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Effects of some growth regulators on the fresh and dry yield of Zante currant (Vitis vinifera var.)

by

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Introduction

Satisfactory yields for Zante currant (syn. Black Corinth, a parthenocarpically setting cultivar of *Vitis vinifera*), for dried fruit in the Murray Valley irrigation areas of Australia, require cincturing (girdling) or treatment with growth regulators such as p-chlorophenoxyacetic acid (PCPA) (Weaver and Williams 1950; Coombe 1953; Blommert and Meynhardt 1955), gibberellic acid (GA) (Weaver 1958), or a combination of GA and PCPA such as recommended by the Victorian Department of Agriculture following unpublished work by Lloyd in 1960.

As a result of the weakening effect of cincturing on the vines, growth regulators have been used as a substitute for it (Weaver and Williams 1950; Coombe 1953). Antcliff (1967) found that PCPA was less effective and GA more effective than cincturing, but due to the high concentrations of GA required its use is regarded as uneconomic. Logothetis (1966) reported GA and PCPA as unsatisfactory compared with cincturing by the removal of a single ring of bark. However the present authors found that even the combinations of GA and PCPA were unfavourable because these treatments produced unacceptably large soft berries which are harder to dry, which split more readily and which have seed structures and lower sugar content. In practice it has been found that local dried fruit packing houses prefer samples with an average fresh berry weight of less than 0.5 grams.

Coombe (1965) found that (2-chloroethyl)-trimethyl ammonium chloride (CCC) increased set of Zante currant but the berries remained small and seedless. It might therefore be possible to increase yield substantially by increasing the number of berries with CCC and enlarging berry size with GA.

Accordingly two field trials were designed to compare the effect of PCPA, GA and CCC, alone and in combinations, on Zante currant yield and quality.

Materials and Methods

The main trial (trial I) was on ten-year-old currant vines on a commercial property. They were planted 2.4 metres apart in rows 3.3 metres apart running south-east to north-west, and were pruned to two buds above the basal group on single spurs. They had never been cinctured before this trial, but had been sprayed annually with GA at ½ ppm plus PCPA at 20 ppm as soon as capfall was complete.

Treatments were applied on single vine plots with 18 replications in randomized blocks. The treatments used were:

Control (no spray, no cincturing);
CCC at 100 ppm;
PCPA at 20 ppm;
GA at 1 ppm;
GA at 5 ppm;
GA at 1 ppm + CCC at 100 ppm;

GA at 1 ppm + PCPA at 20 ppm;
CCC at 100 ppm + PCPA at 20 ppm (second year only).

Two times of spraying were used — early (full bloom), late (two weeks later) — making 13 treatments in the first year and 15 in the second.

A complementary trial (trial II) was carried out in the 1967—68 season to compare overall sprays with bunch-directed sprays. This trial was on another property of forty-year-old vines which had been cinctured up to 1960, then sprayed each year with GA at ½ ppm + PCPA at 20 ppm until 1967. The treatments were combined sprays of GA at 1 ppm + CCC at 100 ppm; GA at 1 ppm + PCPA at 20 ppm; and CCC at 100 ppm + PCPA at 20 ppm, applied at full bloom. Plots were single vines replicated 6 times in randomized blocks.

Sampling for berry size by weight and for sugar content of the juice by refractometer was done for the 1967 harvest by three bulk samples each of 200 berries collected from the 18 replications, while in 1968 the samples were of 100 sound berries from each single vine plot. At harvest the total weight of fresh fruit for each vine was recorded and the corresponding weight of dried fruit was calculated from the relationship between fresh fruit weight and sugar content of the juice according to the relationship described by Lyon and Walters (1941) for sultanas. It has been shown by Antcliff (1967) that this calculated dry weight is usually slightly less than the actual dry weight. The present authors regard the estimates as valid, in spite of some wilting of berries at harvest in the second season. Average numbers of berries per bunch were also calculated for trial II.

Results

Yields of fresh fruit and calculated dried fruit per vine for 1967 and 1968 harvest are shown in Table 1.

From this table it is seen that for fresh fruit yields for the 1967 harvest the treatments fall into four groups in order of decreasing yield:

(a) late GA 1 + PCPA 20;
(b) early or late GA 5, early GA 1 + PCPA 20, early or late GA 1 + CCC 100, and late PCPA 20;
(c) all other treatments except late CCC 100;
(d) late CCC 100 and control.

