sugar mills because of both their logistics and locations.

"With sugarcane we have a cropping system that functions quite differently to many other crop industries," he explained.

"We are producing a huge amount of plant biomass and transporting a large amount of it to a central processing facility, whereas other industries such as grains are leaving a lot of their biomass in the paddock."

"The coastal location of sugar mills is important because it puts sugarcane production and processing close to many of the beef feedlots in both Queensland and New South Wales.

"The higher rainfall environment also means that the industry is producing biomass during the winter, which is a time when it is typically drier in western grazing country and there is an increased need for stock feed."

"We are also seeing cattle production in Queensland developing more sophisticated supply chains where cattle from west of the Divide are trucked to feedlots closer to the coast, which is also where sugar mills are located."



Australian Government  
Department of Agriculture  
and Water Resources

## Biorefineries for Profit

*With the opportunity clear, the project is investigating five main avenues to create animal feed products from sugarcane:*

### 1. Leaf protein

It is already well-understood that any plant leaf contains protein, and that there are existing (but expensive) processes that can extract this protein and could create a feed protein product.

“With this research, we are investigating if there are new methods that could be used at scale to isolate that leaf protein and create an enriched protein product that could go into animal feed,” Dr Harrison said.

“There seems to be increasing interest in whole-crop harvesting, so this could be an opportunity to bring in green leaf and tops to send into one revenue stream, and send the billets in another direction.”

Separate research projects are investigating cane-cleaning options that would assist such a process (See *MillingMatters* April 2016 edition).

### 2. Plant-derived bio-actives

Bio-actives for human consumption have become a growing trend in recent decades and have extended beyond the market of inner city urbanites to underpin the growth of a multi-million dollar ‘nutraceutical’ industry.

“Humans gain a lot of health benefits by having anti-oxidants in our diet,” he said. “And just like us, pigs are mono-gastric (one stomach) animals, so we are investigating these products to enhance their health. As part of that we are looking at both traditional and cutting-edge extraction technology that may be able to isolate some of these compounds for animals.”

### 3. Improved digestibility

Bagasse is a very low quality cattle feed. It has been estimated that once bagasse constitutes more than 5 percent of a ration then cattle weight gain becomes limited.

But can things be done to the bagasse to make it more digestible? This part of the project is looking at two approaches to improving the digestibility. The first is through high temperature treatments, and the second through ‘chemical ensilage’, a process where an agent is added to the bagasse and it is allowed to sit at room temperature for a period of time. “We have proof of concept from previous research, but we want to find the most economical way to do it.”

### 4. Liquid sugar products

The researchers are also investigating liquid sugar products other than molasses, such as converting bagasse into a liquid sugar syrup. This research is asking questions such as: what treatments would need to be used? What treatments would work best? How much energy would be in the product?

“We are using advanced analytical techniques to identify what is in the liquid sugar syrups. We need to be certain that these products don’t contain compounds that actually inhibit the ability of an animal to take up nutrients from their feed.”

This research is possible thanks to multi-million dollar investment that has been made previously by QUT in a Central Analytical Research Facility with both cutting-edge equipment and the skilled staff to both maintain and operate it.

### 5. Solid-state fermentation

Different types of yeasts and fungi are already fed to animals, and this part of the project is investigating if these micro-organisms can be grown safely from the residue of cane production, with a focus on improving the protein content.

If those micro-organisms can also produce fats and oils, as well as protein, then the research project (as a whole) is moving another step closer to producing everything that we need to produce a complete animal feed from sugarcane by-products.

#### Key Focus Area

Product diversification and value addition

#### Project name

Biorefineries for higher-value animal feed, chemicals, and fuels

#### Project number

2015/902

#### Project end date

01/04/2019

#### Conclusion

Dr Harrison said that this research project was about creating a new revenue stream and helping to improve industry profitability. “A sugar mill is not necessarily going to become a formulator of stock feeds, but they could be a supplier of valuable ingredients that go into a feed,” he said.

