

Modelling Sucrose Accumulation in Sugarcane With PySCeS Using Custom Built Extensions.

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Sucrose metabolism in *Saccharum officinarum* (sugarcane) is characterised by a futile cycle of sucrose synthesis and cleavage. This has important implications for the net sucrose accumulation in various cellular compartments, as well as the amounts of sucrose accumulated in plant tissues of differing maturity. Our group has recently developed a kinetic model for the central pathways of sucrose metabolism in medium-mature sugarcane culm tissue. Using this model, a control analysis was performed of the futile cycle. However, the model does not take into account the effect of sucrose storage in the vacuole, nor does it reflect the maturation stage of the particular tissue. Using enzyme kinetic data from sugar cane sampled across its length, and thus reflecting culm tissue of varying maturity, we expand and generalise the model to reflect changes in tissue maturation. This model also accounts for compartmentation effects by including vacuolar sucrose storage and metabolism as separate, explicit pathways. Modelling was performed using the PySCeS software package. A number of extensions were developed for PySCeS to facilitate in data manipulation, e.g. importing and exporting models to and from SBML format or , and modeling, e.g. implementing algorithms for stochastic modeling. This model may optimise the future selection and engineering of sugar cane varieties for improved agricultural production.

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