



Sugar Research
Australia™

Our quarterly magazine
bringing research to
the field



CaneConnection

Spring 2016

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fly control

Welcome to the Spring 2016 edition of *CaneConnection*

At the time of writing, it has been a very frustrating stop-start to the harvest in many districts with the wet weather, so I hope that by the time this magazine reaches you that the situation has improved.

Meanwhile, if you have a spare moment and are looking for something to read over a cup of coffee, then there is plenty of interesting information inside this edition of SRA's magazine. The purpose of this magazine is to provide sugarcane growers and millers with the latest information about your levy investment through SRA. As well as the latest research information, it also includes practical information about the application of research and on-farm perspectives from several growers.

In this edition, one of our highlight stories is showcasing SRA's work on finding the organism responsible for causing Chlorotic Streak. It has been almost 90 years since this disease was first identified, which has been followed by a world-wide research effort, so this achievement is a significant breakthrough for the Australian industry. It is hoped to lead to better management techniques and strategies.

In this edition, we also provide you with an update on current research at the CSIRO looking at the roots of sugarcane, and another CSIRO project that is putting controlled release fertilisers under the microscope to understand their potential benefits in the sugar industry. We also look at other research funded through a program called NANORP, looking at these fertilisers.

We also give a short snapshot of some of the final statistics from the 2015 season, and also look at a small early-career research project by SRA researcher Dr Anthony O'Connell looking at post-harvest deterioration of sugarcane.

In addition to that, we also have a number of grower case studies in this edition as well. As always, if you have any feedback on this magazine, please contact us on (07) 3331 3340.

Brad Pfeffer

Executive Manager, Communications

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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[®], Q183[®], KQ228[®], and Q200[®].

Q208[®] has maintained the number one position as the most dominant variety with just over 11Mt harvested in the 2015 season.

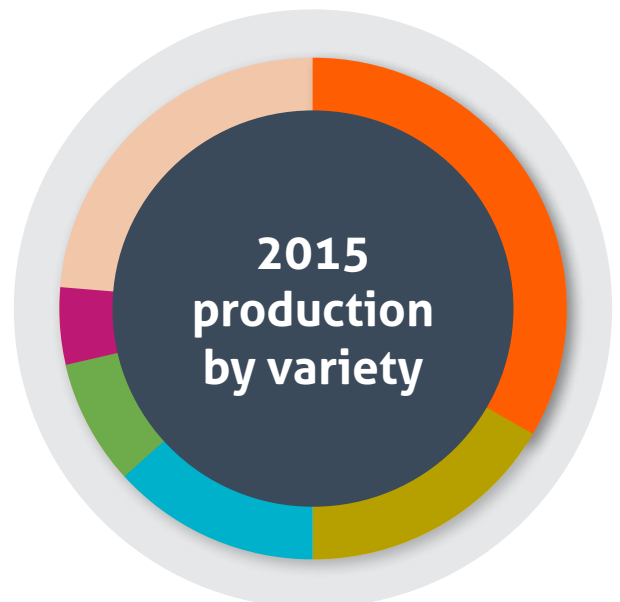
In 2015, 56 varieties with plant breeders rights (PBR) were delivered to Queensland mills, accounting for 31.8 Mt or 98 percent of production.

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 [®]	33.3%
Q183 [®]	16.9%
KQ228 [®]	13.7%
Q200 [®]	7.5%
Q232 [®]	5.4%
Other varieties	23.3%



SRA Researcher Dr Chuong Ngo at SRA's Indooroopilly laboratory.



SRA is working on a trial at SRA Woodford that is hoped to lead to better variety resistance ratings for Chlorotic Streak.

Chlorotic Streak search finds the needle in the haystack

A team effort at Sugar Research Australia has led to the discovery of the organism that causes Chlorotic Streak, which has potential for industry benefits in relation to the disease.

Researchers at SRA have made a major breakthrough in determining the cause of a sugarcane disease that has remained a mystery for almost 90 years.

Chlorotic Streak Disease (CSD) was first recognised in 1929, and since that time there has been considerable research effort from around the world to determine the cause of the disease, how it is spread, and how to manage it.

CSD is a serious and widespread disease of sugarcane. In the worst cases, yield losses can be as much as 40 percent, and it has been estimated to cause an annual loss to the sugarcane industry of \$8 to \$10 million.

In a major recent breakthrough, SRA Researchers Kathy Braithwaite, Chuong Ngo and Barry Croft have used modern DNA technology and traditional pathology to identify the organism that causes CSD.

By combining DNA sequencing, microscopy and microbiological isolations with their previous success in developing a diagnostic test for CSD, the researchers identified a microscopic organism that is a type of protozoa.

The discovery has been a collaborative effort between multiple SRA staff at Indooroopilly, Woodford and Tully. TCPSL and Sunshine Sugar also contributed to the work by providing samples.

The recent research began with SRA researchers Kathy Braithwaite and Barry Croft reviving CSD research in 2010. It took almost three years, but their work eventually led to Dr Braithwaite developing a successful diagnostic test for CSD.

That work then opened the door to using new DNA sequencing technologies. Dr Chuong Ngo led this part of the research that eventually resulted in the discovery of the organism.

"Because we had the diagnostic test, we were able to be completely sure which plants were healthy and which were diseased," Dr Ngo said. "We then used Next Generation Sequencing technologies to compare the DNA between a healthy sample and an infected sample."

They subsequently had information on all the DNA that was within the two samples. With a vast multitude of DNA within a sugarcane plant – more than just the DNA of cane – the challenge was determining which piece of DNA belonged to the organism that they were searching for.

With hundreds of millions of fragments of DNA to sift through, Dr Ngo said they used high powered computing to help find the needle in the haystack.

Their investigations eventually led them to a group of organisms called protozoans.

"Initially we only had short fragments of DNA, but as the project progressed we identified several full length sequences and were able to get a really good idea of where the organism belongs evolutionarily."

The organism is about one hundredth of one millimetre in size and is distinguished by two flagella (whip-like structures).

SRA researchers are currently working with a protozoan expert, Dr David Bass, from the Natural History Museum in London to help formally name the new organism. They also understand that there is more work to be done.

Because the organism has only just been discovered, there are many questions still to be answered. What is its life-cycle like? Can it lay dormant? Does it have an alternative host? What possible control methods are there? "It is so novel, and nobody has worked on anything like this before. There is so much we have yet to understand about its basic biology," Dr Ngo said.

It is already well understood that CSD transmits via water, and its impact is worst in wet growing regions, while also increasing in severity in wet years. The wet La Nina years around 2010-2012 saw an explosion of the disease in some districts.

But the researchers believe there is much further potential in translating the discovery into further benefits for the Australian sugarcane industry.

Diagnostic test

There has already been interest from some productivity service organisations in the diagnostic test.

Further work is planned to improve the efficiency of the diagnostic test, such as potentially allowing for sampling from leaves.

"The current test works really well on stalks and sap, but our challenge is to turn that test into something that the industry needs and wants and is useful to them," Dr Braithwaite said.

"We hope the test will be useful for productivity services to ensure their seed cane truly is clean."

What it means for industry

To date, the industry has not had reliable disease resistance ratings for CSD. The only way to screen varieties was in field trials, which were reliant on rain and floodwater to spread the disease.

Dry years meant that there were poor trial results, and even in wet years researchers found it difficult to control the trials.

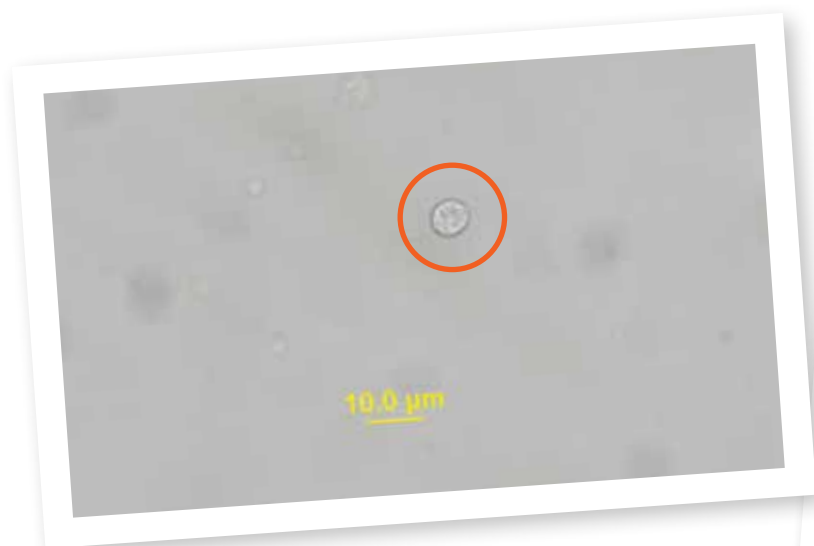
The research team at SRA Tully, led by Dr Rob Magarey, have done much work on variety screening and developed a method of infecting plants via a hydroponic system.

That work is now being taken a step further, as the research team have also been able to successfully grow the organism in culture, which had never before been achieved.

Now that they can produce the organism in the laboratory, they want to develop a rapid reliable infection method to screen sugarcane varieties under controlled conditions. It is hoped that this will lead to reliable disease resistance ratings for our varieties.

"For the industry, there are three big outcomes from our research that we want to deliver: the diagnostic test, which would be useful for productivity services, reliable resistance ratings, which will help growers select the right variety for wet situations, and now that we know what type of pathogen it is, we might be able to develop more targeted control methods," Dr Braithwaite said.

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



Above left: The Chlorotic Streak organism under the microscope (circled).

Above right: Chlorotic Streak symptoms.





Joe Muscat pictured during a Nuffield scholarship tour in Brazil.

Assessing nitrogen inside a plastic coat

The science of fertiliser use is at the frontline of an on-farm revolution that is improving productivity and stopping nutrients such as nitrogen from harming the environment.

Two years ago, central region farmer Joe Muscat, his wife Christine and son Stephen, yielded their biggest sugarcane harvest, with one of their north Queensland properties producing 126 tonnes of sugarcane (19.38 tonnes of sugar) per hectare. They averaged 105t/ha of cane across the total enterprise.

Mr Muscat, who farms 265ha of sugarcane at Oakenden, south-west of Mackay, says the record crop was due to a good growing season, which included the right amount of rain, sunshine and irrigation water, and changes to the way they manage soil nutrition.

