The effect of row spacing on stem volume and its relationship to water soluble carbohydrate storage after anthesis

F.M. Kelleher and P.M. Martin

Hawkesbury Agricultural College, Richmond. N.S.W. 2753.

The major sinks for carbohydrates during the latter growth stages in sweet sorghum are the inflorescence and the parenchymatous tissue located in the stem pith. Of these, the most important with respect to ethanol production is the stem, due to its relatively large storage capacity and its ability to store carbohydrates in a readily fermentable form. This experiment investigates the effect of row spacing on stem volume and the interaction between stem volume and water soluble carbohydrate (WSC) storage between anthesis and seed maturity.

Methods

Sweet sorghum (cv. Rio) was grown under irrigation at Richmond, New South Wales, at three row spacings (35, 70, 105 cm) and two plant populations (80 and 160,000 plants ha^{-1}). Harvests were taken at anthesis and seed maturity and stem volume measured as volume of pith tissue.

Results and Discussion

Stem volume ha increased significantly in response to narrow row spacing particularly at seed maturity (figure 1). Internodes $stem^{-1}$ and tillers ha^{-1} increased significantly in response to narrow row spacing before, but not post-anthesis, while stem diameter increases occurred both before and after anthesis.

Post-anthesis storage of WSC ($+ha^{-1}$) over the three row spacing treatments were significantly related (r^2 = 0.4347 d.f. = 16) to stem volume changes V (m^3) during this period according to the relationship:

WSC storage = 1.7105 + 0.8738 log V

A similar relationship (r^2 = 0.3786 d.f. = 16) between the proportion of carbohydrate partitioned to the stem for storage (1 WSC on T.D.M.) and stem volume changes during this period suggests that much of the yield advantage resulting from narrow row spacing may be due to the influence of the larger stem sink on partitioning of assimilates in the latter growth stages.

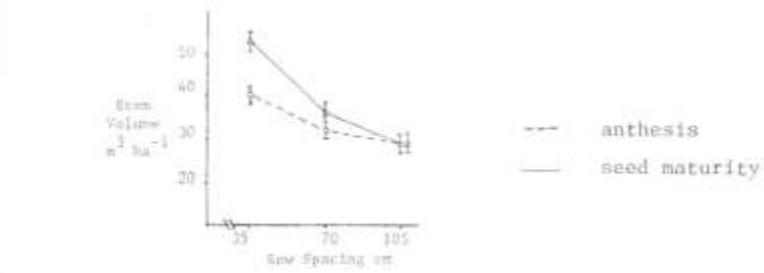

Figure 1. The effect of row spacing on stem volume ha^{-1} at anthesis and seed maturity. (LSD 5%)

The asymptotic nature of both these relationships at high stem volume levels indicates a possible source limitation to yield. Other experiments involving removal of the grain sink in sweet sorghum (1,2) suggest that WSC yields in sweet sorghum may be governed more by source than sink limitations. Further work is required to investigate means of maximising source in this plant.

1. Ferraris, R. (1981) Aust. J. Exp. Ag. An. Husb. 21:83-90.

2. Martin, P.M. and Kelleher, F.M. Unpublished Data.