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(Cover page) Ms Zeynab Amini is completing her PhD at the Queensland University of Technology working within Biorefineries for Profit project. Read more on page 6. Picture by Anthony Waite, QUT.

Design: Catherine Jorissen, SRA.
A Capability Investment Scheme jointly invested by Sugar Research Australia (SRA), Sugar Research Institute (SRI) and Queensland University of Technology (QUT) is providing three rising researchers an opportunity to build industry milling research capacity by working within the QUT Bioprocessing Group.

Milling Matters recently met with the first of the participants within a new milling sector capability building initiative by SRA, SRI and QUT. Dr Iman Ashtiani Abdi will work with the Centre for Tropical Crops and Biocommodities as a postdoctoral research fellow in process engineering, investigating a range of projects related to sugar manufacturing.

Dr Abdi obtained his Bachelor’s Degree in Mechanical and Aerospace Engineering in 2006 before completing his Master’s Degree in 2011, obtaining his PhD from the School of Mechanical and Mining Engineering at University of Queensland. His research focused on investigating fluid flow behaviour within porous media, with applications in heat exchangers and filters. Dr Abdi continued onto postdoctoral research at UQ studying cell optimisation of metal foam to increase heat transfer.

In 2017 he transitioned to a role in industry as a mechanical design engineer working on a range of projects focused on energy generation and storage on farms. Dr Abdi said: “This move to industry, working in a small company with lots of projects in the renewables area was a great opportunity for a researcher to learn the language of industry.”

At QUT he is mentored by Dr Ross Broadfoot and is working on a project to optimise pans to work under lower pressure vapour which will therefore increase efficiency, productivity and profitability in mills. He has also been working on a rig at QUT’s site in Banyo investigating mud permeability.

“Ross Broadfoot is an encyclopedia of sugar knowledge and has been a good mentor since joining QUT,” Dr Adbi said.

“The sugar industry is attractive to me because of its strong focus on sustainability and its ability to generate its total steam and electricity requirements and also export power to the grid.”

“The goal is to extend those green credentials while still producing high quality sugar,” Dr Abdi said.

His current objective is to gain knowledge on the entire sugar industry, not a specific part. Then over the next few years he can learn the specifics and work his way to becoming an expert in a specific area.

He looks forward to applying his knowledge to the sugar industry and continuing to learn from the experts at QUT. He already has ideas for industry and looks forward to working on future research activity to further expand on those projects and deliver outcomes for the milling sector.

Dr Harjeet Khanna, General Manager, Research Funding Unit, Sugar Research Australia, said: “The investment from SRA, SRI and QUT will span across five years. It is recognition of the importance of building and maintaining research capability for the milling sector.”

“Having SRA, SRI and QUT collaborate on this project is a strong win for the milling sector and its future research capacity.”

This investment scheme captures mentoring as one of the modes of transfer of discipline knowledge and intellectual capital. It gives new industry entrants the hard skills they need to succeed in their current roles and prepare them to assume more advanced responsibilities over time. It is therefore also a mechanism to ensure good succession planning where senior professionals pass on the experience-based knowledge they have acquired over the course of their careers to the early and mid-career professionals who ultimately will take over from them.

(Above) Dr Iman Ashtiani Abdi outside the QUT Centre for Tropical Crops & Biocommodities.
A new report commissioned by Sugar Research Australia (SRA) has identified opportunities and challenges for diversifying revenue streams for the Australian sugarcane industry.

The report was prepared by Lazuli Consulting, who worked extensively with SRA Members and industry stakeholders to gain a more detailed appreciation around value-adding and diversification within the sugar industry value chain. They also analysed the technological and market landscape in Australia and overseas.

“Sugarcane is an incredible crop,” SRA CEO, Mr Neil Fisher, said. “In Australia it is grown across diverse climatic conditions from subtropical New South Wales (NSW) along the Queensland coast into the Wet Tropics, and it is generally much more resilient to climatic and disease challenges than other crops grown in these regions.