Mr Muscat says the improved yield is the pay-off from changes they have made to the way they manage soil nutrition. "Soil health is the baseline for any farming system," he says.

These changes include the introduction of a legume crop during the fallow period between sugarcane crops, and testing new fertiliser regimes that improve the crop's use of nitrogen inputs so there is little of the nutrient left behind to run-off into waterways or escape into the atmosphere as nitrous oxide (N₂O).

Mr Muscat works with researchers to run on-farm experiments, one of which tested the effectiveness of a polymer-coated urea product called Agrocote® against sulfur-coated urea.

The objective was to find which fertiliser product achieved the highest nitrogen use efficiency (NUE) – the efficiency of the crop's use of nitrogen as an essential nutrient needed for crop growth.

With agronomy research company Farmacist, Mr Muscat found no significant difference in sugarcane or sugar yields between plots receiving the urea/sulfur blend at 184 kilograms of nitrogen (N)/ha and those receiving a urea/Agrocote® blend at 135kg N/ha in 2014 and 2015 – so there was no production penalty for using the polymer-coated product that delivered less nitrogen.

Although Mr Muscat found the cost of Agrocote® prohibitive, it did work, which is consistent with other research findings that show polymer-coated urea can increase NUE and sugar yield.

The objective, shared by all farmers, is to try and eliminate nitrogen fertiliser wastage. In these trials, the new polymer-coated urea achieved this, but more work will need to be done to make it more cost-effective.

Ingham experiments

Through the National Agricultural Nitrous Oxide Research Program (NANORP), principal scientist Dr Weijin Wang from the Queensland Department of Science, Information Technology and Innovation (DSITI) and colleagues from Sugar Research Australia and Herbert Cane Productivity Services undertook two experiments at Ingham from October 2012 to October 2014.

The work aimed to assess the effects of improved management practices on productivity, profitability, NUE and N₂O emissions using polymer-coated urea and urea coated with the nitrification inhibitor 3,4-dimethylpyrazole phosphate (DMPP), called ENTEC®.

Emissions from soil receiving different fertiliser formulations – conventional urea, polymer-coated urea and DMPP-coated urea applied to sugarcane at recommended and sub-optimal rates – were measured. Plant and soil samples were also taken to determine sugarcane productivity, sugar yield, plant nitrogen uptake and the soil's mineral nitrogen content.

Dr Wang says the research suggests use of both polymer and DMPP-coated fertiliser products could potentially reduce application rates, increase NUE and reduce greenhouse gas emissions.

For example, in the 2013-14 experiment at Ingham he found that using ENTEC® increased sugar yield by about 30 percent (2.8t/ha) and gross margins by about 23 percent compared with conventional urea applied at the recommended rate of 150kg N/ha. It also decreased annual N₂O emissions by about 50 percent.

Dr Wang says that using ENTEC® increases the cost of fertiliser by about \$60/ha compared with conventional urea at an application rate of 150kg N/ha. "However, reducing the nitrogen application rate by 25 percent did not negatively affect the sugar yield, which can largely offset this higher fertiliser cost," he says.

Although the polymer-coated urea increased N₂O emissions compared with conventional urea, decreasing the fertiliser application rate from 150kg N/ha to 110kg N/ha reduced the total N₂O emissions by about 50 percent with no sugar yield loss.

The experiments also highlighted the affect that different soil and weather conditions, in particular wet weather, can have on nitrogen fertiliser loss due to denitrification. This is the process in which soil microbes convert nitrate to nitrogen gases including N₂O.

Waterlogged soils are particularly prone to N₂O emissions as a consequence of denitrification. N₂O is also an indicator of much larger emissions of dinitrogen (N₂), which can exceed N₂O emissions by as much as 50:1 – a significant economic loss.

NANORP research has found that denitrification is the principal source of N₂O emissions from most agricultural soils in Australia. It is widespread in wetter areas – such as some tropical and subtropical sugarcane-growing areas.

In the first experiment at Ingham, very high N₂O emissions (11.3 to 18.1kg N/ha/year) were recorded.

"These emissions were driven predominantly by rainfall rather than nitrogen fertiliser application," Dr Wang says. "There were no significant differences between different urea formulations and application rates."

For Mr Muscat, whose family has been farming at Oakenden for 50 years, an incentive for using polymer-coated urea is to reduce nitrogen leaching on paddocks prone to waterlogging. "It makes no sense to be putting nitrogen down and then losing it," he says.

Although his on-farm trials with Agrocote® showed it worked, and reduced their nitrogen fertiliser use by about a quarter without any yield decline, they also found it was too expensive. "It is about \$800 to \$1000/t more expensive than urea." In 2016, he is continuing to try more nitrogen-efficient fertilisers including ENTEC®.

Mr Muscat also uses legumes to improve NUE and soil health, and has recently started planting the Brazilian fibre crop sunn hemp.

He says sunn hemp has the ability to add 300kg N/ha to their sugarcane yield and produce 22t/ha of dry matter. "The downside is propagating planting seed and it is an intensive seed crop to produce, requiring a heavy spray program – issues we are working to address so we can plant more in coming years."

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** Dr Weijin Wang's work was completed as part of NANORP, which is funded by the Australian Government through the Department of Agriculture and Water Resources.*





Science brings nitrogen back to earth

A national research program has been scrutinising applied nitrogen use, to significantly lower fertiliser costs for sugarcane farmers, and to reduce wastage that ends up as an environmental hazard.

Improved nitrogen use efficiency (NUE) in sugarcane with the aim of increasing returns from investment in nitrogen fertiliser is the clear objective of advice provided by Queensland-based Paul Keevers from Tableland Fertilizers in Atherton.

A Fertcare® Accredited Adviser, Mr Keevers provides fertiliser advice and recommendations for sugarcane growers on the Atherton Tablelands.

He draws on the SIX EASY STEPS™ program to determine nitrogen rates based on realistic yield expectations and nitrogen fixed in the soil where soybeans are grown in rotation with sugarcane.

Where soybeans are used in rotation with sugarcane, applied nitrogen rates are further reduced by up to 30 percent or 30 to 40kg/ha, meaning an extra cost-saving of \$30 to \$40/ha, he says.

In situations where soybeans are incorporated into the soil as a green crop instead of harvested, nitrogen rates can be reduced by as much as 45 percent or 44kg to 55kg/ha.

However, Mr Keevers says that in addition to this cost-saving, incorporating a green soybean crop also lifts overall soil health because it allows for better microbial diversity and moisture-holding capacity.

Although there is still some uncertainty surrounding how much fixed nitrogen will become available to the following sugarcane crop and when, Mr Keevers is confident that growing soybeans in rotation and more realistic, farm-based assessments of yield potential can significantly boost NUE in sugarcane farming systems.

Better NUE means more profit for clients and less adverse environmental impacts when nitrogen inputs are lost through nitrate leaching in the soil and into the atmosphere as emissions of nitrous oxide (N₂O) gas.

N₂O is a greenhouse gas about 300 times more potent than carbon dioxide that remains in the atmosphere for 114 years.

The National Agricultural Nitrous Oxide Research Program (NANORP) is looking at ways to increase NUE on farms to improve the agricultural economy and reduce N₂O emissions.

The findings of a NANORP research project led by Dr Weijin Wang from the Queensland Department of Science, Information Technology and Innovation (DSITI) are consistent with the advice that Mr Keevers provides for his farmer clients.

In trials at Bundaberg, Queensland, growing soybeans in the fallow period between sugarcane crops reduced N_2O emissions by 55 percent compared with bare fallow followed by conventional fertilisation.

The research showed these greenhouse gas emissions were further reduced in situations where no-till was used, or where a nitrogen catch-crop, such as triticale, was grown in the phase between the soybeans and sugarcane.

These measures were not found to increase sugarcane yields, but the damaging effects of applied nitrogen losses as N_2O were substantially lower, and using soybean in rotation returned about \$400 to \$590/ha more income than bare fallow.

Mr Keevers is also experimenting with coated urea products to help boost NUE in sugarcane farming systems.

At this stage, he says the higher price of coated products are not cost-effective options, but he is “watching this space” with a focus on how they can best be used to increase profitability in the event of a price drop or legislative changes in Australia (already implemented in other countries) that require their use.

Mr Keevers’s outlook is echoed by the findings of Dr Wang’s NANORP research exploring use of polymer-coated urea and urea coated with the nitrification inhibitor 3,4-dimethylpyrazole phosphate (DMPP).

Polymer-coated urea creates a physical barrier around fertiliser prills that slows the release of nitrogen to plants, whereas the nitrification inhibitor-coated urea slows the biological oxidation of ammonium or ammonia to nitrate.

Both coated urea products aim to better match the release of nitrogen from prills to the crop’s demand for this nutrient essential to growth.

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Growers are increasingly looking at the role of legume crops and their role in relation to the crop-cycle and improving nitrogen use efficiency. Pictured is Burdekin grower Tristan Cox and daughter Liana earlier this year in a crop of mung beans, which have improved subsequent cane yields.



Science in the field – anatomy of a trial

*Over the past four years participants of the Burdekin Nitrogen Trials (RP20) have gone from sceptics to passionate supporters of the SIX EASY STEPS™ guidelines for nitrogen application. This can be partly explained by the way in which the trials on their farms have been carried out. **By Andrea Evers***

RP20 began in 2011 to test the SIX EASY STEPS™ guidelines on all major soil types in the Burdekin. Many of the participating growers were convinced these trials would prove they needed to apply the same levels of nitrogen that they had been applying before joining the project. These same growers are now supporters of the SIX EASY STEPS™ method and are confident to use it to calculate their fertiliser requirements. This is because the trials have proven that the growers can maintain a profitable and sustainable farming business.

RP20 is now in its final year and harvesting is underway. The first of these harvests took place in the Clare district. Ryan Matthews, farm manager at the SISL farm, invited growers to watch his trial being harvested at a 'seeing is believing' harvest walk.

The challenge was put to growers to see if they could tell the difference between the different strip trials before they were harvested.

At the SISL farm, one strip within the trial had the SIX EASY STEPS™ rate of 160 kg N/ha applied, a second strip had the farmer's rate of 200 kg N/ha applied, and a third strip had a high rate of 240 kg N/ha applied.

