

The patterns of growth and dry matter accumulation of eighteen sugarcane varieties were followed in the field throughout a plant and first ratoon crop. Estimates were obtained of the fresh weight of leaf per unit fresh weight of cane. Those values were significantly negatively correlated with total fresh weight of cane per hectare in the ratoon crop but there was no relationship between them and sucrose % fresh weight of cane. An assimilation index was calculated for all lightly or non-flowering varieties from the changes of total dry matter per cane per day and total leaf fresh weight per unit fresh weight of cane.

Two of the varieties, with about the same leaf weight per unit fresh weight of cane but differing sucrose % fresh weight of cane, were used in an experiment in which radioactively labelled CO_2 was fed to the leaves. It was found that the variety having high sucrose % fresh weight of cane had higher rates of assimilation and translocation than the variety with low sucrose % fresh weight.

In further studies the rates of uptake of sucrose *in vitro* by discs of storage tissue of nine of the varieties used in the field experiments was determined. Varieties differed in rates of both passive and active uptake, varieties with high sucrose % fresh weight in the field experiments having higher rates of both active and passive uptake than varieties with low sucrose % fresh weight. An examination of the size of storage cells showed that

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varieties with high rates of both active and passive uptake had smaller cells than varieties with low rates of uptake. In other anatomical studies no general relationship was found between the number of vascular bundles in the stem and sugar % fresh weight or between number of vascular bundles in the leaf and rate of translocation.

No effect on the sucrose % fresh weights of cane of five varieties could be attributed to the chemical racuza (methyl 3, 6-dichloro-o-anisate) when this was applied as a foliar spray at eight months.

It is suggested that the cane breeder should combine in one variety a low ratio of leaf weight to cane weight with small storage parenchyma cells in order to increase yields of sugar per hectare.

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