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Gibberellic acid, chlorocholine chloride and yield increases in Zante currant

by

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Introduction

A comparison of a number of combinations of gibberellic acid (GA), 2-(chloroethyl) trimethyl ammonium chloride (chlorocholine chloride, CCC) and parachlorophenoxyacetic acid (PCPA, 4-CPA) demonstrated that of all the mixtures tested, the highest dried yield of Zante currant (*Vitis vinifera* cv.) fruit was associated with a spray consisting of 1 mg GA/l and 100 mg CCC/l applied at full bloom (El-Zeftawi and Weste 1970). The following experiment was devised to examine the source of this additive yield increase.

Experimental

The vines used in this experiment were twelve-year-old irrigated vines growing on a commercial property in the Mildura district.

The experiment was a 4×4 factorial replicated 20 times. GA was applied at rates of 0, 0.3, 1.0, or 3.0 mg/l, in factorial combination with CCC at 0, 30, 100, or 300 mg/l. All treatments included 0.05 per cent Tween 20 as a wetting agent, and were applied as a spray to individual shoots. Sixteen shoots each with two clusters, a "primary" or basal cluster and a smaller "secondary" cluster, were selected per vine. All combinations were applied to each vine, polyvinyl chloride sheeting being used to protect the remainder of the vine during spray application. All treatments were applied at or close to full bloom (approximately 80 per cent of calyptrae had fallen), this being within the range of optimum times of application (El-Zeftawi and Weste, unpublished data).

The clusters were harvested on January 28, 1970, about one week before the commencement of commercial harvesting, and their fresh weights recorded.

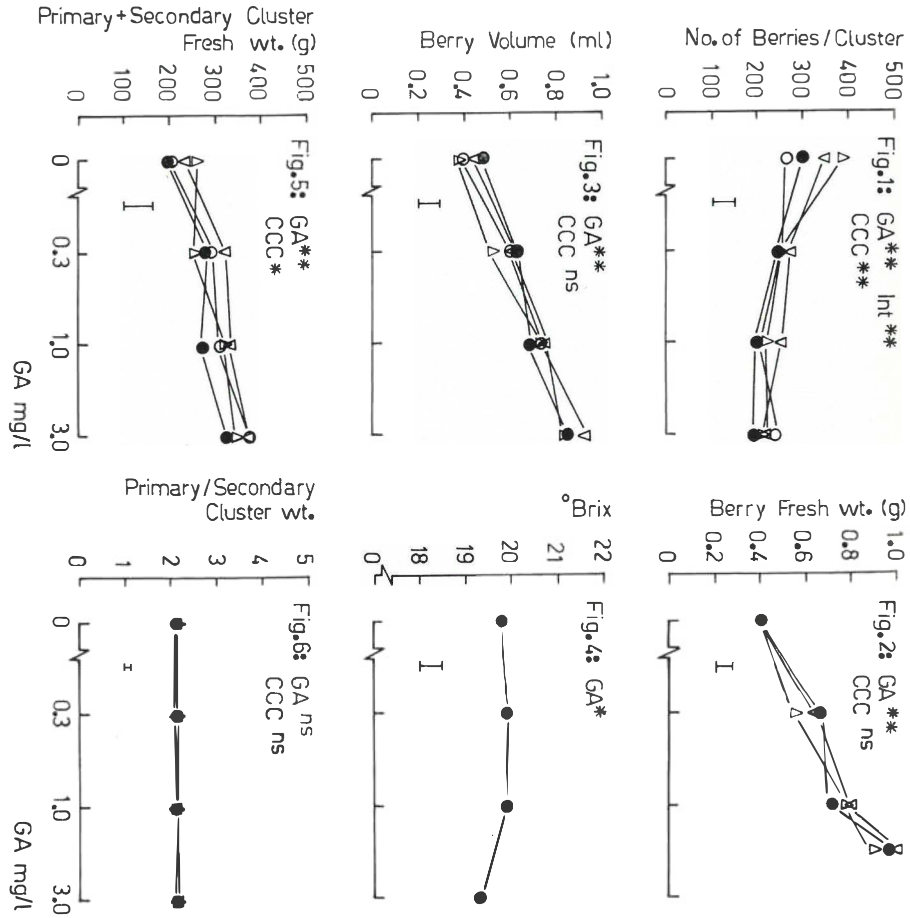
Twenty berries were sampled from each primary cluster and used for an estimation of berry weight and berry volume (measured by displacement of water). Berry number per primary cluster was estimated from the weight of the cluster and the weight of its 20 berry sample. Total soluble solids of a homogenate of the remainder of the cluster were estimated as the degrees Brix (24^0 C) using an Abbé refractometer.

