Varieties and plant breeding update

June 2017

Sugar Research Australia

SRA continues to enhance plant breeding

SRA has recently added additional expertise and capacity to its sugarcane breeding program with the appointment of experienced plant breeder, Dr Jason Eglinton.

Dr Jason Eglinton.

Dr Eglinton is SRA's Leader of Breeding Research and Development, where he is working with Key Focus Area Leader Dr Bert Collard to continue to improve and enhance the breeding program, as well as working with SRA's experienced team of plant breeders and technicians. He leads the molecular genetics and trait development teams.

Both Jason and Bert have extensive experience in plant breeding with other commodities, and will use these skills as a valuable asset in enhancing the Australian sugarcane industry's breeding and research activities.

Dr Eglinton's expertise will greatly contribute to finding innovative ways to modernise and improve the breeding program through the use of modern genetic tools such as molecular markers, improved breeding strategies and selection precision. Dr Eglinton is based at Meringa near Cairns.

Dr Eglinton was formerly the Barley Program Leader at the University of Adelaide, where he led the development and commercialisation of new feed and malting barley varieties.

Re-development of SRA's plant breeding database system: SPIDNET version two

By Steven Comerford and Dion Appo, SRA

Information management is a critical part of all plant breeding programs. Every year, plant breeders generate large amounts of data and make selection decisions based on multiple sources of information. Australia was one of the leaders in data management for sugarcane breeding with computerised records initiated in the 1980s. During the next decades, computing become more advanced and the database system evolved into the development of SPIDS (Sugarcane Plant Improvement Database System).

SPIDNet is SRA's current plant-breeding information management system. It was originally developed in 2003 to use all available information to help create better crosses.

Trial performance and mill productivity data captured in SPIDNet also provides information to SRA's public variety recommendation and reporting program QCANESelect™.

SRA has embarked on a key initiative to redevelop this application to support all of SRA research and selection activities in the coming years. The redevelopment is aimed at:

- Supporting other research activities within SRA, such as entomology, weeds and agronomy.
- Collecting and displaying spatial information for observations to improve validation and add other analysis methods.
- Allowing trial data to be collected and analysed for more than one purpose.
- Allowing data to be stored and analysed at a more flexible hierarchy than a field trial, such as at the stalk or leaf level or within laboratories.
- Supporting more modern data collection tools, such as Android smartphones connect to external GPS devices.
- Supporting quarantine processes whilst moving samples between regions.
- Scheduling activities to be performed during field trials.

This work is due to be completed by early 2018. Once completed, it will provide a solid foundation for further enhancements to QCANESelect™.

A new hub for sugarcane research data

A CSIRO research project has worked to create a new research interface that will house a wealth of data for sugarcane researchers to access important information such as genetic data on the sugarcane plant.

A new tool is under development to provide sugarcane industry researchers with access to important information about the genetics of the sugarcane plant.

This tool has been created as part of a project led by CSIRO, where the project team is creating an interface for the huge depth of data on the sugarcane genome, which will help researchers to conduct better and more efficient research for the industry.

This interface will be called The Sugarcane Hub.

So what is inside? Currently, because the sugarcane genome is more complex than most other field crops, a complete sugarcane genome sequence is not available yet, although work carried out by CSIRO has generated a partially assembled sugarcane genome which is already proving to be valuable.

Research is progressing on completing the first sugarcane genome sequence and a result is expected within the next few years, but in the meantime the Sugarcane Hub will provide access to the assembled parts of the genome that include the gene sequences. This will provide a wealth of data on the parts of the sugarcane genome that are already understood.

Within the Hub, which will be an online tool for researchers, all of this information will be correlated to the genome of sorghum in the first instance, which is the closest mapped relative of sugarcane, and a genome that is already understood.

"By lining up the sugarcane genome information with sorghum genome information, we can look at particular genes that are aligned in different regions, in order to target those regions more easily in sugarcane, such as for plant breeding," said CSIRO's Dr Karen Aitken, who is the lead researcher of the project.

"This will be of particular interest to those with an understanding of molecular genetics, creating a useful tool to help them with their work. The potential is that breeders can look at a region of the genome that may have, for example, disease resistant genes. They can then create markers around that region and use this as a selection tool in the breeding program for creating new sugarcane varieties. In addition, it also provides a vast depth of knowledge for researchers to access."

The Sugarcane Hub could also assist with reducing the breeding time for new varieties, something that SRA is also continuing to invest in through a number of other projects and activities.

The Sugarcane Hub will include information on genetic mapping in sugarcane with links to genome regions that are associated with important agronomic traits such as CCS and cane yield.