Nobody could tell which strip had the different rates of nitrogen applied, which further confirms the project outcomes.

This also matches with the yield data collected in previous years of the project, showing the project team and collaborating growers that tonnes are maintained across the nitrogen rates being trialled.

While the trials were being harvested, Johan Deutschenbaur, SRA technician, and Andres Jaramillo, SRA Adoption Officer, were on hand to explain the process of how data was collected for these trials.

Observing and understanding the data collection process has given the growers who have participated in RP20 confidence in the results.

This has led to participating growers using the SIX EASY STEPS™ method for calculating their fertiliser requirements across their entire farm and seeing the benefits – savings in fertiliser costs, maintaining tonnes and, in most cases, increasing tonnes of sugar per hectare.



Left: Before the harvest, Johan marks out each replicate and treatment to ensure that cane is consigned correctly.

The trial farm will have either 4 replicates with 3 treatments or 3 replicates with 4 treatments.

Each trial site has a map that shows exactly where the various treatments and replicates are, and markers are used to mark these in the field.

The same six rows are used with the same treatments during the entire crop cycle – plant, 1st ratoon, 2nd ratoon and 3rd ratoon.



Above: Johan is on hand during the harvest and goes to the end of each plot to ensure that the harvester stops and the haulout is changed. He follows the haulout to the siding and makes certain that a separate consignment ticket is filled out for each plot. Wilmar generates a separate report for each replicate and treatment, including tonnes of cane and CCS.

Another group of Burdekin growers have begun working with Farmacist on a new project – Complete Nutrient Management Planning for Cane Farming (RP161).

The project provides \$5,000 worth of agronomic services to participating farmers with personalised one-on-one extension and farm visits from Farmacist.

It includes whole-of-farm and tailored nutrient management planning, fertiliser box calibrations and farm decision support. In addition, the team will also address irrigation and weed management, if these are an issue on particular farms.

SRA will again be providing support with the collection and analysis of data and assisting with irrigation management. If you are a Burdekin grower and would like more information, you can contact Jayson Dowie on 0408 009 348 or at jdowie@farmacist.com.au.

The final results of RP20 will be presented at the beginning of next year and will include a complete economic analysis, trial results and case studies over a full crop cycle.

You can see the results so far by visiting www.sugarresearch.com.au or request a copy by contacting Andrea Evers on 3331 3308 or at aegers@sugarresearch.com.au.



Doug and Rodney Rasmussen see that soil health and growing a good crop is about more than just N, P, K, and S.

Soil health a core focus for Rasmussen family

The Rasmussen family at Mossman take a broad-reaching approach to nutrient management and soil health at their properties, and are seeing good results. By Brad Pfeffer

Brothers Rodney and Justin Rasmussen and father Doug hope that they are in the midst of a rare season when good prices align with one of their best crops in several years.

When *CaneConnection* visited the Rasmussens in June, it was the first day of the harvest with a long way to go, but Rodney Rasmussen was feeling cautiously optimistic.

"It looks like the biggest crop I have grown, and according to dad it is one of his biggest too," Rodney said. "I know that for some growers an El Nino is bad, but for us at the Northern end of the industry it meant that we received rain about once each week and a lot of sunny days, so things were perfect in Mossman."

But Rodney is the first to say that it is not just perfect weather that produces a solid crop. That is why the family have a strong focus on applying research, and in particular looking at new and more efficient ways of managing their soil health.

Their farms includes a mix of heavy clay soils, as well as hillsides with loose red soil, and river sand country that is free-draining.

Using the SIX EASY STEPS™ nutrient management guidelines, soil sampling on fallow blocks sets a foundation for their nutrient management plan.

"That soil sampling lets us know the conditions of blocks going into the crop cycle," he said.

With some acidic soils due to the volumes of rain, they apply lime accordingly, and assess whether they will reapply at the first or second ratoon.

"We also need to assess what is affordable. So if a soil test says that we need 4t/ha of lime then it becomes expensive and prohibitive, so we see that we are better off applying 1t/ha each year rather than the 4t/ha in year one."

"Profitability is the main driver of our approach. If we're not profitable, then we won't be here in four years' time. If we can keep the crop healthy across four years, then we are better off."

He said their approach was also shifting beyond simply nitrogen, phosphorous, potassium and sulphur.

With that in mind, they also use mill mud when it is available, they focus on increasing organic soil carbon, and three years ago changed to using liquid fertiliser sourced from Ingham.

"The liquid fertiliser has molasses in it, which we believe is helping with the microbiology in the soil. Driving along the headland you won't see a vast difference, but we are seeing the results in our figures at the end of the year," Rodney said.

"I think we as an industry need to keep thinking beyond N, P, K, and S."

Rodney said the cost difference of the liquid fertiliser was only a few dollars per hectare more than from the bag, but it was also much safer, easier, and more accurate to use.

A flow rate controller in the tractor allows him to adjust anywhere from 800 litres to 1200 litres per hectare.

"When planting with the liquid everything is in synch, so the powerhaul does 1ha and the liquids do 1ha, and I can get more planted in one day with the liquid."

The Rasmussens are also highly aware of their proximity to the Great Barrier Reef when it comes to farm management. "Our farm that is closest to Reef is particularly important, and even though it is already quite level and there is minimal run-off, we have installed sediment traps. We also know that with the variable application of the liquid fertiliser that we can cut it back at the touch of a button.

"It is an easier process doing it from within the cab than having to get out and change a sprocket."

Below left

Day one of the harvest at the Rasmussen's property at Mossman.

Below right

"On our harvester we have turned the billet length to the longest chop and that is where it will stay all year," Rodney Rasmussen says.

More information

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Putting research into practice to improve harvest efficiency

The Rasmussen family are keen followers of the latest research and information when it comes to harvesting efficiency and are always on the lookout for ways of putting research into practice.

"In high school I did work experience with BSES (now SRA) with harvest losses, and I saw more than 15 years ago that cutting a longer billet and improving harvesting best practice was going to be the best way to improve profitability," Rodney said. "But it has taken me a long time to convince the guy in the harvester seat that we can do things better.

"With the figures that are being currently being produced by the likes of Adoption Officer Phil Patane (SRA), we are seeing that if we cut cane better we are going to make more money. But we also know that it doesn't always work out that simply for the harvester operator," he said.

"That is something that needs to be worked on and I hope that SRA research can drive that further for the whole industry."

He said he agreed with the approach of a major new SRA project on harvest losses, which would bring together growers, millers, and harvester operators, as all three parties needed to discuss and agree upon the opportunities.

He said this could allow for a better payment system for harvesting, which would be a potential driver for improvement.

Mr Rasmussen also is a stronger follower of research into issues such as billet length. "On our harvester we have turned the billet length to the longest chop and that is where it will stay all year. I am hoping to see an improvement in tonnes of sugar per hectare, which is money in the bank at the turn of a dial," he said.

"The harvester might have to drive a bit slower, but I would rather an extra unit of sugar than knocking off 20 minutes earlier at the end of the day. Wages are cheap compared to sugar lost from out the extractor fan."

Grower survey identifies opportunities for RD&E

SRA undertook its second survey of growers in May 2016, surveying a random sample of 400 members weighted proportionately across the sugarcane growing regions of Queensland and New South Wales.

The SRA grower survey has been used to track trends that we received last year, both in relation to the rate of practice change in the industry, and SRA's performance. By identifying these measures, and any changes that have occurred over the last year, SRA is able to assist in targeting research, development and adoption activities. The performance measures are also a valuable way of assisting us to ensure we continue to improve the value of the services we offer to you as our members. Thank you to all the SRA members who took the time to take part in the phone survey. We appreciate your involvement.

1

Many of the practice change measures that were tracked in last year's survey revealed similar results compared to 2015. The industry continues to demonstrate a strong rate of practice change, with 62 percent of respondents changing farm practices over the last two years (58 percent last year).

Large shifts in the rate of practice change are not expected from one year to the next, but over time it is hoped that these rates of positive practice change continue to grow. The survey revealed opportunities to drive positive practice change.

23%

changed
fertiliser application
or management

16%

used chemicals, sprays, herbicides
or pesticides more efficiently

18%

changed to or increased
reduced tillage or
no tillage

6%

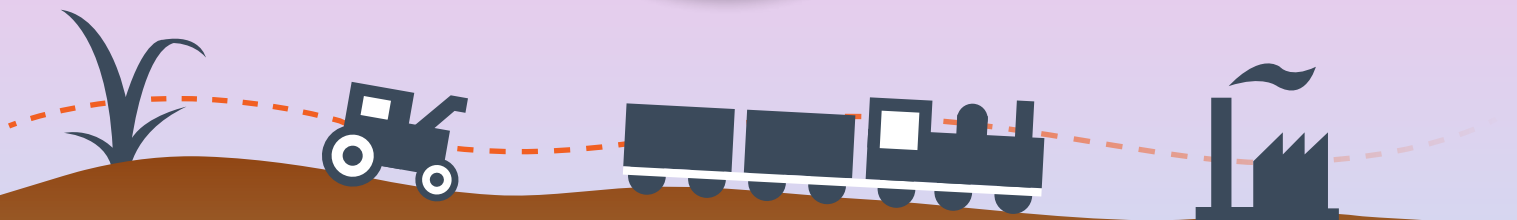
purchased or upgraded
equipment or
machinery

62%

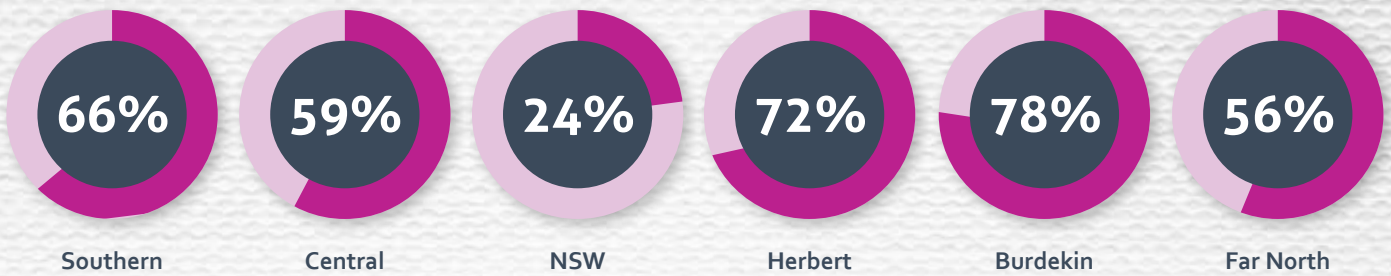
of surveyed growers have
changed farming practices
over the last two years