“Sugarcane is the economic scaffold for many regional communities in Queensland and NSW. It also produces a large biomass, yet we are not extracting the full potential from this biomass.

SRA acknowledges the investment contribution from the Queensland Department of Agriculture and Fisheries towards this research activity.
“Diversification already plays an important role in the industry through products such as molasses, rum, ethanol, and electricity cogeneration, but this new report by Lazuli Consulting identifies that there are other opportunities for our industry. However, these opportunities may also face considerable challenges in becoming commercial reality.”

Mr Fisher said the report was an initiative of the SRA Board and had also been identified as an industry need at a Futures Forum convened by SRA and industry in April 2018.

CANEgrowers Chairman Mr Paul Schembri welcomed the report as a platform from which the industry can move forward.

“As farmers, we are proud of the crop that we produce and the significant amount of biomass it offers as feedstock to new ventures,” Mr Schembri said. “This report is a good starting point for industry discussions around a more diversified future for the industry and the mechanisms by which all sectors can benefit from the rewards that new opportunities present.”

Managing Director of Lazuli Consulting, Mr Eris O’Brien, said that the report identified the primary opportunities as electricity cogeneration, ethanol, food products and densified biomass, and a secondary list of opportunities as chemicals from sugar and animal feed.

Mr O’Brien said that the report reinforced the view that Australia was heavily reliant on raw sugar production when compared with major competitors such as Thailand and Brazil.

“Construction costs in Australia are high compared to other sugar-producing countries, and financing projects is difficult without long-term, commercially priced off-take agreements,” he said.

Despite these and other challenges, the report identified the importance of the Australian industry continuing to investigate new technologies and opportunities.

SRA currently invests in this research area through Key Focus Area six of its Strategic Plan: Product Diversification and Value Addition.

This includes a major research project supported by SRA through investment from the Australian Government Department of Agriculture as part of the Rural R&D for Profit program and by the Queensland Government Department of Agriculture and Fisheries.

“Lazuli Consulting’s report is a timely and valuable input to the industry’s thinking,” said David Rynne, Director of Trade, Policy and Economics at the Australian Sugar Milling Council (ASMC).

“With world raw sugar prices returning less than the cost of production, and with margins being eroded, Australia needs to reassess its heavy reliance on raw sugar.

“ASMC is in the early stages of developing a revitalisation strategy for consideration by other industry stakeholders including government, and diversification is one of the key pillars of work.

“This report demonstrates the array of possibilities available - to add value and shore up the viability of the sugar industry while delivering substantial environmental objectives,” said Mr Rynne.

“The report also demonstrates the array of obstacles our members face.”

(Above left) Recommendations for SRA from the report. (Above right) The process for adoption of new technology.
The global demand for probiotics for human consumption is growing rapidly on the back of an increasing understanding of their contribution to health. At the same time, the use of probiotics in livestock production is experiencing growth and has been predicted by some analysts to reach a value of US$7 billion by 2025, up from about US$4.6 billion currently. This growth follows recognition and understanding of the role they can have in improving feed conversion.

Recognising this potential market opportunity, research has been underway for the last three years looking at the creation of feed additives from agricultural by-products, including molasses and bagasse. Readers of Milling Matters may be familiar with this research into identifying probiotics that can be generated from sugarcane by-products. However, the research team at QUT are taking a further step with this research activity in their quest to understand the best possible animal feed that could be created from cane by-products.

QUT PhD student Ms Most Sheauly Khatun is working on research under the supervision of Dr Zhanying Zhang to identify products called prebiotics that could be created by using sugarcane by-products. Prebiotics are compounds that can create an environment to promote the growth of beneficial bacteria including probiotics, thus improving feed digestion and animal health.

The research is another way of further upgrading the feed value of a product such as molasses. Ms Khatun’s work is investigating the use of microbial enzymes for converting molasses to a mixture of compounds called fructo-oligosaccharides (FOS) which are already understood as prebiotic compounds for human consumption.

"Molasses as a feed product is quite low value. But if we can upgrade it to a more functional feed additive, this would increase the value significantly," she said.