“Fibre is an important part of animal diets and cane factories have a lot of fibre. So we are looking at: what can we do to it to ensure that the nutritional value is improved.”

“At the end of the day this is about helping the industry to make money. Throughout the research we are always asking ourselves: could this work in a sugar mill?”

The project is in its first year, which has a strong emphasis on research, and in years two and three the project will focus more on pilot demonstrations and economics around investment.

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

## \$75M Green Power Station for Tableland Mill near Mareeba, QLD

*MSF Sugar has announced that a \$75M green power station will be built at its Tableland Sugar Mill.*



The power station will use bagasse to produce 24 megawatts of electricity – enough to power every house in the Tableland region.

MSF Sugar CEO, Mike Barry described the project as a significant confidence booster for both the region and the local sugar industry.

Mr Barry said: “This is the first of hopefully four green power stations to be built by MSF Sugar, with the others in the early stages of planning for construction at its sugar mills at Mulgrave near Cairns, South Johnstone near Innisfail and at Maryborough.

“The go-ahead for the remaining three green power stations will depend on the success of the Tableland project as well as stability in the relevant legislation. If all four green power stations are completed, it will equate to approximately 100 megawatts of renewable power generation capacity and a capital spend of around \$500 million.

“Building this renewable power station is the next step in our long term vision to transition our industry

towards producing a range of higher value products, moving away from mills that produce solely raw sugar.”

The project will create around 80 jobs during the construction phase, plus opportunities for local firms and contractors. Some \$40M – more than half the project cost – is expected to be spent on locally sourced labour and materials. Construction is expected to commence in May 2017 with completion planned for June 2018.

Mareeba Mayor Tom Gilmore described the development as a “considerable event” that would be a major boost for the economy.

The SRA Board toured the mill in August and received a briefing on the project from Mr Barry. The tour also included a visit to MSF’s farming operations and a run-down on their investment activities, and work on extension in the region.

The SRA Board regularly hold board meetings in regional locations, and this was their first opportunity to visit the Tableland region since the creation of SRA in 2013.



**Photos:** MSF has announced plans for a 24 megawatt power station at the Tableland mill.



## Pilot project looks at billet deterioration

*A small-scale career-development project has investigated the use of hormones in relation to deterioration of sugarcane billets after harvest.*

Growers and millers already understand that once sugarcane is harvested the clock is ticking to get the cane through the mill before the billets start to deteriorate, which minimises sucrose loss.

Research has shown that deterioration can start to occur 14 hours after harvest, and best practice recommends milling the cane within 16 hours.

With that in mind, a small-scale career development project funded through SRA has investigated if there are ways to delay the deterioration process.

The research was part of SRA's investment in Early-Career Research Awards, which is a grants program that is aimed at building capacity within researchers and also in conducting research outcomes for the industry.

It was conducted by Dr Anthony O'Connell, who is based in Brisbane within SRA, and who also works on SRA's herbicide tolerant cane project, as well as a new project working with sugarcane breeders in India on

collaborations with the Australian breeding program. The purpose of the research was to see if the natural plant hormone cytokinin could be used in various applications to sugarcane before harvest or after harvest, in order to delay the deterioration.

"What I had in mind with this project was that milling cane within 16 hours does have costs and creates logistical problems," he explained. "We have a massive transport network set up to get the cane as quickly as possible to the mill, and that has a cost. There are also bottlenecks and issues with scheduling.

"So the question was – what if the billets could last longer than 16 hours before milling?"

Dr O'Connell said the project was an initial investigation into the use of the cytokinin hormone and new scientific knowledge around its use with postharvest deterioration of cane. He said while the hormone was able to reduce sucrose loss in billets, the effect was not large enough to make it a practical solution to post-harvest deterioration of sugarcane.