9%

implemented different
crop rotations, planted
alternate crops or changed
use of legumes



Rate of practice change

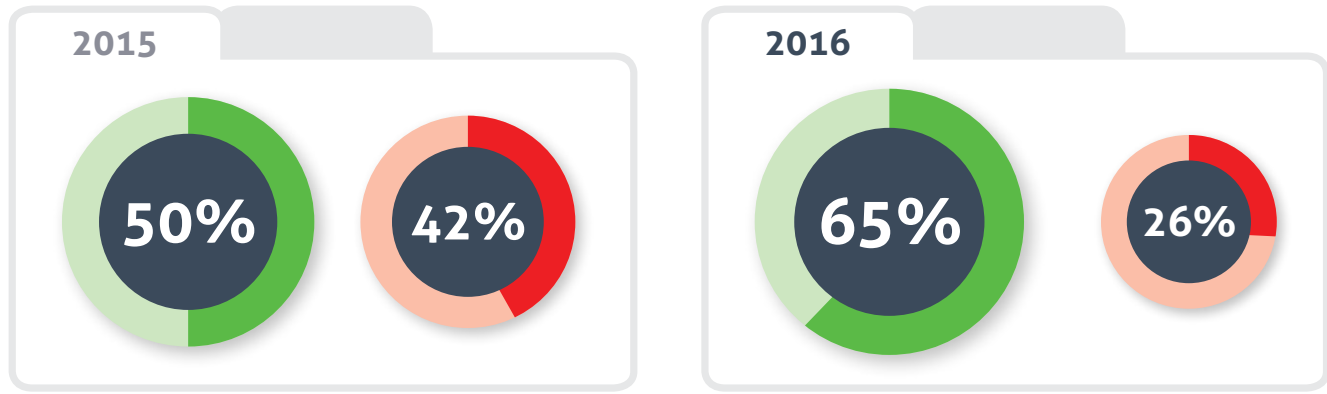


2 In line with the 2015 survey, the average respondent is 57 years old, with the average tonnes harvested being 11,000 from 150 hectares. Younger growers (18-39) are significantly more likely to have made practice changes than their older counterparts. The greater the tonnage produced, the lower the average age. On farms harvesting 3500 tonnes or less, the average age is 60 years, whereas farms harvesting greater than 14,000 tonnes the average age is 55 years.

Satisfaction with current practices is again the main reason that respondents have not changed practices, but financial constraints prevent some growers from making improvements. The survey also revealed positive sentiment around prices and yield. Confidence in the industry's future is significantly more widespread than 12 months ago at 65 percent (compared to 50 percent one year ago), mainly driven by improved prices.

Confidence in industry's future

● Positive ● Negative

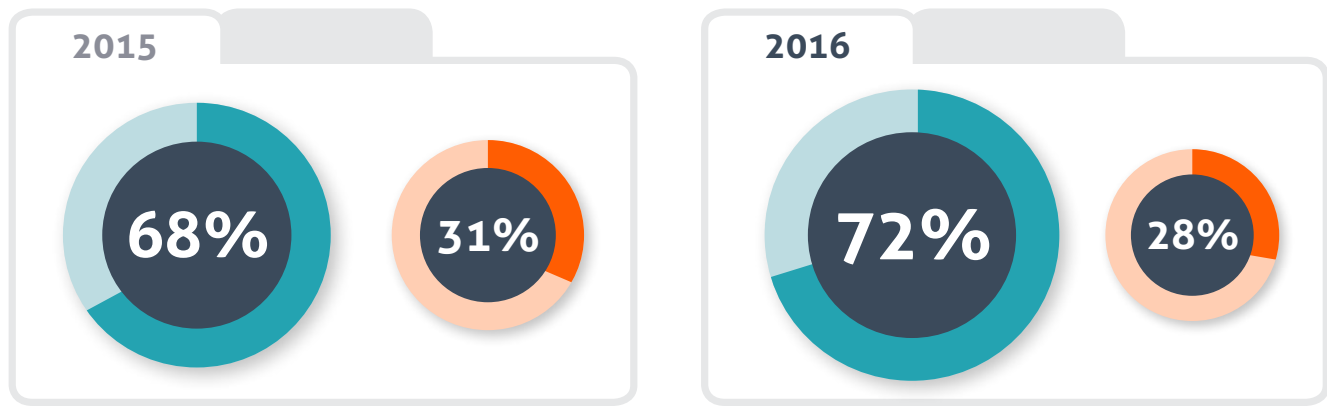


3 The survey also asked a number of questions about how you think SRA is performing. Despite being a relatively new organisation, awareness of SRA activities has increased over the last year. The overall number of people rating SRA's performance as high was 74 percent, which has increased from 66 percent last year.

Our goal is to continue to increase these ratings by continuing to deliver valued research, development and adoption outcomes for the Australian sugarcane industry. It is encouraging that SRA publications, events and other activities are clearly highly valued, and we are always looking for new ways to make them even better.

How much do you know about what SRA actually does?

● Fair-considerable amount ● Very little



Drew Watson with this year's crop being harvested.



Long term focus on improvement in the Wet Tropics

Mossman farmer Drew Watson says the well-known Tully saying 'no drain, no cane' has strong application in the Wet Tropics and drainage improvement should be one of the first steps in improving farm efficiency. By Brad Pfeffer

Even after more than 133 years of cane farming history that has occurred on the home property at Mossman, Drew Watson admits that there are always new investments that can still be made to improve efficiency and drive productivity and profitability.

The Watson family marked their centenary at the Mossman property Brie Brie Estate in 2005, which is the foundation property in the district where sugarcane was grown dating back to 1883.

Fast forward to today, and much has changed and brothers Drew and Gregg Watson continue to look for ways they can improve efficiency at Brie Brie Estate, as well as other properties they lease and own in the region.

This has seen them continue an ongoing program of improving drainage at their properties, which in recent times has evolved from laser levelling to global positioning system (GPS) assisted smoothing.

The average annual rainfall at Brie Brie Estate at Mossman is in the range of 2500mm per year, and with some heavier soil as well, drainage is crucial.

To get the job done, he uses a bucket that is owned by Mossman Ag Services, which was bought thanks to a financial contribution from the local CANEGROWERS, and then shared among the region's growers.

"We have used laser grading for more than 15 years here, and I am a firm believer that if there are flat spots in the paddock then these spots just won't grow cane," Drew Watson said.

"My philosophy is that we have to get the drainage right first and then look at additional things. For example, I would love to do an EM survey of the place, but I know that this is pointless if there are puddles in the paddock."

Research has shown that for every 24 hours sugarcane spends underwater, yields of cane are reduced by half a tonne of cane per hectare.

He said the GPS was possibly slightly less precise than laser levelling, but it was far less labour intensive. He already has GPS in several tractors and also within the harvester, so starting the process of the smoothing is simply a matter of driving the paddock to map it out, with this data then fed back to a computer at the productivity office in town.

"The only downside is the accuracy of the satellite," he said. "It is supposed to be accurate to 20mm left or right and it is usually 10-12mm accurate, but when you are talking height, rather than left or right, the inaccuracy can double."

"So previously we could probably get away with a slope of 0.1 percent with the laser, where with the GPS smoothing you might have to go just a little bit more. Having said all that, it does a very good job at the end of the day, particularly on paddocks that have undulations and required a lot of work with the laser."

This year, his focus was on three paddocks that were at the end of the crop cycle and therefore presented an opportunity to improve the drainage. The forecast for the wet season was that it should be reasonably dry, and this year would therefore have been a good opportunity to get the job done.

The actual weather turned out wetter than forecast, with significant rainfall in December 2015 that delayed the levelling much further into the wet season. If there had been a drier start to the wet season and a completion of the levelling then this would have allowed for a quick crop of rice in a shift from their usual choice of a green-manure legume.

However, the weather stopped this from occurring, meaning the ground was only ready in time for May sugarcane planting ahead of a short-term forecast of good rain that would get the crop established.



Above: This plaque was laid on the centenary of the Watson family at Brie Brie Estate in 2005.

"Unfortunately that rain event in May turned out to be 250mm within a few days of planting, so not even the best drainage job could have saved the cane that was planted. It certainly wasn't the fault of the drain, and in most years and most times I think the drainage will do the job," he said.

"All three paddocks are fairly long rows that run from lighter soil to heavier soil at the bottom end where they drain out, so drainage is important."

Their drainage plan also links back to making sure that they have a range of options for cutting during a wet harvest season.

"We have an ambition to have one third of the farms fallow as usually green manure crops, and two thirds replant. When we get 2500mm of rain in a year, we feel sometimes we need a paddock to sacrifice in the wet, so then at the end of the year if there are paddocks that have been bogged out these are the ones that are ploughed out."

They have also shifted to wider rows of 168cm, which Mr Watson concedes is not as good as 180cm, but he still sees that it delivers benefits compared to their previous narrower rows.

"We changed over about eight years ago, and our older ratoons are looking a lot better, which I put down to us not running over the ground as much. Compaction is our enemy.

"We cut our own cane here, so we are adamant that the haul-out drivers need to drive straight."

He sums up that he is cautiously hopeful of a good crop in 2016, but doesn't want to get to optimistic before all the paddocks have been cut.

"I was recently speaking to another farmer from the Burdekin and showed him my rainfall chart. Our rainfall for this crop has matched pretty closely to what ideal irrigated conditions would be, so in theory this should be as good of a crop as we can grow."

More information

Drew Watson
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Project details

Key Focus Area:

Optimally adapted varieties, plant breeding and release

Project name

Advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane

Project number

2014/053

Principal provider

SRA

Project leader

George Piperidis

Bringing a bit more mongrel into sugarcane varieties

A research project is looking at the role of introgression in improving Australian sugarcane varieties, by bringing in genetics from wild relatives of sugarcane. By Rod Fletcher, Adoption Officer, Meringa

The challenge accepted by Sugar Research Australia (SRA) is to deliver more profit to the Australian sugarcane industry.