The research is also looking at how to produce the enzymes using the molasses based-medium through fermentation as well as how the prebiotics (FOS) promote the growth of potential feed probiotics.

"There is already an understanding of the benefits of prebiotics. We are providing more evidence specific to our industries within the project, and determining an economic process for delivering the product."

Prior to taking on the PhD at QUT, Ms Khatun worked at the Department of Chemical Engineering at Jessore University of Science Technology in Bangladesh.

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When it comes to feeding livestock, bagasse isn’t much better than cardboard. Sure, livestock can eat it, but it contains a very high proportion of fibre and not much else, so it can only make up a small part of a complete feed ration. But what if there were ways to make bagasse more digestible and nutritious for livestock?

For the last three years, researchers at QUT have been working to convert sugarcane bagasse into higher-value products including animal feed, feed supplements, aviation fuel, and chemicals as part of the Biorefineries for Profit project. Ms Zeynab Amini is completing a PhD in the Biorefineries for Profit project on the conversion of bagasse into a more nutritious and digestible animal feed. Pre-treated bagasse has higher digestibility but, even after it’s been pre-treated, it isn’t a complete animal feed and protein is needed to make pre-treated bagasse a complete feed.

“There are two main issues with bagasse,” Ms Amini explained. “The first is low digestibility. And the second is nutrition, especially protein content.” “Pre-treatment improves the digestibility. My work is aimed at understanding how to increase the protein content.” Through her work, she has tested how well micro-organisms use the carbohydrates in the bagasse to grow and what that does to the overall nutritional content. Readers of Milling Matters would appreciate that plenty of micro-organisms are happy to grow on bagasse piles – especially in the wet tropics. Of course, none of these is suitable for animal feed. The micro-organisms that Ms Amini is using were carefully chosen to be completely safe for consumption. Her work began with 16 different filamentous fungi and yeast, all of which can be safely eaten by livestock, and testing their growth in the laboratory in liquid culture.

As the micro-organisms grew, they produced protein. “We tried to add more value by adding low-cost nitrogen sources like ammonium-sulphate or urea. That way, the micro-organisms used both the carbohydrates and the nitrogen, and they grew much better.” Ms Amini and the research team made a careful assessment of how the micro-organisms grew, what they grew on, how they grew over time, and how productive they were. This led to the identification of the two micro-organisms which had the highest capacity to increase the protein content of bagasse-based feed. Following the submerged fermentation tests, the work progressed to solid-state culture, which involved growing the two best micro-organisms directly on pre-treated bagasse and is a step closer towards understanding the adoption of the technology at a broader scale. Dr Mark Harrison at QUT is one of the lead researchers on the Biorefineries for Profit project and is working closely with Ms Amini. He said the research was creating exciting opportunities for the industry. “Zeynab has worked very hard and been very thorough, and we can confidently say that we have identified the best micro-organisms,” Dr Harrison said. “We know that we can’t extrapolate results from a test tube in the lab to a factory, so we are transitioning into solid state fermentation and from there it is a relatively quick transition to pilot-scale experiments.” “This work has the potential to change how we look at bagasse. A lot of Australia is still in drought and farmers are looking for livestock feed wherever they can get it, and that means looking for feed from unconventional sources like bagasse.” “As a feed, untreated bagasse is pretty poor, but with a few tweaks and after fermentation, we can make it into an almost complete feed at a time when it is really needed.”

For more information contact: Zeynab Amini on zeynab.ami@gmail.qut.edu.au

The Biorefineries for Profit project is funding by SRA and the Australian Government Department of Agriculture through the Rural R&D for Profit Program.
During the 2017 and 2018 harvesting seasons, SRA conducted 95 replicated field trials and workshops across 12 sugarcane regions between Harwood and Mossman.

The performance of settings recommended by Harvesting Best Practice (HBP) parameters were compared with each harvesting operation’s standard practice by assessing cane yield, sugar yield, CCS, bin mass, extraneous matter (EM), fibre, sugar loss and revenue.

