Vitis **10**, 27—30 (1971)

Department of Agriculture, Mildura, Victoria, Australia

Effects of GA and CCC on setting, splitting, yield and quality of Zante currant (Vitis vinifera var.)

by

B. M. El-Zeftawi

Introduction

Gibberellic acid (GA) in combination with (2-chloroethyl)-trimethyl ammonium chloride (CCC) when applied at full bloom was found to increase dried fruit yield of Zante currant *(Vitis vinifera* var.) in the irrigated areas of Victoria, Australia, by increasing the number of berries per bunch and maintaining berry size (El-Zeftawi and Weste 1970 a).

Observations on these trials also suggested that GA + CCC produced well coloured, mature, medium-sized berries (less than 0.5 g for average fresh berry weight) with little tendency to split due to early summer rain and with few undeveloped berries, while GA in combination with p-chlorophenoxyacetic acid (PCPA), which has been the standard practice since 1960, had many opposite effects.

The trial described in this paper was designed to evaluate the effects of GA + CCC on setting, splitting, yield and quality of Zante currant, in comparison with GA + PCPA during 1967—1968 and 1968—1969 seasons.

Materials and Methods

The treatments were:

(I) Nil (no spray);
(II) GA at 1 ppm + CCC at 100 ppm;
(III) GA at 1 ppm + PCPA at 20 ppm.

They were applied as soon as capfall was complete.

Just before flowering 20 primary bunches on each vine were selected at random, numbered and tagged. Flower number on each bunch was recorded. In both seasons rain caused splitting of the berries, the amount of rainfall during the 3 weeks prior to harvest was 10 mm in 1968 and 2 mm in 1969. At harvest each marked bunch was picked individually and weighed, then dissected and the number of berries counted into three categories, sound, split or undeveloped. The weight of the sound berries was recorded, then a sample composited from 10 sound berries from each bunch was weighed and tested for sugar. The following data were then calculated for each bunch:

$$\text{Setting per cent} = \frac{\text{number of sound + split + undeveloped berries}}{\text{number of flowers}} \times 100$$

$$\text{Undeveloped berries per cent} = \frac{\text{number of undeveloped berries}}{\text{number of sound + split + undeveloped berries}} \times 100$$

Splitting per cent =

$$\frac{\text{number of split berries}}{\text{number of sound + split berries}} \times 100$$

Estimated weight of split berries =
average berry weight of sound berries × number of split berries
Fresh weight per bunch =
weight of sound berries + estimated weight of split berries.

The dried weight per bunch was calculated from the fresh weight and sugar content of the juice according to the relationship described by Lyon and Walters (1941) for Sultanas.

Results

The number of flowers per primary bunch in these Zante currants varied from 120 to 1200, with an average of 568 in 1967 and 574 in 1968. Natural set overall was 66 per cent in one season and 44 per cent in the other (Table 1).

Table 1 also shows that GA + PCPA increased set in both seasons, while GA + CCC increased set significantly in the first season only. Compared with GA + CCC and no spray, GA + PCPA decreased undeveloped berries per cent in the first season but increased it in the second.

As shown in Table 2, GA + CCC in both seasons increased berry weight without increasing splitting or reducing sugar content significantly, while GA + PCPA in-

Table 1

Effect of GA + CCC and of GA + PCPA on setting and berry development of Zante currant for 1967-1968 and 1968-1969 seasons

Treatment (ppm)	Berry set (per cent)		Undeveloped berries (per cent)	
	1967—1968	1968—1969	1967—1968	1968—1969
Nil (no spray)	66.12	43.61	19.70	14.76
GA 1 + CCC 100	80.06**	53.52	19.50	11.23
GA 1 + PCPA 20	74.49*	65.04*	12.87*	25.35**
L.S.D. $P < 0.05$ (*)	7.69	15.19	6.30	9.28
$P < 0.01$ (**)	10.94	21.60	8.96	13.19

Table 2

Effect of GA + CCC and of GA + PCPA on splitting, fresh weight and sugar content of Zante currant berries for 1967-1968 and 1968-1969 seasons

Treatment (ppm	Splitting (per cent)		Average berry weight (g)		Sugar content (° Brix)	
	1967—1968	1968—1969	1967—1968	1968—1969	1967—1968	1968—1969
Nil (no spray)	51.9	8.8	0.27	0.20	26.9	25.4
GA 1 + CCC 100	41.3	6.2	0.42**	0.32**	25.2	26.4
GA 1 + PCPA 20	72.2**	42.1**	0.59**	0.55**	23.4**	21.7**
L.S.D. $P < 0.05$ (*)	15.4	12.1	0.10	0.09	2.0	1.8
$P < 0.01$ (**)	21.9	17.1	0.14	0.13	2.8	2.6

Table 3

Effect of GA + CCC and of GA + PCPA on fresh and calculated dried weight of selected primary bunches, including the estimated weight of the split berries, for 1967-1968 and 1968-1969 seasons

Treatment (ppm)	Fresh weight per bunch (g)		Dried weight per bunch (g)	
	1967—1968	1968—1969	1967—1968	1968—1969
Nil (no spray)	83.1	28.5	27.1	9.3
GA 1 + CCC 100	186.8**	73.3**	54.3**	23.3**
GA 1 + PCPA 20	220.9**	128.2**	58.0**	31.6**
L.S.D. $P < 0.05$ (*)	49.9	18.4	16.1	5.2
$P < 0.01$ (**)	70.9	26.2	22.9	7.3

creased berry weight further, to unacceptable values (0.5 g for average fresh berry weight), with lower sugar content and more splitting.