One of the approaches SRA leads is exploring ways to manipulate the current commercial sugarcane varieties to improve genetic gain.

SRA currently uses plant breeding for this process, where plant breeders select elite parents to cross together to try and produce new varieties that have the most desirable traits.

This method has been used successfully for several decades by sugarcane breeders and has produced incremental gains in cane yield, CCS, disease resistance, and ratooning.

Over these years, the genetic potential of the breeding program has relied on two main ancestral species from the *Saccharum* (S) family: *S. officinarum*, which is the main source of high sucrose levels; and *S. spontaneum*, which gives it vigour and hardiness.

Dr George Piperidis (Leader Crossing and Selection, SRA) is the Chief Investigator of an SRA funded project that proposes to improve the sugarcane breeding program. The title of the project is *Advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane*.

The project objectives are to:

- Identify and exploit new sources of genes for better ratooning, resistance to nematodes and *Pachymetra* root rot.
- Examine (ground-truth) identified clones that were resistant to nematodes and *Pachymetra* root rot in controlled-environment screening tests in field-based trials.
- Select clones with higher yield and ratooning ability under harsh conditions.
- Establish a clear path for future direction and investment in introgression.

This project aims to improve the current sugarcane breeding program by introducing new desirable genes from wild relatives of sugarcane, improving genetic variability, resulting in better yields, disease resistance and ratooning from SRA varieties.

This project and the research findings were communicated at a recent series of Research Forums held throughout the industry. At these forums, Dr Piperidis described the project goals at a grass-roots level. "Think of the current commercial sugarcane varieties as having genetics from a "princess cane" (*Saccharum officinarum*) and a "mongrel" (*S. spontaneum*). What the project hopes to do is to introduce more mongrel from the *Erianthus* (E) and *S. spontaneum* families into the genetic potential," he said.

Above: Lawrence DiBella stands next to sugarcane from the introgression breeding program in Florida, USA (left) and from the SRA introgression breeding trial in the Herbert (right). The question is: whose stalk is bigger?

Achievements of the project so far:

- Successful trial conditions and treatments have been achieved for disease trials, specifically for Root Lesion Nematode levels in Herbert and Mackay where numbers between treated and untreated plots showed a positive 100-fold and 10-fold difference.
- Phenotypic measures were taken from the Herbert seedling trial in April 2016. These measures are potentially useful for identifying clones or families or both with high yield or good ratooning ability or both to rapidly recycle them as parents for use in crossing.

Project Partners include HCPSSL, MAPS, ISIS Productivity Services, Wilmar and Sunshine Sugar.

Manager of Herbert Cane Productivity Services Limited Lawrence DiBella has partnered with SRA on this project and witnessed what can be achieved by introgression breeding when he visited Florida and Louisiana, (USA), in 2013.

"The Louisiana cane industry has been using introgression material in their plant breeding program now for over 30 years to improve crop yields, disease resistance and cold tolerance. The Louisiana program has been very successful with numerous high producing new varieties being released to their industry in the past few years," Mr Di Bella said.

This project will end in June 2017 and the plant crop results will be communicated to industry once they have been collated and analysed.

A follow-on project will be proposed to continue the trials and allow collection of data from the ratoon crops.

One of the important questions to address in this work is how SRA can structure a long-term program to ensure that the benefits and successes as seen in the Louisiana program are also realised in Australia.

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

We want to bring more of the good traits of *S. spontaneum* and *E. arundinaceus* into our varieties

S. officinarum

- Chewing or noble canes
- Thick stalks
- Broad leaves
- High sugar, low fibre
- High maintenance
- Poor ratooning
- Disease susceptibility
- Poor adaptability



S. spontaneum

- Mostly thin stalks and leaves
- Low sugar, high fibre
- Good ratooning
- Disease resistance
- Highly variable and adaptable
- It's a weed!



E. arundinaceus

- Vigorous growth, relatively thick stalks, massive root system
- Almost immune to *Pachymetra*
- Highly resistant to nematodes
- Grows in harsh conditions (i.e. drought, waterlogging)
- Almost no sugar
- High fibre
- Very difficult to cross with sugarcane (genetically dissimilar – wide hybrids)
- Fertile hybrids are very rare!
- No commercial varieties with *Erianthus*





SRA Researcher Emilie Fillols with Mossman farmer Chris McClelland, who is also Chairman of Mossman Ag Services.



The rainfall simulator in action in Far North Queensland.

Rainfall simulator improves research efficiency

Just as unexpected rain or drought events severely impact farming operations, they can also impact important research activities that SRA is investing in for the Australian sugarcane industry.

In the Wet Tropics, the next rainfall event is never far away. But as farmers and millers in the region understand, despite the large rainfall, the forecasts for rain events can often prove to be dramatically different to what actually occurs.

And just as an inaccurate forecast puts a spanner in the plans of farm work, the same applies to many important research activities undertaken by Sugar Research Australia (SRA).

One such project that has a crucial relationship with the weather and rainfall is the current project called: *Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics area*, led by SRA Researcher Emilie Fillols.

A part of that project involves assessing the runoff of herbicides when a major rain event occurs 48 hours after herbicide application on the paddock.

According to Ms Fillols, the challenge of timing the research to synchronise with the forecasts is very difficult and, the dry year in 2015 made things very challenging to get the research trials completed.

So Ms Fillols and her research team devised a solution that has been commonly used by researchers in this field of work. They built their own rainfall simulator, based on specifications developed by runoff experts. Owning a rainfall simulator increases work flexibility and reduces the cost compared to contracting the service.

It has been used several times this year at sites in the Wet Tropics and the runoff samples are currently being analysed. It will also be used in important future research activities, including a new project that seeks to increase the adoption of practices that reduce pesticide loss in the Wet Tropics.

How it works

The rainfall simulator covers two fixed areas of three metres by 75cm, and in recent trials it has simulated an 80mm-in-one-hour rainfall event.

This is considered to be a standard benchmark for a one-in-five-year rain event in the Wet Tropics, marking a large event but also one that is reasonably possible to occur.

"We are analysing the results of a worst case scenario," Ms Fillols said. "We apply the chemical, let the chemical bind for 48 hours and then assess what happens when massive rainfall occurs.

"We sample the runoff and we also sample the soil and the trash blanket to find out how much chemical has bound to the soil and the trash.

"This is important to provide growers with information about the runoff that is occurring in considering a range of factors such as soil type and slope.

"This data is important for the industry to ensure it has sound science when it comes to all issues around water quality."

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

More information

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Project details

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

Deterioration of sugarcane billets can start to occur 14 hours after harvest.

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 after 14 hours of harvest, and best practice recommends milling the cane within 16 hours.

With that in mind, a small-scale career-development project funded through Sugar Research Australia (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 post-harvest 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.

General Manager of the Research Funding Unit (RFU) at SRA, Dr Michael O'Shea, said the small project provided interesting work around billet life that was based around implications for season length, billet storage and harvest scheduling.

"Although the work wasn't successful in terms of leading to a new outcome, it is an example of an innovative small project from one of our bright young researchers to give him a chance to manage a project by himself, which is exactly why this scheme exists," Dr O'Shea said.

More information

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Project details

Key Focus Area:

Optimally adapted varieties, plant breeding and release

Project name

Sugarcane root systems for increased productivity; development and application of a root health assay

Project number

2015/002

Principal provider

CSIRO

Project leader

Dr Anne Rae

Digging down into the function of sugarcane roots

A new project is looking at sugarcane roots in relation to genetics, environment, and management, and working toward important new information for the Australian sugarcane industry. By Brad Pfeffer

What does a healthy and high-performing sugarcane root system look like, and how does it function?

This might seem like a simple question, but a new research project being led by the CSIRO is delving deep into these and many other unanswered questions about sugarcane roots and how they are performing below your soil.

Roots are supposed to be one of the biggest consumers of energy within a sugarcane plant, yet information on their function and structure has, until recently, been limited because of the size of the plant and the opaque nature of the soil.

New digital scanning technology is changing that and allowing researchers to get a clearer picture of sugarcane roots.

Dr Johann Pierre with CSIRO said that work on sugarcane roots was a vitally important area of research because of their huge importance to the crop.

New technologies developed in other crops can benefit sugarcane and build on what we knew previously about roots.

The roots are large. Stretched end to end, he said the roots of a mature sugarcane plant measured about 2km in length.

They also consume a lot of the energy of the plant, consuming up to 50 percent of the photosynthate produced each day just for root respiration.

“About 60 percent of the root length are the very fine roots, which measure less than a quarter of one millimetre in diameter. They are the active pipe supplying water and nutrients to the plant but there is a high metabolic cost to these roots for their growth, maintenance and uptake function.

“So for the plant, it is a question of how it invests its resources. Does it invest in big roots to go deeper and try and access more of the mobile resources

such as nitrogen and water, or stay closer to the surface to access more of the topsoil resources?”

He said a better understanding of the plant response in different conditions would have potential for management considerations for growers.

The project, which is funded by Sugar Research Australia, is also investigating the difference in root characteristics between varieties. It is also looking at old varieties and comparing the roots to new varieties such as SRA1[®] to see if the root characteristics have changed over time within the SRA breeding program.

Dr Johann Pierre said that this process started with 20 different varieties grown in large PVC pots that were grown for two months under optimal conditions.

From there, the roots of mature plants were washed free of soil and digitally scanned.

"There were some interesting varietal differences in the way the roots were able to explore the volume of soil around them," Dr Pierre said. "For example, we found contrasting root-shoot ratios in different varieties."

The research team are now testing to see if these differences still persist in mature plants and how the number of stalks affects root system biomass and shape. That is hoped to lead to very useful information in relation to how different varieties are performing underground.

For example, growers have already observed and understand that some varieties establish quicker than others. In some cases, the researchers said, this may be because more effort is going into the roots first. The research will also look at how this may advantage those varieties.

Dr Anne Rae with CSIRO said that over the long term, the information from this research is also hoped to be useful for the SRA breeding program.

"The breeding program is selecting highly productive varieties and they all have strong root systems, but there are differences between varieties and we think that those differences might allow some varieties to be better suited to some field conditions or management practices than others," she said.

"It might seem that a bigger root system is always better, but there is a cost to maintaining a root system for the plant. If a plant puts a lot of resources into a big root system, then perhaps that is a resource that could have gone into sugar. So you need the right balance of a root system that does the job, but without wasting resources.