Findings suggest that harvesters are typically operating at ground and fan speeds of 0.9 km/hr and 95 rpm/hr on average above those recommended for harvesting best practices.

Higher ground speeds increased throat pour rate by about 21 tonne per hour. However, this overloads the cleaning chamber which necessitates an increase in fan speed to eliminate the additional extraneous matter entering the machine. Unfortunately, the increase in fan speed also removes additional cane through the extractor. Cane usually disintegrates in the process, making it invisible to the naked eye. The trial methodology included two methods – mass balance and infield sugar loss measurement system (ISLMS). The ISLMS treatment indicated the average sugar loss out of the extractor increased by 0.15t/ha when compared to HBP settings. Furthermore, HBP settings had no significant impact on extraneous matter levels or bin mass.

Mill analyses across all green cane trials identified cane and sugar yields for the recommended practice were 4.8 t/ha (cane yield) and 0.7 t/ha (sugar yield) higher than standard practice.

Economic analyses completed by the Queensland Department of Agriculture and Fisheries (DAF) indicated the potential for an additional $25M revenue per annum for the Australian milling industry, should the green cane harvesting sector move from current standard practice to HBP. This was based on trial results with an assumed average sugar price of $421/t.

It is important that growers, harvest operators and millers recognise that cane loss through the extractor resulted in less cane per hectare delivered to the mill. Contractors in general endeavour to deliver the best outcomes for their grower but the harvesting industry is currently facing considerable challenges. The objective of the DAF economic analysis is to understand the cost-benefit ratio of operating within HBP parameters for both the grower and contractor in order to produce a positive financial outcome to both parties. Ultimately, each sector of the value chain will need to work together to find the “sweet spot” to maximize the potential economic gains for all members of the value chain.

Over the page is a combined summary of the 2017 and 2018 trials, with focus on the implications of HBP for the Australian milling sector (green cane).
The 2017 and 2018 combined field demonstration trials show a 1.2M tonne or 5 percent increase (per annum) in tonnages moving from average industry contractor harvesting practices (standard) to recommended (HBP) practice. This yield increase requires no increase in cane land. A statistically significant difference was recorded between industry standard practice and recommended harvested yield.

Bin fill rates in the 2017 and 2018 field demonstration trials indicate a 0.6 bin/hr (8.2%) decline between average industry contractor harvesting practices (standard) to recommended harvesting practice. (Statistically different).

A key measure of harvesting best practice is reduced flowrate into the harvester. Currently industry standard is >110 tonnes per hour. Harvesting best practice targets 70 – 90 T/Hr flow rate into the machine.

Bin mass across the 2017 and 2018 trials decreased on average 0.6 % (this represents no statistically significant difference). Collaboration between the SRA Harvesting team and Australian milling sector to understand bin fleet logistics and tipping rate is a vital step towards optimising the potential yield gains of harvesting best practice.
Whilst 2017/2018 trial results showed no significant difference in CCS, sugar yield increased by about 164,000 tonnes or 5.2 percent (statistically significantly different). Assuming a sugar price of $421/t, the increase to industry revenue is estimated at $69.3 million should harvesting contractors change their standard harvesting practice to recommendation. However, the increase to milling revenue does not account for the cost (if any) associated with milling cane at HBP.

In conclusion, the 2017 and 2018 harvesting demonstration trials indicate a $25M increase to industry milling revenue if harvesting contractors were to change their standard harvesting practice to recommendation. However, the increase to milling revenue does not account for the cost (if any) associated with milling cane at HBP.

Each milling region has unique drivers (e.g. payment arrangements between growers and contractors, and between contractors and their operators) and pinch points (operating hours, bin fleets, number of contractors). The SRA harvesting team remain committed to working with the Australian milling sector to address, resolve or reduce these barriers to adoption and maximize the opportunities presented through innovative and efficient harvesting practices.

For more information contact Ms Carol Norris on E cnorris@sugarresearch.com.au T 07 4963 6824.