The current breeding process is based around selection, which is a time and resource consuming process to select new potential varieties.

"So, potentially, we may be able to find an important gene for disease resistance, which could then allow breeders to screen their seedlings, meaning the plants never actually have to be grown in a field to test that trait. You could eliminate all the seedlings that did not have that gene for disease resistance, for example."

The Sugarcane Hub will also include information on genetic mapping in sugarcane with links to genome regions that are associated with important agronomic traits such as CCS and cane yield. This will allow researchers to identify the potential candidate genes for these traits which will assist in the development of perfect markers for the sugarcane breeders to use.

This process will improve significantly once the sugarcane genome is completely sequenced, which will bring the sugarcane breeding program closer to the advancements of the breeding programs of other crops such as wheat, barley, and maize.

For more information

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Celebrating

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SRA MERINGA SUGAR EXPERIMENT STATION

Celebrating 100 years of the Meringa Sugar Experiment Station

Above: Meringa glasshouses years ago.

Above: Meringa photoperiod facilities today.

Far North Queensland has celebrated a century of sugarcane research and development activity at Meringa, south of Cairns.

The Meringa Sugar Experiment Station first began operation in 1917 as the Australian sugarcane industry's first and only entomological research station, as part of what was then the Queensland Government's Bureau of Sugar Experiment Stations.

SRA Chairman Dr Ron Swindells said that the Meringa station was now run by Sugar Research Australia (SRA), and its focus had broadened beyond insects to major research activity including sugarcane variety development, milling research, water quality, pests and weeds, and adoption.

To mark the occasion, an event was held on June 14 to showcase the station to local industry, former staff, and officials.

"The Australian sugarcane industry has a proud history of research and development that includes 100 years of research activity that has occurred at Meringa," Dr Swindells said.

"In that time, the goal has always been to increase the productivity, profitability and sustainability of sugarcane growers and millers, who provide vital economy activity for regional communities."

In recognition of the achievements and history of the station, the Meringa Experiment Station was heritage-listed in 2014, including several historical buildings.

"The Meringa station has also been the subject of a major investment by SRA to modernise its facilities, meaning that the history of the station is preserved, but also combined with modern facilities to allow for first-class research," Dr Swindells said.

"Meringa remains the engine room of the SRA sugarcane breeding program, where the first steps are made for creating new sugarcane varieties for growers and millers.

"It is where field cross of sugarcane varieties are made, and it is also home to our photoperiod facilities, which have been a major technological advancement for the breeding program.

"I take this opportunity to thank all of the staff who have worked at the research station over the last 100 years.

"I also thank the local community of Gordonvale for their support, as the station is also a piece of their local history.

"Our research work continues to be targeted at delivering valued solutions for a growing industry, and this work will continue well into the future."

Regional Variety Committees are replacing the former Variety Approval Committees. *Photo by Tim Staier, SRA.*

Variety decisions rest with the local industry through new RVCs

With changes to biosecurity legislation in both Queensland and New South Wales, the previous process for the approval and release of sugarcane varieties from SRA has changed.

The changes have required several processes to be established and over recent months SRA has supported the establishment of these processes under the new system.

As part of the legislative changes, the previous power held by the Queensland and NSW departments for the establishment of approved variety lists has been removed.

SRA will develop and release sugarcane varieties that are developed through the SRA breeding program and, based on the recommendations from the Regional Variety Committees, SRA will produce recommended variety lists. The Regional Variety Committees (RVCs) will replace the previous Variety Approval Committees.

These regional committees are responsible for the decisions around variety release. For that reason, SRA does not chair these meetings, as the decision on variety approval is a decision for the committee (growers, millers, and other stakeholders).

These committees have held their first meetings, with the process of the nomination of voting members identified at a regional level.

RVC membership includes representatives from growers, mills and productivity service organisations and includes the identification of a chair and secretary within the committee. SRA's role within the RVC will be limited to the provision of relevant technical information to assist the committee in making decisions on particular varieties.

SRA will continue to provide logistic support to the RVCs, through regional variety officers and plant breeders, to ensure an effective transition into the new system.

The Sugarcane Industry Biosecurity Committee (SIBC) will act as the industry committee for biosecurity matters. Its membership consists of industry, research organisations, and State government.

In addition to decisions on varieties, the RVCs are also reviewing the current disease thresholds for their region and advise SIBC of the recommendations. SIBC will consider biosecurity matters impacting the SRA plant breeding program and provide advice to Biosecurity Queensland and the NSW Department of Primary Industries with regard to biosecurity factors such as disease resistance that can determine/limit movement of sugarcane plant material between biosecurity zones.

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