"At the moment we are setting a baseline for how much genetic variation there is, and then we will look at the environment and management conditions.

"We can then start to answer questions about whether some shapes and architectures of roots are better in say sandy soil, or dry soil, or compacted soil, or soil with different nutrient availability, which then is ultimately about which roots provide better productivity in the field."

The research has already started field work, working closely with SRA researchers, with more to continue over the duration of the project until mid-2018. SRA acknowledges the funding contribution from the Queensland Department of Agriculture and Fisheries towards this research activity.



Above (left): The root architecture of the varieties, left to right, of Q242[®], KQ228[®], and SRA1[®].

Above (right): An analysis of washed sugarcane roots.

Developing techniques for field analysis of roots

The work on the roots project is being enhanced by Dr Johann Pierre's award of an Early-Career Researcher project funded by SRA.

SRA invests in professional development opportunities such as these for researchers to develop innovative ideas that enhance their skills and benefit the Australian sugarcane industry.

This ECR project is working to develop a soil test that would allow researchers to determine the root biomass within a soil core, by using DNA analysis.

It involves using technology that has been developed by the South Australian Research and Development Institute (SARDI) for other crops, and applying it to sugarcane.

It will not only provide information on the root biomass in the soil, but also on those roots which are alive and those that are dead.

It could have useful applications in a range of field tests, including disease situations where it is important to understand what is happening underground.

All of this will help provide information about understanding the overall function of the roots, which includes the turnover of roots within sugarcane.

"We know there is a turnover of root systems in other species, and this technique will give us the tools to understand how much root turnover there is within sugarcane, and particularly between ratoons."

More information

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Controlled-release fertilisers: unravelling the mystery

Project details

Key Focus Area:

Soil health and nutrient management

Project name

Role of controlled release fertiliser in Australian sugarcane systems

Project number

2014/011

Principal provider

CSIRO

Project end date

July 2017

Controlled-release fertilisers (CRFs) have been promoted as an option for reducing nitrogen losses, but a research project is confirming that it is crucial that applications be matched to the needs of the crop in order to capture both an on-farm economic outcome, and an environmental outcome.

A research project looking at CRFs in sugarcane farming systems is unearthing important information about how these fertilisers work and interact with the crop.

The research is being conducted by the CSIRO and is bringing together a vast array of information from trials on CRFs from previous research, as well as current research activities. It is using this information and also computer modelling to help provide guidance for farmers, advisors and researchers in relation to these fertilisers. It is doing so specifically for sugarcane farming systems.

CSIRO researcher Kirsten Verburg said that despite the many trials that had been undertaken on these fertilisers, there were many unanswered questions.

"Sometimes the trials see positive results, and sometimes they do not. We want to know: why is that? What does that mean for a particular soil or climate?"

The research is funded by SRA and it is already observing some important points about CRFs. "The early results are confirming that different products have

different release patterns, and also that there is a strong temperature effect on the rate of release," she said.

"So the same fertiliser used in north Queensland may release faster than it would in the south, just as it would release faster in November than it would in August. We also know that one CRF product is not the same as another product.

"At the moment, there is not a large range of CRF products available within the Australian sugarcane industry, but if you look worldwide, there are many. That is why these observations are important.

"Ideally, the product releases just when the crop needs the nutrient. So if we can learn more about when the crop needs nutrients and when the fertilisers are releasing, then we can find a better match."

By releasing the urea slowly, CRFs may be able to reduce nitrogen losses such as those occurring through runoff, into the atmosphere, or through leaching. A crucial aspect of ensuring the products could provide value is matching the release of the fertiliser to the needs of the crop.

Given that CRFs are generally more expensive than traditional fertiliser, the research is targeting the question "where and when will they make a difference?".

The answer is far from simple and is strongly linked to the nitrogen rate, the conditions, and losses.

"You may get a benefit in terms of yield in situations where you have nitrogen loss and the CRF reduces that loss, provided the crop can use that extra nitrogen," Dr Verburg said.

"We already know that with nitrogen, the crop reaches a point where the yield just does not increase further and the yield plateaus.

"So when we look at CRFs, you may get a yield increase if you are not quite at that plateau and the crop still responds to extra nitrogen. This means that CRFs may allow a reduction in the rate of fertiliser nitrogen applied."

The project will now delve deeper into these findings to understand the fertiliser release patterns and timing of crop nitrogen demand in more detail, and these results will be communicated to the industry.

SRA Technician Jill Jennings at the Bundaberg chemical trial site in August 2016.

Research investigates options for soldier fly management

Current research activity is looking at new options for soldier fly management, including both chemical trials and variety trials. By Brad Pfeffer.

A series of research trials is investigating potential control and management options for soldier fly.

These trials are occurring in regions that have experienced some of the worst impacts of this pest, at Maryborough, Isis, Bundaberg and Mackay, and in collaboration with productivity services organisations and growers in those regions.

Soldier fly are not considered a major pest of sugarcane, but they can cause very severe damage for growers who have them, particularly to ratoon crops.

There has been extensive research into the pest in the past, but to date no control method exists outside of farm management strategies to reduce their population.



A female soldier fly.

The purpose of the new trials is to investigate practical and affordable alternatives.

SRA Senior Technician Jill Jennings is running several of the trials in the southern region, including variety trials at Maryborough, Isis and Bundaberg, and two chemical trials at Bundaberg. Similar trials are being conducted at Mackay by SRA Entomologist, Karel Lindsay and SRA Technician Allen Eaton.

“At the moment we don’t have chemicals or other options, and the only treatment strategy is to try and break the life cycle and reduce the population,” Ms Jennings said. “One purpose of the chemical trials is to see what happens if we apply an insecticide into the furrow at planting.

“Will that slow down the infestation in your plant crop? We have seen farmers with a big soldier fly problem having them in their plant crop and then they are losing their crop from the first ratoon, so that is a major cost.”

Chemical treatment at planting allows the chemical to be applied in a wider band than it would on ratoon crops.

Some of the chemicals being trialled are currently not registered for use in sugarcane, and are not disclosed because they are still to be assessed. Ratooning vigour and soldier fly numbers will be evaluated after harvest.

Cane treated with unregistered chemical will not be crushed. The variety trials are assessing varieties chosen by each region, with the objective of providing information to growers on varieties that may be more tolerant to soldier fly.

“We hope that this information will be useful for farmers if they are able to choose a variety that may be more tolerant over one that is more susceptible,” she said.

She added that there were still questions about how soldier fly actually impacted the crop and the ratoons, as the impact on the crop was not distinct like with cane grubs, for example. Soldier Fly suck on the roots, but why that impacts on ratooning is unclear.

More information on these trials will be communicated with industry as relevant information is available.



Pictured recently at chlorotic streak trials at Woodford are SRA staff Priyanka Wickramasinghe, Kathy Braithwaite, Barry Croft, Mona Singh, and Chuong Ngo.

Pathology research puts industry on a strong footing

Retiring SRA plant pathologist Barry Croft has played an integral role in vital industry research into biosecurity issues over 38 years. By Amy Claireton

There's never a dull moment when it comes to dealing with exotic pests and diseases that threaten the cane industry and retiring SRA plant pathologist, Barry Croft has certainly been in the thick of things during his 38-year career.

Based in Tully for 17 years, Barry led the pathology team investigating possible causes for poor root syndrome, which was suppressing yields for farmers despite significant advances in varietal performance.

The outcome of their investigations was the identification of an oomycete that was completely new to science, later named *Pachymetra*. This fungus-like organism was found to be present in soils throughout the cane growing regions of Australia.

While the only crop it affects is sugarcane, *Pachymetra* is only found in Australia so, although not confirmed, the expectation is that it probably also has native plant hosts.

Having identified *Pachymetra* root rot as one of the causes of poor root syndrome, a new area of work opened up for the pathology team to help the Yield Decline Joint Venture to develop farming systems to address the wider problem of yield decline.

Barry developed a method of rating varieties for their resistance to *Pachymetra*, a major control measure now used to supply the industry with varieties that produce well in the presence of *Pachymetra* in the soil.

The close working relationships that Barry fostered between the plant pathology and plant breeding teams has served the industry well through the responses to orange rust and sugarcane smut outbreaks and, most recently, to lessen the effect of chlorotic streak disease on yields.

Although ratoon stunting disease (RSD) had been identified in Australia in 1944, diagnosis remained a problem because

the disease has no external symptoms. Barry trained Productivity Service staff in using microscopes to diagnose the disease and then developed a new ELISA test in 1993 that has since been the industry standard method and been used to process over 500,000 samples in laboratories at Tully, Mackay and Indooroopilly. The ELISA test is also used to screen varieties for resistance to RSD.

Barry worked closely with Productivity Services to develop protocols to ensure the highest level of quality control for the 'disease-free' or 'approved seed schemes' that operate in each growing area.

The nucleus of disease free material is hot water treated in successive years before planting into the plots to ensure the planting material distributed to farmers is free of RSD.

The protocols Barry prepared for the 'disease-free seed scheme' have stood the test of time and although the scheme is now being replaced with tissue culture propagation in some growing areas, the SRA disease-free plots still provide starting material for tissue culture of new varieties.

In 1995, the pathology and plant breeding teams identified sugarcane smut as a disease with a high risk of causing production losses in Australia, the disease having already spread to nearly every other sugarcane producing country. A contingency plan was prepared and published in 1997 only to be implemented almost straight away when sugarcane smut was identified in the Ord, WA, in 1998.

Once again, screening varieties for their resistance to the disease has been a central component to the industry's response. Initially screening was conducted on an isolated Indonesian island where it was possible to test more clones against the sugarcane smut pathogen before they advanced through the breeding program.

The eight years of screening varieties prior to the eventual outbreak in Queensland in 2006 had rated the existing varieties and ready to release varieties for resistance to the disease and so Barry was able to provide growers with the information they needed to move as quickly as possible to resistant varieties.

With sugarcane smut now present in all growing areas the screening program in Indonesia was closed and the work is now done at the SRA research station at Woodford, along with screening for other diseases.

Barry says the smut screening program initially tested 2000 clones/year and found 50–60 percent were susceptible to sugarcane smut, but 10 years later the best smut-resistant parents have been identified and as many as 80 percent of the clones tested each year now 'pass' the sugarcane smut test.

