



shoot architecture modification to boost cane and sugar yields

Very few sugarcane growers would say no to growing varieties with increased sucrose yields...more sucrose equals more income. A Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB) project, titled 'The Molecular Physiology of Bud Outgrowth', has focused on enhancing sucrose by altering the shoot architecture of the cane plant.

Background

In this project, CRC SIIB scientists have been using biotechnology techniques to investigate what controls tillering, ratooning, suckering and set germination and investigating whether or not by manipulating these traits genetically they may be able to boost yields. Their work has involved the use of advanced research tools to help unravel the genetic controls behind sugarcane shoot development and understand how to maximise a plants yield potential. In essence, researchers have utilised new cutting-edge tools to unravel the genetic controls of sugarcane shoot development and understand how to maximise realisable yield potential.

Basically, two approaches have been employed in these studies. Firstly, genetic variation relating to various shoot architecture traits has been evaluated in selected sugarcane germplasm. This assessment, which was carried out with the help of the BSES-CSIRO breeding team, included physiological studies, gene expression analysis and genetic mapping. The study established the linkage between shoot architecture traits and different chromosomal locations to the presence or absence of specific genes.

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The second approach employed similar molecular technologies and transgenic studies to exploit the current knowledge of genes shown to regulate branching in other species, such as Arabidopsis, pea, rice and maize to uncover the molecular controls of sugarcane branching.

Progress

Collectively, these two research approaches uncovered a number of sugarcane branching genes and highlighted the interrelationships between stalk traits and CCS.

Scientists have shown that of all the stalk traits, sugar content is most closely correlated with stalk height. However, they have not yet determined whether this is true in different environments or across a wide range of genotypes.

This work also revealed that some of the genes regulating shoot architecture in other plants also affect shoot architecture in sugarcane. This will greatly facilitate the mapping of branching genes in the sugarcane genome and ultimately marker-assisted breeding of new varieties.

This project has pioneered the application of the latest DNA technologies, including gene-specific size polymorphisms, ecotilling and the Sequenom Mass Array SNP detection system in sugarcane and has also generated a vast amount of useful information. Application of these sophisticated technologies has paved the way for more rapid sugarcane gene mapping in related and other sugarcane research activities in the CRC; a significant step forward in sugarcane biotechnology development.

Looking ahead

Transgenic lines of cane with varying levels of tiller production have been generated through this project and will be field tested for their productivity in the coming years. This work is continuing in the CRC SIIB as the new project, ‘Yield improvement through manipulation of shoot architecture’, which is poised to make great leaps towards sugarcane crop improvement for the Australian sugar industry.