This project was funded by SRA and the Australian Government Department of Agriculture through the Rural R&D for Profit Program.
SMALL MILLING RESEARCH PROGRAM ENHANCES COLLABORATION BETWEEN MILLERS AND RESEARCHERS

SRA has announced new investment in the Small Milling Research Program (SMRP), which will see a range of milling companies partner with research organisations to undertake projects that benefit the Australian sugarcane industry.

This is the second year of the program and it was developed as a way for SRA to invest in relatively small research projects that develop a product, service, or process that would solve targeted problems in sugar mills and deliver tangible outputs with almost immediate outcomes.

SRA CEO Mr Neil Fisher said that SRA was investing in four new projects in 2019. The project investment is:

- Evaluate the performance of the falling film tube evaporator at Bingera Mill (Bundaberg Sugar / QUT)
- Evaluate the suitability of the fixed element crystalliser for widespread adoption in Australian sugar factories (Sunshine Sugar / QUT)
- Reducing surging in shredders (MSF Sugar / QUT / Wilmar)

Mr Fisher said that the SMRP projects would deliver lower-cost, short-term, industry-identified and industry-led research.

“The SRA Board has undertaken this initiative to allow SRA to work on priority areas of research that align with the needs of our Milling Members. The investment is included in our current total investment in our Key Focus Area (KFA) of Milling Efficiency and Technology,” he said.

“Now in its second year, the scheme continues to improve and is strengthening collaboration between industry and research through the direct involvement of the milling sector in SMRPs. It is also increasing research skills and capability in sugar mills.”

Existing 2018 SMRP projects are currently being concluded and outcomes from these projects will be communicated to the industry from SRA.

(Left) SRA is investing in four new small milling research projects in 2019. Picture of sugar crystals by Dr Stephen Mudge, SRA Research Funding Unit.
Ten new varieties of sugarcane have been approved for sugarcane growers and millers across the industry following Regional Variety Committee (RVC) meetings earlier this year. These varieties have been created as a result of extensive work through the SRA plant breeding program and more than a decade of development. They have been developed to maximise profitability for sugarcane growers and millers by optimising characteristics such as tonnes of cane, sugar content, resistance to diseases, and ability to be processed within the mill.

**NEW SOUTH WALES**

The NSW RVC approved the new variety WSRA18\(^A\) (seedling number: KQB07-34350) and the Southern Region variety SRA11\(^A\) (seedling number: QS05-6092).

SRA11\(^A\) is available as a one-year and two-year variety. In trials, it had fast, reliable germination and good disease resistance. It is resistant to *Pachymetra* root rot, Fiji Leaf Gall, leaf scald, *Mosaic* and intermediate resistant to Red Rot.

WSRA18\(^A\) is a result of joint breeding work between SRA and Wilmar Sugar, via its program based in the Burdekin region. It has been approved for release as a two-year variety. This variety has resistance to Fiji Leaf Gall, Leaf Scald, *Mosaic* and Red Rot, and has an intermediate rating for smut and *Pachymetra*. It has been released specifically for NSW two-year cane production, where it has shown moderate commercial cane sugar (CCS) but excellent tonnes of cane per hectare (TCH), giving competitive productivity across a range of field trials.

Harwood grower Alan Munro is part of the NSW RVC and he said that the region was looking for new varieties that offer good disease resistance and productivity through tonnes and sugar content.

“Frost is also an issue for us. Most of our crops are grown as two-year crops, but...”
if the cane gets frosted at one-year then we want to be able to harvest the crop in that situation and know there will be sugar there,” Mr Munro said.

“We have seen this improve with recent varieties for our region, so we look forward to better understanding how WSRA18 and SRA11 fit into the mix.”

**SOUTHERN**

The Southern RVC approved the varieties SRA19 (seedling number: QN02-1707) and SRA20 (seedling number: Q507-8815). SRA Senior Plant Breeder, Mr Roy Parfitt, said SRA19 was a top-performing variety in SRA trials with moderate to high tonnes and moderate commercial cane sugar.

It is classified as resistant to Pachymetra root rot and leaf scald, as well as intermediate resistant to smut and Fiji leaf gall, all of which are important diseases in the Southern Region.