Just as he started, Barry is finishing his career with SRA with another world-first discovery to solve a 90 year-old mystery.

He and fellow pathologists Kathy Braithwaite and Chuong Ngo have uncovered the cause of chlorotic streak disease. The new protozoan will soon be described to the scientific world in a published paper but already Barry and the team have set up the variety screening protocols where new varieties can be inoculated with the pathogen and rated for their resistance.

Barry is thrilled to be leaving SRA on such a high note later this year, having been instrumental in identifying the cause of a disease that affects sugarcane crops across the world, using the latest of DNA technology along with traditional plant pathology laboratory techniques to isolate the pathogen and grow the cultures for the inoculum.

Barry is confident that the Sugar Industry Biosecurity Plan recently developed with Plant Health Australia, and the individual contingency plans for known exotic insect pests and diseases, will serve the industry well into the future.



Left: Barry Croft during the sugarcane smut incursion at Childers in 2006.



Below: Barry Croft speaks to ABC television recently regarding SRA's biosecurity and disease work.

New Biosecurity legislation implemented for Queensland

Queensland's new biosecurity regulation has come into effect, which has important implications for the Australian sugarcane industry. By Matt Reynolds, Adoption Officer, Mackay

July 1 has seen the implementation of the *Biosecurity Act 2014* and the *Biosecurity Regulation 2016*, which will impact the way biosecurity and particularly the movement of sugarcane plant and machinery occurs within Queensland.

The new legislation brings into effect the 'General Biosecurity Obligation', requiring all Queenslanders to take all reasonable steps to ensure they do not spread a pest, disease or contaminant.

The commencement of the new legislation replaces all existing powers of the *Plant Protection Act 1989*, *Plant Protection regulation 2002* and the *Plant Protection (Approved Sugarcane Varieties) regulation 2003*. The new legislation brings a number of changes relevant to the movement of sugarcane and sugarcane machinery:

- 1) Sugarcane biosecurity zones replace pest quarantine areas (PQAs);
- 2) Movement of sugarcane plant material or machinery;
 - a. Requires a Plant health assurance certificate (PHAC)
 - b. All previous inspectors will require accreditation to become authorised inspection persons under the new act.
- 3) General biosecurity obligation (GBO) affects all Queenslanders.

Sugarcane Biosecurity Zones SBZs replace PQAs

Previously, pest quarantine areas (PQAs) represented the boundary for plant and machinery movement within a region. These areas allow potential and present biosecurity risks to be managed through restricting their spread. Under the new act, the PQAs have been replaced with sugarcane biosecurity zones (SBZs).

The changes have seen a slight reduction in the number of biosecurity zones. The new map includes generic zones (e.g. Far Northern Biosecurity zones) and industry specific biosecurity zones, with each industry defining zones relevant to their industry. The key changes for the sugarcane industry are:

- The addition of the far northern biosecurity zones 1 and 2, which relate to all industries.
- The merging of the previous PQA2 and PQA2a to form the sugarcane biosecurity zone 1 from Coen to Townsville.
- The modification of the two most southern biosecurity zones to now capture Rockhampton to Victoria point (Sugarcane Biosecurity zone 4) and Victoria Point to the NSW/QLD border (Sugarcane biosecurity zone 5).

The sugarcane biosecurity zone map can be viewed at www.sugarresearch.com.au.

Movement of sugarcane plant material or machinery

The movement of machinery between SBZs requires a plant health assurance certificate (PHAC) from an authorised inspection person. Under the new legislation, all existing powers to inspect machinery have ceased with the removal of the *Plant Protection Act 1989*.

All machinery that has come in contact with sugarcane plant material or soil used for sugarcane production will require a PHAC to move between zones. The machinery will need to be free of any cane trash or soil and be accompanied during transport by a PHAC before being moved between zones.

To arrange an inspection contact your local accredited productivity services officer or Biosecurity Queensland on 132 523.

To move sugarcane plants (stalks, leaves, potted plants) between sugarcane biosecurity zones contact Biosecurity Queensland on 132 523.

General Biosecurity obligation

The general biosecurity obligation requires every Queenslanders to take all reasonable steps to ensure they do not spread a pest, disease or contaminant.

This is important to remember when moving not just between sugarcane biosecurity zones but also between farms.

Biosecurity at a farm level is important to manage across a range of areas from the movement of vehicles onto the farm, the management of pests and weeds on the farm, and even with the selection of varieties.

There are a number of ways an individual can ensure they meet their General Biosecurity Obligation and it's all around ensuring reasonable steps are taken to reduce the risk.

In the event that you believe the risk associated with the spread of pest, disease or contaminant is not being appropriately managed, contact Biosecurity Queensland on 132 523.

If you suspect an exotic pest or disease, contact the Exotic Plant Pest Hotline on 1800 084 881 and report to QDAF or your productivity services organisation.

More information

www.sugarresearch.com.au

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Sugarcane Biosecurity Zone Map



- All appliances (harvesters and other sugarcane machinery) moving between sugarcane biosecurity zones must:
 - > be free of cane trash and soil
 - > be inspected by an authorised inspection person who will issue a Plant Health Assurance Certificate (PHAC)
 - > be accompanied during transportation by the PHAC.
- Machinery inspections can be arranged by contacting the local Productivity Service organisation.
- To move sugarcane plants (stalks, leaves, potted plants, etc) between biosecurity zones contact Biosecurity Queensland (13 25 23).

Variety management: a local industry approach



The Tully Variety Management group (TVMG) is a local industry initiative for promoting adoption of new varieties. By Greg Shannon, TSL, and Gavin Rodman, SRA

The TVMG was established in 2012 by Tully Sugar Limited (TSL) with assistance from TCPSL and SRA, with the objective of taking new or recently released SRA varieties, and fine tuning local recommendations in relation to:

1. Germination characteristics
2. Maturity Trends from small mill CCS curve trend analysis based on 10-14 months crop age
3. Herbicide tolerance – commercial observations
4. Field characteristics such as lodging, trashing, suckering, flowering, and ratooning ability.

The information is designed to assist Tully growers adopt these varieties as quickly and efficiently as possible and also strengthen the relationship between the local industry and SRA.

How the TVMG fits into the industry:

SRA variety development

Tully Variety
Management Group

TCPSL Approved Seed

A critical factor integral to the success of the group is the use of the TSL laboratory for small mill sampling to sample blanket-approved varieties.

These blanket approved varieties have been tested through the SRA Final Assessment Trials and released to the industry by the Variety Approval Committee, usually with limited local trial data.

These trials provide local information that lead to better recommendations and facilitate commercial adoption.

TSL is currently trialing the SRA Cane Maturity Calculator for suggestions on refining a version suitable for the small mill sampling done for regional trials. They hope this will improve efficiency and reduce costs.

The group has high expectations for new varieties SRA6 and SRA7 and their suitability in the region. These varieties have been released with complementary variety information from SRA trials in the northern region.

These varieties are to be included in the TVMG trials to fine tune the recommendations reported.

The TVMG began with five growers, TSL, TCPSL and SRA and two trial sites in 2012. The group now has 32 growers, seven trial sites, and fortnightly updates of variety performance both from small mill and commercial analysis.

Tully-based SRA Adoption Support Officer Gavin Rodman joined the group in 2016. TSL's Cane Productivity Manager Greg Shannon leads the group with TSL technician Jimmy Chen and Gavin Rodman making up the local team who conduct the weekly sampling and observations.

They are supported with strategic and technical information by Roderick Fletcher (SRA Adoption Officer – Varieties).

In 2016 a new local variety guide was produced as a companion to the SRA variety guide to assist growers and advisors with variety recommendations.

Tully Canegrowers Director and original group member David Singh believes this group is a significant step forward for the industry. "Having a group like this developing local recommendations for new varieties gives growers extra confidence," Mr Singh said.

"While SRA do a good job breeding the canes and providing sound recommendations on a district scale, we still need local knowledge before we go full steam ahead and plant a new variety, especially now with so many to choose from.

"This group allows us to fine-tune recommendations under local conditions so that by the time we are ready to plant large amounts, we have access to this local data and observations."

TSL provides an on farm variety recommendation service, as do TCPSL who release the new SRA-bred varieties. In addition, information is also provided via QCANESelect™ via www.sugarresearch.com.au.

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

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.

Project details

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

Total Research Investment

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 1 (Optimally-adapted varieties, plant breeding and release)				
Maximising the rate of parental improvement in the Australian sugarcane breeding program	2008/319	SRA	Xianming Wei	01/05/2016
Australian support for the International Consortium for Sugarcane Biotechnology (ICSB)	2010/002	SRA	Frikkie Botha	01/07/2016
Maximising genetic gain from family and within family selection	2011/343	SRA	Roy Parfitt	01/12/2016
New germplasm to develop more productive varieties with enhanced resistance to nematodes, pachymetra root rot and smut	2011/344	SRA	Barry Croft	01/05/2016
Development and testing of a SNP marker platform in sugarcane	2012/025	CSIRO	Karen Aitken	01/06/2016
SmutBuster II: accelerated breeding of smut-resistant varieties	2012/325	SRA	Roy Parfitt	01/06/2016
Improving the accuracy of selection in sugarcane breeding trials through accounting for site variability	2012/351	SRA	Xianming Wei	01/05/2018
Exploiting introgression for the development of productive and regionally adapted varieties for NSW	2013/022	NSW Sugar	Roy Parfitt	01/05/2020
Sugarcane for future climates	2013/029	CSIRO	Chris Stokes	01/06/2017
Applying the genome sequence for variety improvement: validation and implementation	2013/030	CSIRO	Karen Aitken	01/08/2018
Developing cytogenetic and molecular tools to improve selection for soil-borne pathogen resistance in wild hybrids	2013/358	SRA	Nathalie Piperidis	01/04/2017
Phase 1: advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane	2014/053	SRA	George Piperidis	30/06/2017
Optimising productivity and variety recommendations through analysis of mill data	2014/054	SRA	Joanne Stringer	01/08/2016
Field assessment and further development of high-sucrose sugarcane	2014/069	UQ	Luguang Wu	31/10/2017
Sugarcane root systems for increased productivity; development and application of a root health assay	2015/002	CSIRO	Anne Rae	01/07/2018
Impact of stool architecture on ratooning ability	2015/004	CSIRO	Anne Rae	01/07/2018
Leaf sucrose: the link to diseases such as YCS and enhancement of sugarcane productivity	2015/016	SRA	Gerard Scalia	30/06/2018
Generation of a high throughput SNP marker chip for introgression of resistance genes from wild germplasm into sugarcane, targeting smut, pachymetra and nematodes, to generate more resistant varieties faster	2015/025	CSIRO	Karen Aitken	30/06/2018
Selecting high value chromosomes from wild introgression material to deliver more resistant varieties faster	2015/026	CSIRO	Karen Aitken	01/08/2018
The Sugarcane Hub, development of a interface between the sugarcane genome sequence and sugarcane genetic data to allow researchers to identify genes that underpin important agronomic traits	2015/027	CSIRO	Karen Aitken	01/08/2017
Improving early stage selection of SRA breeding program by indirect selection of plant vigour	2016/028	SRA	Jaya Basnayake	2019
Optimising productivity, variety recommendations and mill operations through analysis of mill data	2016/032	SRA	Jo Stringer	2021
New approaches to identify and integrate Pachymetra resistance genes from Erianthus into SRA breeding program	2016/039	SRA	Nathalie Piperidis	2020
Licence to Farm: Nitrogen use efficient varieties to meet the future environmental targets	2016/044	SRA	Prakash Lakshmanan	2019