### Key Focus Area

Capability development, attraction and retention

### Project name

Reduction of post-harvest deterioration of sugarcane

### Project number

2014/401

### Principal provider

SRA

### Project leader

Anthony O'Connell

### More information

**Dr Anthony O'Connell**

[aconnell@sugarresearch.com.au](mailto:aconnell@sugarresearch.com.au)

(07) 3331 3309

# Mill stats show the results of solid 2015 harvest



*An analysis of mill data from the 2015 harvest has shown the strong yields achieved in 2015 and an overall crop of 34.83 million tonne.*

The 2015 Australian harvest totalled 34.83 million tonnes, which was the biggest crop since 2006. The average tonnes of cane per hectare was 91.2, which was the highest in more than 10 years, and the CCS of the 2015 Australian crop was 13.81.

With favourable seasonal conditions, several regions set records or harvested crops that were the biggest in several years.

A breakdown of the varieties grown in 2015 showed that the top four varieties account for over 70 percent of the Australian crop. These varieties are Q208<sup>®</sup>, Q183<sup>®</sup>, KQ228<sup>®</sup>, and Q200<sup>®</sup>.

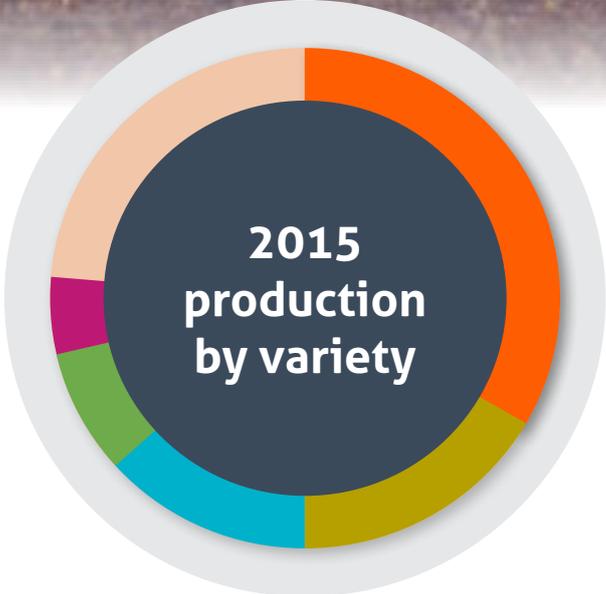
Q208<sup>®</sup> has maintained the number one position as the most dominant variety with just over 11Mt harvested in the 2015 season.

In 2015, 56 varieties with plant breeders rights (PBR) were delivered to Queensland mills, accounting for 31.8 Mt or 98 percent of production.

The promising aspect of the variety composition in 2015 is that many of the new SRA varieties are making their way toward greater adoption by the industry, and these varieties are demonstrating results in trials that are comparable to or greater than many of the current dominant varieties.

SRA sees that the new SRA varieties are all showing promise for the industry and will have a strong role to play in the future. The SRA plant breeding program is the single biggest area of investment by SRA for Australian sugarcane growers and millers, and SRA is committed to continuing to deliver new and improved varieties for industry.

More information on varieties is available via SRA's online tool, QCANESelect™.



| Variety            | %     |
|--------------------|-------|
| Q208 <sup>®</sup>  | 33.3% |
| Q183 <sup>®</sup>  | 16.9% |
| KQ228 <sup>®</sup> | 13.7% |
| Q200 <sup>®</sup>  | 7.5%  |
| Q232 <sup>®</sup>  | 5.4%  |
| Other varieties    | 23.3% |

## New milling research investment kicks off

*Three new milling-related research projects have begun in 2016, as part of the most recent round of investment announced by Sugar Research Australia earlier this year.*

### Online analysis systems to measure the available nutrients in mill mud

Rapid measurement techniques to quantify the nutrients in mill mud/ash are a key factor in maintaining its availability as a nutrient source and soil ameliorant in an increasingly regulated environment. Legislation and best management practice (BMP) guidelines around agronomic inputs focus on quantifying and recording nutrient inputs, with the aim of optimising productivity and minimising environmental losses.

While these guidelines are effective for synthetic fertilisers, they penalise the use of milling by-products as a nutrient source, as their nutrient loading, chemical composition and biological availability are highly variable and difficult to quantify. This has also contributed to challenges in developing a beneficial use approval (BUA) for the products.