“SRA20 also performed well in our trials and produced high tonnes and moderate CCS. It had reliable germination and good resistance to diseases including smut and Pachymetra root rot, and intermediate resistance to Fiji leaf gall and leaf scald,” Mr Parfitt said.

The Southern Region encompasses the Wide Bay region including Bundaberg, Childers and Maryborough, and extends to the Sunshine Coast and the Rocky Point areas.

Hervey Bay grower Ashley Petersen has trials with the varieties on his property and said both these varieties, as well as SRA11 that was released last year, looked promising.

“We’re farming on a dual-row controlled-traffic system, so it is essential that our varieties are nice upright cane. These varieties look to be standing up well so we will assess them further as they move through the system,” Mr Petersen said.

“SRA11 is so far looking good in a range of conditions.”

**CENTRAL**

The Central RVC approved the varieties SRA21 (seedling number: QC05-316) and SRA22 (seedling number: QSO4-772).

In trials, SRA21 had equal TCH and CCS compared to the average of the commercial standards, while SRA22 had higher TCH and CCS than the standards.

SRA22 has good resistance to Pachymetra root rot and sugarcane smut, while SRA21 has good resistance to smut and is resistant-intermediate to Pachymetra. Both SRA21 and SRA22 have acceptable milling characteristics.

Frank Perna is Chair of the local RVC and he said that from early data the varieties looked promising, with both SRA21 and SRA22 having good productivity traits.

“In the Central Region, as well as productivity characteristics, we need our varieties to be resistant to Pachymetra, which is the case for these varieties. We look forward to them making their way through to commercial production, where we can assess how they perform,” Mr Perna said.

SRA21 will be distributed to growers in 2019, and SRA22 in 2020. Both varieties are also available for ordering through tissue culture.

**BURDEKIN**

The Burdekin RVC approved the variety SRA23 (seedling number: QA07-2330). In SRA trials, SRA23 had similar performance to the average of the current major commercial varieties, including Q183, Q208, and KQ228, in terms of tonnes and CCS.

It is available as tissue culture, and on a broader scale through Burdekin Productivity Services (BPS) in 2021.

Cane grower Mr Kris Tasselli has a strip trial on his farm in collaboration with BPS where these trials looked at SRA23 and WSRA17 in commercial farming conditions.

“The strip trials with BPS help us have a good look at new varieties, and also compare them closely to established varieties like Q240,” Mr Tasselli said.

“As growers we are obviously looking to maximise tonnes and sugar, so we are looking at how these new varieties perform in our conditions.”

**HERBERT**

The Herbert RVC approved the release of the new variety SRA24 (seedling number: QA05-2486)

SRA24 is resistant to key diseases such as smut, Pachymetra root rot and leaf scald. In trials, it had an average to above average yield when compared to a range of existing commercial varieties. It had an average to below average CCS in comparison to these varieties, and has been noted to be a potential to mid to late CCS variety.

Herbert grower Mr Robert Lyon said that local growers were looking for a good resistance to diseases such as smut and Pachymetra from new varieties, as well as ratoonability.

“SRA14 was approved for release last year and is looking good in its very early stages, and we will see how it goes this year as we plant more of it. We look forward to learning more about SRA24 from next year onwards,” Mr Lyon said.

Growers will be able to access planting material of the new variety in 2020.

**FAR NORTH QUEENSLAND**

The FNQ RVC approved the new varieties SRA25 (seedling number: QN08-1898), SRA26 (seedling number: QN08-2282) and SRA27 (seedling number: QA04-1448).

In SRA trials, SRA25 was competitive with Q200 and Q208 for cane yield but lower in CCS. It has good disease resistance to most major diseases, being classified as resistant to Pachymetra and Leaf Scald, intermediate to smut, and susceptible to red rot.

SRA26 has excellent disease resistance to all the industry’s major diseases, including smut, Pachymetra root rot, leaf scald and red rot. It performed strongly in comparison to the established commercial varieties Q200 and Q208 for yield and CCS across all sites and crop classes.

