A possible physiological mechanism underlying the response of sugar accumulation in rockmelons ripened under reduced irrigation

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Restricting water supply to a rockmelon crop in the last 10-14 days of its development is a practice used by commercial growers to increase the sugar content and thus eating quality of the fruit. However, this simple management strategy has been recommended with little or no understanding of the underlying mechanisms involved, a factor which has undoubtedly contributed to the variable success of the practice in the field (1,2).

Possible mechanisms by which the sugar content of rockmelons increases under mild water deficit were examined in a field and glasshouse experiment.

Method

Mature rockmelon vines in 47 L containers were either maintained at field capacity; rewatered to field capacity when soil water potential reached 30-35 kPa or left to dry from field capacity for the 11 day experimental period. The rates of photosynthesis, shoot extension and leaf expansion and bulk leaf water potential, relative water content and stomatal conductance were monitored in all treatments.

Results and discussion

Photosynthesis was found to be initially as sensitive as extension growth and leaf expansion to mild soil water deficits of 10-60 kPa. This was due to stomatal rather than mesophyll resistance to carbon dioxide diffusion. Neither the reduction in growth nor stomatal conductance were associated with a measurable decline in bulk leaf water potential or relative water content. It was postulated that the decline in shoot growth was due to a lack of assimilate caused by water deficit rather than a reduction in cell turgor pressure in the extending shoots. Stomatal conductance was associated more closely with soil water potential than with either leaf water potential or relative water content. This suggested a root-based rather than leaf-based signal operated to close stomata.

After 6-8 days of continual drying stomata of water-restricted plants remained partially open and photosynthesis was maintained at 30-35% of control rates. However, extension growth did not continue in the driest treatments or in plants rewatered to field capacity from a soil water potential of 30-35kPa.

If the mechanism operated in fruiting vines it may allow sugars to increase in rockmelons grown under reduced water supply through a redistribution of assimilate.

1. Flocker, W.J., Lingle, J.C., Davis, R.M. and Miller, R.J. (1964). J.Am.Soc.Hort.Sci. 86 : 424-432.

2. Pew, W.D. and Gardner, B.R. (1983). J.Amer.Soc.Hort.Sci. 108: 134-137.