This project seeks to develop online NIR spectroscopic systems to analyse the availability of key nutrients in mill mud and ash mixtures as it leaves the factory. Project lead: Ms Eloise Keeffe, SRA, (07) 3331 3351.

### A boiler simulator for improved operator training

Continuous, efficient and safe operation of a sugar factory depends on having competent and confident operators who can prioritise their requirements and react under pressure. Most operators have another role during the maintenance season and there is anecdotal

evidence from factories that issues arising from operator error are more common early in the crushing season when operators are getting back up to speed.

Recent incidents have cost factories several million dollars in boiler repair costs and lost production, and have been attributed in part to operator error. These incidents have highlighted the importance of having boiler operators that can deal effectively with the many issues that can arise.

In some other industries simulation packages are an integral part of operator training, maintenance of skill levels and assessment of competence. If the sugar industry lags behind in this area it is likely that such incidents will continue to occur. The importance of this issue has been raised by the People and Safety Committee of the ASMC. This project is supported by the committee.

A training simulator consists of a front end, the interface that the user interacts with, and a back end that carries out the calculations. The front end receives input from the user which is sent to the back end. After performing the calculations, results are sent from the back end to the front end which displays the results in a suitable format.

This project involves the development of both back end and front end components of a boiler simulator and the interfacing of the two components into an integrated generic simulator for boiler operators. Project lead: Dr Anthony Mann, QUT, (07) 3138 1333.

### Reducing boiler maintenance costs and deferring capital expenditure through improved technology

Boiler tube wear and corrosion costs the industry an estimated \$5 million a year in repairs, stops and inefficient operation.

Given that most boilers in the industry are more than 30 years old and that the high capital cost of new boilers will result in very few replacements, nearly all existing boilers will operate into the foreseeable future.

As these boilers age, the wear and corrosion costs are likely to increase.

Tube coatings have been successfully applied in other industries and are expected to be equally beneficial to sugar mill boilers.

The application of tube coatings is expected to replace tube shields and significantly reduce wear and corrosion of boiler tubes in convection banks, air heaters and economisers.

The coatings will also be able to be used in currently mostly unprotected areas such as the super-heater loops.

This project aims to reduce boiler maintenance costs and defer capital expenditure through improved technology by identifying better and more practical coatings.

Project lead: Dr Floren Plaza, (07) 3138 1239.

## New research project into sugarcane harvest losses builds momentum



Australian Government  
Department of Agriculture  
and Water Resources

*A holistic research program is looking at the vexed challenge of sugarcane harvest losses right along the value chain.*

A major new research program is tackling the challenge of reducing the loss of sugarcane associated with mechanical harvesting, a problem that has been estimated to cost the Australian sugarcane industry \$150 million per year.

The research is being led by Sugar Research Australia (SRA) and it is aiming to improve harvesting efficiency from multiple research strategies along the value chain, all the way from encouraging the adoption of existing research on-farm, to exciting new on-line tools to help harvester operators maximise the efficiency of removing sugarcane and sugar from a field in real-time.

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme and will run for three years, going through to June 2019.

SRA has appointed consultant Bernard Milford to coordinate the activity within the \$5.5 million program, which involves multiple research and industry collaborators.

“Bernard Milford is well known to many within the industry and has an understanding of the challenges and opportunities facing cane growers, harvester operators and millers,” SRA CEO Neil Fisher said.

A project Research Management Group has also formed to help steer the project and ensure its outputs are relevant to industry needs.

It met in September for the first time and it comprises researchers, mill owners, harvester operators and cane growers.

This group will play a key role in developing strategies to ensure that the benefits of the research flow through to the industry.

“With the harvest well underway, SRA is committed to ensuring that this program maximises the opportunity of creating positive outcomes via research and adoption,” Mr Fisher said.