Chair of the Northern RVC Mr Greg Shannon said that SRA25 and SRA26 should provide value to the Wet Tropics sugar industry due to their Pachymetra resistance.

**REGION** | **VARIETY NAME** | **YEAR OF DISTRIBUTION**
--- | --- | ---
North | SRA27 | 2019
North | SRA26 | 2019
North | SRA25 | 2019
Herbert | SRA24 | 2019
Burdekin | SRA23 | 2021
Central | SRA22 | 2020
Central | SRA21 | 2019
South | SRA20 | 2019
South | SRA19 | 2019
NSW | WSRA18 | 2020
NSW | SRA11 | 2019

More information on these varieties, and other varieties, is available in the SRA 2019/20 Variety Guides, which have been sent in hardcopy to growers and are also available on the SRA website.
Boiler tube wear and corrosion is a major cost for the Australian sugarcane industry due to inefficient operation, stops, repairs and replacement investment.

However, research is underway to understand if there are options available to help protect critical components associated within boilers, extend their lifespan and thus help milling companies defer capital expenditure, potentially saving costs and time.

This research is funded by SRA and is being delivered by the CSIRO in Melbourne and Queensland University of Technology (QUT) and is investigating the potential for applying protective ‘hard facing’ coatings on boiler convection tubes and air heater tubes.

Dr Floren Plaza (QUT) is leading the project with Dr Nazmul Alam (CSIRO), who is an expert in hard facing processes using a range of materials and processes. Dr Anthony Mann (QUT), an expert in boiler measurements and modelling to reduce erosion and corrosion, is also involved.

Dr Plaza said that in the initial years of the project, which started in 2016, they have looked at commercially-available coating options, including materials that could be sprayed or painted on to the surface of the boiler tubes, as well as existing tube materials and protection options from around the world which have shown promise in boiler applications.

He said they had experimented with a range of coatings and materials that looked promising in a laboratory environment and referenced the results to the performance of bare tubes and existing protection options.

“Experience over the last 40 years has shown that the lab is a good indicator of what erosion happens in the boiler tubes, however corrosion is more difficult to predict in the lab. So we now need to put the materials to the test in the real world,” he said.

Therefore, the next step is that these prospects for protecting boiler tubes will be tested starting this season at two mills, namely Isis and Mulgrave.

Dr Plaza said there were several options under consideration, and they were also carefully considering the practical adoption of this technology, including factors such as cost and ability to apply the material. Comparison to existing technologies, such as tube shields for erosion, was an important consideration.

PROJECT NAME: Reducing boiler maintenance costs and deferring capital expenditure through improved technology
PROJECT NUMBER: 2016/020
END DATE: June 2021
CHIEF INVESTIGATORS: Floren Plaza and Nazmul Alam

(Above) Convection bank tube sections ready for shipping to Mulgrave Mill pre-season, some with a coating, some without for performance reference.
**TOTAL RESEARCH AND DEVELOPMENT INVESTMENT**

