SIIB
CRC Sugar Industry Innovation through Biotechnology

project profile

investigating the plant biofactory

In today's global economy, agricultural businesses are finding that product diversification is one of the keys to sustained prosperity. To help ensure the Australian sugar industry's future success, the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB) is focused on finding lucrative new product options.

A recent CRC SIIB project, 'Sucrose derivative production in sugarcane' has revealed the strong potential for sugarcane to be utilized as a plant biofactory (ie capable of producing valuable compounds in addition to sucrose).

Background

The goal of this work was to demonstrate the feasibility of using the sugarcane plant as a vehicle to produce commercially viable quantities of an alternative sugar, sorbitol. CRC scientists set about to determine whether or not the host organism (sugarcane) was affected when its normal cellular processes were altered using a single gene to accommodate sorbitol production.

Ultimately they wanted to determine whether or not sucrose could easily be converted into sorbitol and if it was possible to influence the levels at which it formed.

Progress

The gene responsible for the synthesis of sorbitol in apple was cloned and transformed into sugarcane. Transformed sugarcane plants were later screened to identify individuals that produced exceptional amounts of sorbitol. The research team then propagated replicates of these plants in a glasshouse to acquire greater insight into the metabolic capability of sorbitolcane. Various limitations were taken into account so as to best estimate the biofactory capacity of sugarcane.

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High sorbitol concentrations were achieved in the leaves of transformed plants where it was found that sorbitol accrued to 12% of the leaf dry weight (or 61% of the total soluble sugars). Significantly less sorbitol was detected in the cane plants' stalks. The cellular processes of the cane plant did not appear to be greatly affected by the introduction of sorbitol; however, sorbitolcane was generally smaller than untransformed cane monitored as a comparison. While the overall reduction in size was undesirable, it was not lethal to the plant.

Looking ahead

This project has provided a good model for evaluating the technical merit of converting sugar intermediates (ie sugar phosphates) into alternative products. Some of the unwanted features associated with sorbitolcane, such as the disparity between leaf and stalk product concentrations and reduced plant growth, may arise for other products that the CRC looks to produce in sugarcane. However, because of its simplicity (only a single gene is required to synthesize sorbitol), the sorbitol system is a useful tool for investigating and developing solutions to these problems. Ultimately, with the help of sophisticated research systems such as sorbitolcane, it may become more feasible for sugarcane to be transformed into a vehicle for many lucrative product options.

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