The research work will kick off with investigations into cane cleaning in conjunction with low-loss harvesting, machinery modifications to reduce stool damage and improve cane

feeding, sensing tools to give feedback on the quality of the harvesting job, and improvement of a software tool to assess the financial benefits of different harvesting strategies (SCHLOT, Sugarcane Harvest Loss Optimisation Tool). Additional work will be commissioned on advice from the Research Management Group, but is likely to include economic analyses across the sugarcane value chain and initiatives to encourage adoption of harvest best practice.

“This work complements existing research and adoption activity that is underway to reduce sugarcane harvest losses,” Mr Fisher said.

“This research program is an amazing opportunity to answer specific research questions, to develop new technology for the industry, to better understand the economics of efficient harvesting, and to ultimately deliver the adoption of improved practices.

“This will lead to a more profitable industry value chain, creating a positive outcome for the industry, regional communities, and the economy.”





|  |
|--|
| <b>Key Focus Area</b>  |
| Multiple   |
| <b>Project name</b>  |
| Enhancing the sugar industry value chain by addressing mechanical harvest losses through research, technology and adoption |
| <b>Project number</b>  |
| 2016/901   |
| <b>Project end date</b>  |
| June 2019  |

- The industry representatives on the committee are:**
- Gary Longden (SRA Research Funding Panel)
  - Hywel Cook (MSF)
  - Ian Davies (Wilmar)
  - Ian McBean (NSW Sugar)
  - Dick Camilleri (Tully Sugar Limited and cane grower)
  - Craig Bentley (Mackay Sugar)
  - Paul Nicol (Isis Central Sugar Mill)
  - Simon Doyle (Bundaberg Sugar)
  - Michael Deguara (grower and contractor)
  - Joe Marano (grower and contractor)
  - Vince Russo (grower and contractor)
  - Mario Raccanello (grower).



# Climate forecasting to improve nitrogen management in the Wet Tropics

*SRA researcher Danielle Skocaj's PhD thesis investigated the impact of climatic conditions on Tully sugarcane yields and nitrogen fertiliser requirements. She found that climate forecasting can be used to predict N fertiliser requirements for ratoon crops.*

*By Gavin Rodman and Danielle Skocaj, SRA Tully*

## Key Focus Area

Capability development, attraction and retention

## Project name

Climate forecasting to improve sugarcane nitrogen management in the Wet Tropics

## Project number

STU073

## Principal provider

SRA

## Project leader

Danielle Skocaj

The Wet Tropics experiences one of the most variable climates in the world. The El Niño Southern Oscillation (ENSO) is one of the largest sources of year-to-year climate variability in this region.

ENSO has two extreme but closely linked phases, El Niño and La Niña. El Niño refers to the unusual warming of normally cool water in the central and eastern equatorial Pacific Ocean resulting in drier conditions than normal along Australia's sugarcane growing regions.

Conversely, La Niña refers to increased warming of water in the Western Pacific Ocean and extensive cooling of water in the central and eastern Pacific Ocean. Rainfall and storm activity increases over Australia and tropical cyclones tend to be frequent.

The influence of ENSO on Australia's rainfall significantly impacts cane yields. The La Niña event of 2010/2011 was one of the strongest on record and resulted in prolonged periods of wet weather, cyclonic activity, extremely low cane yields and widespread standover cane.

The impact of climate variability on cane yields and nitrogen losses makes the task of applying the right amount of nitrogen fertiliser to optimise profitability and minimise environmental losses extremely challenging.

Danielle found total rainfall over the spring-summer period had a strong influence on Tully cane yields. High spring-summer rainfall favours lower cane yields.

To investigate the impact of spring-summer rainfall on nitrogen fertiliser requirements Danielle used data from field experiments and a crop growth model to simulate nitrogen fertiliser requirements for ratoon crops grown on the Bulgun series soil in dry (low spring-summer rainfall) and wet (high spring-summer rainfall) years. The Bulgun soil is often referred to as a poorly-drained alluvium.