It should be noted that the least significant differences given in the figures apply to the comparison of individual values, but the significance of the treatment, GA or CCC, is based on the mean of GA at all levels of CCC and *vice versa*.

Results

Fruit set (Fig. 1):

GA reduced fruit set even when applied at 0.3 mg/l, and tended to dominate the increase in set due to CCC.



Figs. 1 to 6: The response of a number of parameters of cluster growth of Zante currant to concurrent applications of GA and CCC: ●, CCC 0 mg/l; O, CCC 30 mg/l; Δ, CCC 100 mg/l; ▽, CCC 300 mg/l. The vertical lines represent L.S.D. ($P < 0.05$).
Figs. 1 to 4 refer to primary clusters only, and Fig. 4 represents GA averaged over all levels of CCC.

Berry weight (Fig. 2):

CCC had no significant influence on berry weight, but a positive response to GA was obtained even at 0.3 mg/l. The increase in berry weight was linear over the logarithmic range of concentrations chosen.

Berry volume (Fig. 3):

The response curve was similar to that for berry weight but indicated a possible reduction of berry size in response to CCC applied alone.

Degrees Brix (Fig. 4):

Clusters treated with GA at 3.0 mg/l had a slightly lower level of total soluble solids.

Total fresh weight of primary and secondary clusters (Fig. 5):

There was an additive response, an increase, which was nearly equal for both GA and CCC.

Ratio of the weight of the primary and secondary clusters (Fig. 6):

No treatment altered the ratio (2 : 1) to any extent, and thus conclusions based on data obtained from the primary clusters hold for the secondary cluster as well.

Discussion

It is clear that the additive increase in total weight of fruit harvested per shoot, which arose from the co-application of GA and CCC, was due to CCC increasing fruit set and GA increasing berry size. The significant interaction between GA and CCC concentration on berry number, seen in Fig. 1, indicated that GA tends to dominate the CCC response. A similar effect was noted in another cultivar of *Vitis vinifera*, Cape currant (Considine and Coombe, in preparation).

The increase in berry size for a given concentration of GA is greatest when applied at anthesis (Considine and Coombe, *loc. cit.*), but the timing of the CCC spray differs from that reported by Coombe (1965). In the latter paper it was stated that no significant increase in set was obtained from CCC at 100 mg/l applied as a cluster dip at anthesis, although berry number was nearly doubled by a similar application of CCC two to three weeks before anthesis. Thus it is probable that a set increase better than the 16 per cent realised here (CCC at 300 mg/l averaged over all concentrations of GA) could have been obtained by applying the CCC earlier.

Although whole shoots were used to approximate the field situation, these results cannot be quantitatively extrapolated to the whole vine. A reason for this is the ability of a shoot to import photosynthates from neighbouring shoots (Antcliff 1955, Meynhardt and Malan 1963), and thus the response may be larger than would have been obtained using whole vines.

The additive response of vine yield to combined application of GA and CCC can be reconciled to current theories on the mode of action of CCC. It is likely that GA acts within the cluster on fruit set while CCC is effective at a different site — possibly the shoot (Considine and Coombe *loc. cit.*) — and thus their actions are probably independent with respect to fruit set. Furthermore it has been suggested that both GA and CCC act within the berry to affect berry size (Considine and Coombe *loc. cit.*).

Small berries that are high in total soluble solids and resistant to damage are desirable. This trial further demonstrated that high yields can be achieved in Zante currant without producing the excessively large berries that are associated with the use of GA and PCPA either alone or together.

Summary

GA and CCC additively increased yield of Zante currant fruit. GA induced an increase in berry size (weight and volume) which was unaffected by CCC, while CCC offset to an appreciable extent the reduction in berry number associated with low concentrations of GA.

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