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 2 (Soil health and nutrient management)				
Quantifying the effects of microbial additions to sugarcane soils on crop productivity	2013/069	Farmacist	Jayson Dowie	01/05/2016
Strategies to manage soil-borne fungi and mitigate sugarcane yield decline	2013/101	CSIRO	Paul Harvey	01/08/2017
Regenerating a soil food web capable of improving soil health and reducing losses from soil-borne pests and pathogens of sugarcane	2014/004	Biological Crop Protection	Graham Stirling	01/07/2017
Role of controlled release fertiliser in Australian sugarcane systems	2014/011	CSIRO	Kirsten Verburg	01/08/2017
Boosting N-use efficiency in sugarcane through temporal and spatial management options	2014/045	USQ	Bernard Schroeder	01/10/2017
Assessment of new management strategies for marginal soils	2015/007	SRA	Barry Salter	31/12/2019
Improving NUE for sugarcane crops with constrained yield potential	2015/065	SRA	Danielle Skocaj	30/06/2019
Decision support for informed nitrogen management: soil nitrogen mineralisation test and the assessment of soil crop N contribution to crop N requirements	2015/069	DSITI	Phillip Moody	30/06/2018
Spatially explicit estimation of Achievable Yield Potential – an improved basis for fertiliser management	2015/070	CSIRO	Rob Bramley	01/07/2017
Improving management practices of legume crop residues to maximise economic and environmental benefits	2015/074	DSITI	Weijin Wang	30/06/2018
How much N will that crop need? Incorporating climate forecasting into nitrogen management in the Wet Tropics	2015/075	JCU	Yvette Everingham	01/05/2018
Key Focus Area 3 (Pest, disease and weed management)				
Rapid detection of ratoon stunting disease	2013/001	CSIRO	Amalia Berna	01/06/2016
Mass production of the Adelina disease to better manage greyback canegrubs	2013/356	SRA	Nader Sallam	30/06/2016
Innovative approaches to identifying the cause of chlorotic streak and new management strategies	2013/357	SRA	Barry Croft	01/06/2016
Development of controlled-release formulations of imidacloprid for canegrub control	2014/006	SRA	Andrew Ward	01/04/2016
Solving Yellow Canopy Syndrome	2014/049	SRA	Dave Olsen	30/06/2017
Developing an alternative herbicide management strategy to replace PSII herbicides in the Wet Tropics area	2014/050	SRA	Emilie Fillols	01/01/2018
A Novel Polyphasic Framework to resolve Yellow Canopy Syndrome Paradox	2014/082	UWS	Brajesh Singh	01/05/2017
Validation of LSB-PCR diagnostic for ratoon stunting disease and characterisation of non-Lxx strains of Leifsonia associated with sugarcane	2014/086	USQ	Anthony Young	30/06/2017
Review of the sugarcane Industry Biosecurity Plan (IBP) and development of a Grower Biosecurity Manual (GBM)	2014/088	PHA	Rodney Turner	01/10/2016
Delivery of remote sensing technology to combat canegrubs in Queensland cane fields	2015/038	SRA	Nader Sallam	01/01/2018
Securing Australia from PNG biosecurity threats	2015/046	SRA	Rob Magarey	02/08/2017
Identifying new-generation insecticides for canegrub control as contingency for loss of amenity with the existing product	2016/003	SRA	Andrew Ward	2020
You can't manage what you can't identify: Managing threats from exotic moth borers through accurate identification	2016/041	SRA	Nader Sallam	2019
Molecular assay of major soil-borne pathogens for better exploitation of commercial varieties	2016/047	SRA	Rob Magarey	2018

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 4 (Farming systems and production management)				
Developing targeted, seamless weather/climate forecasting systems for critical early season harvest periods	2013/004	USQ	Roger Stone	01/06/2016
Developing remote sensing as an industry wide yield forecasting, nitrogen mapping and research aide	2013/025	UNE	Andrew Robson	01/10/2016
Product and profit – delivering precision to users of precision agriculture in the Australian sugar industry – yield monitoring	2014/028	USQ	Troy Jensen	01/02/2017
A non-pneumatic cane cleaning system with no cane loss	2014/035	QUT	Neil McKenzie	01/12/2017
Too wet to forget – reducing the impact of excessive rainfall on productivity	2014/046	SRA	Barry Salter	01/07/2017
Increased harvest recovery: reducing sugar loss and stool damage	2014/048	SRA	–	01/07/2017
Modernisation of furrow irrigation in the sugar industry	2014/079	USQ	Malcom Gillies	01/07/2017
Demonstration of GPS-guided laser levelling and its associated productivity response	2014/094	Mulgrave Central Mill	Matt Hession	01/02/2018
Bio-prospecting for beneficial endophytes of sugarcane	2015/051	AgResearch	Stuart Card	01/01/2019
Cropping solutions for the sugarcane farming systems of the Burdekin (extension of 2011/922)	2015/077	SRA	Barry Salter	01/01/2017
Incorporation of Australian Crop Data and Industry characteristics into a Tool to Facilitate Informed Harvest Decision-making for the Australian Industry	2015/079	NorrisECT	Stuart Norris	01/09/2016
Sensors for improved harvesting feedback: a feasibility study	2015/080	SRA	Eloise Keefe	14/02/2017
Opening the data highway: Access to remotely sensed spatial and temporal data for the Australia sugar industry to assist with yield forecasting and nitrogen management	–	UNE	Andrew Robson	2019
Key Focus Area 5 (Milling efficiency and technology)				
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 Keefe	01/08/2017
Managing aspects of raw sugar quality in the Australian sugar industry	2014/052	SRA	Eloise Keefe	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 Keefe	2020
Reducing boiler maintenance costs and deferring capital expenditure through improved technology	2016/020	QUT	Floren Plaza	2020
Key Focus Area 6 (Product diversification and value addition)				
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

Project Title	Project Number	Principal R&D Provider	Chief Investigator	End Date
Key Focus Area 7 (Knowledge and technology transfer and adoption)				
Increasing farm business intelligence within the sugar industry	2014/001	AgProfit	Matthew Bryant	30/06/2017
Measuring the profitability and environmental implications when growers transition to Best Management Practice (as defined by the new Canegrowers Smartcane BMP)	2014/015	DAF	Mark Poggio	02/05/2018
Improving industry returns through harvest best practice	2014/091	NSW Sugar	Ian McBean	30/06/2017
Understanding the impact of harvester speed on subsequent ratoon performance in the Burdekin	2014/092	BPS	Robert Milla	30/06/2017
Tissue culture – managing impediments to adoption in Tully	2014/093	TCPSL	Jordan Villaruz	01/01/2017
Sugar industry productivity and data recording spatial data hub for research and extension	2015/045	Agtrix	Robert Crossley	28/02/2018
Pre-commercial evaluation of a PCR-diagnostic for Ratoon Stunting Disease and the development of a business case for full implementation	2015/078	SRA	Nicole Thompson	01/03/2017
Protecting our chemicals for the future through accelerated adoption of best management practice	2016/002	SRA	Andrew Ward	2019
Master classes in soil health/soil biology for the sugar industry	2016/025	SRA	Andrea Evers	2019
Key Focus Area 8 (Capability development, attraction and retention)				
Enhancing sugarcane for decreased water content and increased sugar content at harvest	2011/072	QUT	Anthony Brinnin Mark Kinkema	01/05/2016
Production of furanics and chemicals from bagasse and molasses	2012/074	QUT	Joshua Howard William Doherty	01/04/2016
Investigating the utility of mill mud for soil health conditioning and nutrient use efficiency on sodic soils within the Burdekin	2013/077	USQ	John Bennett	01/09/2016
Effect of organic nutrients on sugarcane growth, microbial activity and greenhouse gas emissions	2013/078	UQ	Susanne Schmidt	01/09/2016
Sugarcane for water limited environments: characterization of a selected sugarcane germplasm for transpiration efficiency and high biomass production for the sugarcane growing regions in Australia	2014/102	UQ	Sijesh Natarajan Shu Fukai	01/06/2017
Exploiting soil microbe associations with sugarcane roots for resistance to canegrubs	2014/104	UWS	Andrew Frew	14/09/2016
Investigation of genetic control of sugar accumulation within the sugarcane culm (stalk)	2014/107	UQ	Patrick Mason	01/06/2018
Soil nitrogen dynamics – a microdialysis approach to quantify nitrogen cycling in sugarcane soils	2014/108	UQ	Scott Buckley	01/07/2018
Statistical data mining algorithms for optimising analysis of spectroscopic data from on-line NIR mill systems: improving system calibrations for quality measures and variety discrimination	2014/109	JCU	Justin Sexton	30/05/2018
Reduction of post-harvest deterioration of sugarcane	2014/401	SRA	Anthony O' Connell	01/08/2016
Enhancing sugarcane growth and yield by biocontrol agents/biofertilizers	2014/402	QUT	Jan Zhang	01/12/2016
A boiler simulator for improved operator training	2016/001	QUT	Anthony Mann	2019

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