As the majority of nitrogen fertiliser is typically applied to ratoon crops during spring, existing seasonal climate forecasting techniques based on sea surface temperature changes in the Pacific Ocean were investigated to see if fertiliser requirements could be predicted with sufficient lead time (at the start of spring).

The simulation study identified nitrogen fertiliser requirements are, on average, 25 percent lower in wet years for ratoon crops grown on the Bulgun soil. The study also showed that sea surface temperatures can be used to predict fertiliser requirements for ratoon crops grown on the Bulgun soil.

The link between nitrogen inputs and sea surface temperatures exists because the chance of experiencing

high spring-summer rainfall and hence lower cane yields increases when sea surface temperatures are in the La Niña phase.

High spring-summer rainfall is associated with lower cane yields at Tully because of increased waterlogging and lower solar radiation. Given high spring-summer rainfall is associated with lower cane yields, reducing nitrogen fertiliser rates in wet years will improve nitrogen use efficiency and grower profitability.

"Based on work to date; Tully growers could consider reducing nitrogen fertiliser application rates to ratoon crops grown on the Bulgun soil when sea surface temperatures are in the La Niña phase," Dr Skocaj said.

"This is because the chance of experiencing high spring-summer rainfall and lower cane yields at Tully increases in La Niña years. Growers could also consider using an enhanced efficiency fertiliser product on the Bulgun soil in wet years."

These results are specific to a single poorly-drained alluvial soil (Bulgun series) at Tully. The Bulgun and other poorly-drained alluvial soils are widespread throughout the Wet Tropics. More research is required to extend these findings to other soil types and districts.

## Milling Research Investment

| Project Title  | Project Number | Principal R&D Provider | Chief Investigator | End Date   |
|--|----------------|------------------------|--------------------|------------|
| <b>Key Focus Area 5 (Milling efficiency and technology)</b>  |                |                        |                    |            |
| Determine the optimum tube dimensions for Robert evaporators through experimental investigations and CFD modelling | 2012/054       | QUT                    | Ross Broadfoot     | 01/09/2016 |
| Improved modelling of wet scrubbers  | 2012/055       | QUT                    | Anthony Mann       | 01/05/2017 |
| A retrofit to a mill to reduce its operational and maintenance costs   | 2013/059       | QUT                    | Geoff Kent         | 02/08/2017 |
| Reducing the maintenance costs of mill rolls   | 2013/060       | QUT                    | Geoff Kent         | 01/08/2019 |
| Real time harvest and transport system (under contract)  | 2014/037       | QUT                    | Geoff Kent         | 01/09/2017 |
| Improving mill efficiency through rapid analysis methodologies   | 2014/051       | SRA                    | Eloise Keeffe      | 01/08/2017 |
| Managing aspects of raw sugar quality in the Australian sugar industry   | 2014/052       | SRA                    | Eloise Keeffe      | 01/08/2017 |
| Investigation into modifying pan boiling techniques to improve sugar quality                                       | 2015/013       | QUT                    | David Moller       | 01/06/2017 |
| Increasing capacity to undertake cane preparation research through modelling and experimentation                   | 2015/018       | QUT                    | Geoff Kent         | 01/05/2017 |
| Develop a blueprint for the introduction of new processing technologies for Australian factories                   | 2015/043       | QUT                    | Ross Broadfoot     | 01/09/2017 |
| Developing online analysis systems to measure the available nutrients in mill mud                                  | 2016/019       | SRA                    | Eloise Keeffe      | 2020       |
| Reducing boiler maintenance costs and deferring capital expenditure through improved technology                    | 2016/020       | QUT                    | Floren Plaza       | 2020       |
| <b>Key Focus Area 6 (Product diversification and value addition)</b>   |                |                        |                    |            |
| Process for making bagasse paper pulp  | 2012/053       | QUT                    | Thomas Rainey      | 01/04/2018 |
| A profitable future for Australian agriculture: biorefineries for higher-value animal feeds, chemicals and fuels   | 2015/902       | QUT                    | Ian O'Hara         | 01/04/2019 |





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