

FACTORS AFFECTING DRY MATTER AND SUCROSE CONTENT OF SUGARCANE

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Sugarcane, like many other crops, offers little scope for yield improvement by increasing the inherent rate of canopy photosynthesis, at least with conventional breeding and husbandry practices. The conversion of radiant energy intercepted by leaves appears to be maximum at approximately 1,8 MJ/g dry matter (DM) in well adapted varieties. There is more scope for yield improvement in the interception of radiation by leaves, but this is limited to conditions where there is adequate water. The scope for improving DM allocation to the economically important components of the crop could be assessed by considering the large body of data available for South African genotypes. In this study the results of direct cane analysis (DAC) from over 400 released variety trials (RVTs) were collated in order to establish genotypic differences in the way dry matter is partitioned in the stalk. The presence of NCo376 in all RVTs provided a paired data set for each variety and a convenient way of determining how the varieties compared in regard to DM allocation within the stalk. Age and seasonal effects on partitioning were determined by conducting DAC on stalk segments of eight crops of NCo376 ratooned at two month intervals and sampled 8, 10, 12, 14 and 16 months after ratooning.

Varieties

Sucrose % cane (S%) of the varieties tested in RVTs since N12 was released in 1978, varied from -2 to +35% of the S% for NCo376 (Figure 1). The varieties differed substantially in the way S% depended on dry matter % cane (DM%) and sucrose % DM (S%DM). S% of N17 was 7% greater than that of NCo376 because of increased DM% and S% of N15 was 9% higher than that of NCo376 because of improved S%DM (Figure 1). The large improvement in quality in CP66/1043 depended equally on increased DM% and S%DM. This variety and others (N15, N19, N24) with considerably enhanced S%DM have the inherent potential of producing greater su-

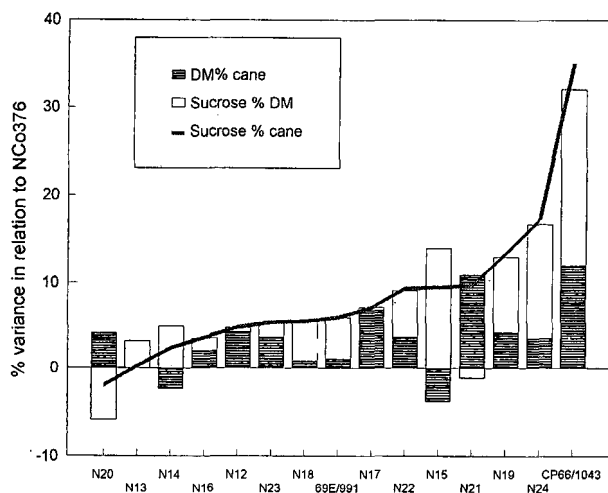


FIGURE 1: Quality components of varieties in RVTs relative to quality of NCo376. Varieties ranked in S% order.

crose yields than NCo376 because they allocate DM more efficiently in the stalks, although many other factors may override the performance of these varieties in the field. The t-test on all paired data sets except those for N24 were significant ($p = 0,01$).

Age and season

DM% and S%DM of the basal (lowest) 20 cm stalk segment of NCo376 varied more with crop age ($r^2 = 0,43$ and $0,30$ respectively, using linear and quadratic terms) than with month of sampling ($r^2 = 0,17$ and $0,21$ respectively, using sine transformation). Sucrose mass in this segment was highly dependent on S%DM ($r^2 = 0,79$, $n = 39$). This segment quickly attained high S%DM (>40% DM) and then accumulated additional sucrose in winter (up to 55% DM) or lost a little (<5% DM) during summer or with ageing (Figure 2). S%DM increased more rapidly and was conserved better in young than in old segments (data not shown). There was no indication of substantial re-mobilisation of sucrose to support renewed growth. S%DM of segments was highly dependent on their distance from the natural breaking point and green leaf number per stalk ($r^2 = 0,77$, $n = 260$). Green leaf number is an index of water stress which has a profound effect on leaf and stalk elongation. These data suggest that sucrose is well conserved in stalks of NCo376 and that the seasonal variation in S% arises because of fluctuations in the proportion of expanding to expanded stalk tissue and, to a lesser extent, because of seasonal variations in DM%. The mass and/or quality of the expanding portion can be manipulated by topping, by ripener application and by withholding irrigation water. A mechanistic model of DM partitioning needs to be developed to help advise growers how best to use these management options.

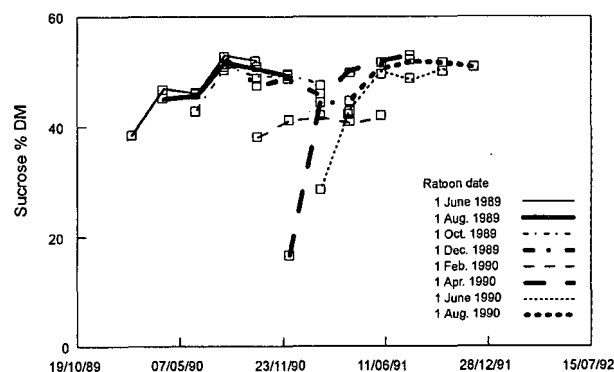


FIGURE 2: Sucrose % DM of the basal 20 cm segment of cane stalks of NCo376 ratooned at two month intervals and sampled 8, 10, 12, 14 and 16 months after ratooning.

Conclusions

Options available to growers for increasing the proportion and amount of dry matter ending up as stored sucrose include choice of variety, topping height, ripener application and irrigation scheduling. Stored sucrose is not readily re-mobilised and reductions in sucrose % cane should not be regarded as reductions in sucrose yield.