Table 3 shows the effects of GA + CCC and of GA + PCPA on fresh and calculated dried weight of the selected primary bunches, including the estimated weight of the split berries. In both seasons GA + CCC and GA + PCPA increased the average fresh and dried weight per bunch.

Discussion

The problem in Zante currant production is not increasing setting of berries per bunch, but developing the berries that set. Undeveloped berries wither and drop in the course of bunch development, leading to disappearance of bunches, between flowering and harvest. For example, only 66 per cent of the bunches counted at full bloom were there to be harvested from untreated vines in 1967—1968, but the corresponding figure for the GA + CCC treatment, and also for the GA + PCPA treatment, was 97.5 per cent.

The failure of GA + PCPA to increase developed berries per cent in the second season may be associated with a reduction in the proportion of developed berries in the nil treatment in that season. If so the effectiveness of GA + PCPA would seem to be tied to environmental conditions favouring berry development. PCPA on its own was found to decrease the number of developed berries per bunch (El-Zeftawi and Weste 1970 c), and GA + PCPA has been reported to be unreliable, especially in comparison with cincturing (Logothetis 1966, El-Zeftawi and Weste 1970 b).

Susceptibility to splitting is here associated with amount of rain that fell during the 3 weeks prior to harvest and berry size. In 1968 10 mm of rainfall during that period resulting in 52 per cent splitting in the nil treatment, while in 1969 only 2 mm of rainfall during the same period and resulted in 9 per cent splitting. In both seasons splitting with GA + CCC did not differ significantly from splitting with nil treatment but there was a highly significant increase in splitting with GA + PCPA.

GA + PCPA treatment produced large berries which were highly susceptible to rain damage in both seasons, the GA + CCC treatment and the control produced smaller, more mature and less susceptible berries.

Although GA + PCPA appears equal to GA + CCC in its effect on average weight per bunch in this trial, it increased average berry splitting per cent here by 30.9 in 1967—1968 and by 35.9 in 1968—1969 compared with GA + CCC. By allowing

for this amount of splitting the average dried weight per bunch over the two seasons would be 30.2 g instead of 44.8 g for GA + PCPA in comparison with 38.8 g for GA + CCC, a reduction of 22 per cent.

Earlier data (El-Zeftawi and Weste 1970 a) and growers' observations have shown that GA + PCPA has inconsistent effects on total dried fruit yield from year to year. As this trial's results suggest, this may be due to the GA + PCPA treatment increasing berry susceptibility to splitting and to GA + PCPA being more effective in increasing developed berries per cent in a season favouring this anyhow.

Summary

Ten-year-old Zante currant vines (*Vitis vinifera* var.) were sprayed in two seasons with GA at 1 ppm + CCC at 100 ppm or GA at 1 ppm + PCPA at 20 ppm as soon as capfall was complete. The average number of flowers per bunch for a random selection of primary bunches was 568 in 1967 and 574 in 1968. Natural setting without treatment on these bunches was 66 per cent in 1967 and 44 per cent in 1968.

Berry development is the main problem in the production of Zante currant. Susceptibility to splitting was associated in this trial with amount of rain that fell during the 3 weeks prior to harvest and with berry size. Ten mm of rain caused 52 per cent splitting on untreated vines in one season while 2 mm of rain caused 9 per cent splitting in the other. Treatments with GA + CCC or GA + PCPA, although both improving berry setting, differ in their effects on the final quality and dried yield of these berries. GA + CCC produced acceptably sized berries with high sugar content, and of advanced maturity and colour, with less tendency to split, and high dried yield, while GA + PCPA produced excessively large sized berries with low sugar content and retarded maturity and colour, which split more readily, resulting in 22 per cent dried yield reduction over two years.

Acknowledgements

Thanks are due to Mr. H. M. Tankard, on whose property the trial was carried out, and to ICIANZ Ltd., and Cynamid D.H.A. Ltd. for supplying the GA and CCC.

The author is indebted to Mr. R. Jardine, of the Victorian Department of Agriculture, Melbourne, for statistical analysis, and to his colleagues Messrs. J. G. Baldwin and H. L. Weste for help with the manuscript and for technical assistance.

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Eingegangen am 12. 10. 1970

B. M. El-Zeftawi
Victorian Dept. of Agricult.
Horticult. Res. Station
Mildura, Victoria 3500
Australia