



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*