### Key Focus Area 5 (Milling efficiency and technology)

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Year</th>
<th>Organisation</th>
<th>Responsible Party</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation into modifying pan boiling techniques to improve sugar quality</td>
<td>2015/013</td>
<td>QUT</td>
<td>David Moller</td>
<td>1/06/2020</td>
</tr>
<tr>
<td>Online analysis systems to measure the available nutrients in mill mud</td>
<td>2016/019</td>
<td>SRA</td>
<td>Steve Staunton</td>
<td>01/06/2020</td>
</tr>
<tr>
<td>Reducing boiler maintenance costs and deferring capital expenditure through improved technology</td>
<td>2016/020</td>
<td>QUT</td>
<td>Floren Plaza</td>
<td>01/06/2021</td>
</tr>
<tr>
<td>Evaporator Liquor Brix Sensor</td>
<td>2017/003</td>
<td>Wilmar</td>
<td>Robert Stobie</td>
<td>01/01/2019</td>
</tr>
<tr>
<td>Managing aspects of raw sugar quality in the Australian sugar industry Part II</td>
<td>2017/006</td>
<td>Griffith University</td>
<td>Chris Davis</td>
<td>01/11/2019</td>
</tr>
<tr>
<td>Investigations to mitigate the effects of juice degradation in factory evaporators on sugar recovery and quality, corrosion and effluent organic loading</td>
<td>2017/007</td>
<td>QUT</td>
<td>Darryn Rackemann</td>
<td>01/03/2022</td>
</tr>
<tr>
<td>Pan design and operational changes to suit Australian pan stages operating on low pressure vapour</td>
<td>2018/012</td>
<td>QUT</td>
<td>Ross Broadfoot</td>
<td>01/11/2021</td>
</tr>
<tr>
<td>Evaluate the performance of the falling film tube evaporator at Bingera Mill</td>
<td>2019/201</td>
<td>Bundaberg Sugar</td>
<td>Neil Sichter</td>
<td>22/05/2020</td>
</tr>
<tr>
<td>Evaluate the suitability of the fixed element crystalliser for widespread adoption in Australian sugar factories</td>
<td>2019/202</td>
<td>Sunshine Sugar</td>
<td>Daniel Rojo</td>
<td>22/05/2020</td>
</tr>
<tr>
<td>Reducing surging in shredders</td>
<td>2019/204</td>
<td>MSF Sugar</td>
<td>Peter Chohan</td>
<td>22/05/2020</td>
</tr>
</tbody>
</table>

### Key Focus Area 6 (Product diversification and value addition)

<table>
<thead>
<tr>
<th>Project</th>
<th>Year</th>
<th>Organisation</th>
<th>Responsible Party</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A profitable future for Australian agriculture: Bio-refineries for higher-value animal feeds, chemicals and fuels</td>
<td>2015/902</td>
<td>QUT</td>
<td>Ian O’Hara</td>
<td>01/04/2019</td>
</tr>
<tr>
<td>Manipulation of carbon partitioning to enhance the value of sugarcane (ARC LINKAGE UQ collaboration with SRA contribution)</td>
<td>2016/801</td>
<td>UQ (SRA contribution)</td>
<td>Frikkie Botha</td>
<td>08/12/2018</td>
</tr>
<tr>
<td>Establishing a strategic roadmap for product diversification and value addition</td>
<td>2018/014</td>
<td>Lazuli</td>
<td>Eris O’Brien</td>
<td>Completed</td>
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</tbody>
</table>

#### THE FOLLOWING PROJECTS HAVE SUBMITTED MILESTONE REPORTS TO SRA SINCE THE LAST EDITION OF MILLING MATTERS:

- Reducing boiler maintenance costs and deferring capital expenditure through improved technology
- Investigations to mitigate the effects of juice degradation in factory evaporators on sugar recovery and quality, corrosion and effluent organic loading
- Integrated standardised training for Sugar Milling Operations
- Evaluate the performance of the falling film tube evaporator at Bingera Mill
- Online analysis systems to measure the available nutrients in mill mud
- Managing aspects of raw sugar quality in the Australian industry.

#### THE FOLLOWING PROJECTS HAVE SUBMITTED FINAL REPORTS SINCE THE LAST EDITION OF MILLING MATTERS:

- Establishing a strategic roadmap for product diversification and value addition
- Bio-refineries for higher-value animal feeds, chemicals and fuels (phase 1)
- A boiler simulator for improved operator training
- Evaluation of the Netlec Colour Q for measuring the purity of magma from C centrifugals (Small Milling Research Project (SMRP))
- Improving the impact of evaporator calandria noxious gas bleeding arrangements on evaporator rate and condensate quality at Racecourse Mill (SMRP)
- Evaporator liquid brix sensor (SMRP)
- Understanding the cause of high colour sugar - intrinsic cane colour, extraneous matter or factory practices? (SMRP)
- Activated sludge plants – optimising operations and technology (SMRP)
- Real-time harvest and transport system
- Increasing capacity to undertake cane preparation research through modelling and experimentation.