For dried fruit yields at this harvest, however, the marked advantage of late GA 1 + PCPA 20 is lost and the treatments fall into two groups:

(a) early GA 5, early or late GA 1 + CCC 100, early or late GA 1 + PCPA 20, early or late PCPA 20 and early CCC 100;
(b) late GA 5, early and late GA 1, late CCC 100 and control.

For the 1968 harvest, for both fresh and dried fruit the highest yielding treatment is early GA 1 + CCC 100. For fresh fruit yields early GA 1 and early GA 1 + PCPA 20 are better than the remaining treatments and control, but their advantage is lost when dried fruit yields are considered. None of the late treatments gave any significant response in that season.

Table 2 shows the average sugar content of the juice and the average fresh berry weight for each treatment at the 1967 and 1968 harvests.

It is seen from this table that at the 1967 harvest, while all treatments except late CCC 100 increased berry weight over control, early or late GA 1 + PCPA 20 and early or late GA 5 do so to an unacceptable extent i. e. average fresh berry weight greater than 0.5 g. The four treatments giving unacceptably large berries also give

Table 1

Yields of fresh fruit and calculated dried fruit per vine at 1967 and 1968 harvests in trial I

Treatments (ppm)	Fresh fruit per vine (kg)		Dried fruit per vine (kg)	
	1967	1968	1967	1968
Full bloom:				
CCC 100	8.54*	6.85	3.59*	2.32
PCPA 20	8.90*	7.19	3.62*	2.17
PCPA 20 + CCC 100	—	8.28	—	2.55
GA 1	8.78*	9.16	3.51*	3.01*
GA 1 + CCC 100	10.83**	13.53**	4.15**	4.46**
GA 1 + PCPA 20	10.81**	8.70	3.76**	2.52
GA 5	11.72**	6.93	4.15**	2.43
2 weeks after full bloom:				
CCC 100	7.06	6.07	2.81	2.13
PCPA 20	10.47**	5.86	3.80**	1.83
PCPA 20 + CCC 100	—	6.03	—	2.50
GA 1	8.50	6.41	3.35	2.28
GA 1 + CCC 100	10.35**	6.63	4.03**	2.34
GA 1 + PCPA 20	13.46**	6.60	3.96**	2.11
GA 5	10.37**	6.79	3.54*	2.25
Control	6.99	6.68	2.92	2.36
L.S.D. from Control				
$P < 0.05$ (*)	1.53	1.72	0.56	0.58
$P < 0.01$ (**)	2.02	2.27	0.74	0.76

sugar content significantly less than control whereas no other treatment except late PCPA 20 gives a sugar content significantly different from control.

At the 1968 harvest, early PCPA 20, early PCPA 20 + CCC 100 and early GA 1 + PCPA 20 increased berry size to an unacceptable degree, with a significant decrease in sugar content. Early GA 1, early GA 1 + CCC 100, late PCPA 20 + CCC 100, late GA 1 + PCPA 20 and late GA 5 increased berry size over control without any significant decrease in sugar content. The remaining treatments gave berry size similar to control or reduced sugar content.

In trial II in 1968, comparing the effect of overall sprays and bunch-directed sprays, there were no differences between the two methods except in increased sugar percentage with bunch-directed GA 1 + CCC 100. However, studying the effects in this trial of the sprays themselves, as shown in Table 3, there is evidence of the way GA 1 + CCC 100 increases yield. There is a highly significant increase in the number of berries per bunch, with adequate berry size and sugar content.

Discussion

From the above results it appears that although GA ½ + PCPA 20 sprays have been recommended and widely used in Victoria as a substitute for cincturing since 1960, GA 1 + CCC 100 might be a better recommendation. In the first year of these trials GA 1 + CCC 100 gave as much dried fruit as any of the treatments, and in the second year much more dried fruit than any other treatment. The fruit from GA 1 + CCC 100 was of commercially acceptable size, seedless and of suitable

Table 2

Sugar content of juice and average fresh berry weight at 1967 and 1968 harvests in trial I

Treatments (ppm)	Sugar content (°Brix)		Average fresh berry weight (g)	
	1967	1968	1967	1968
Full bloom:				
CCC 100	31.3	27.5	0.31**	0.28
PCPA 20	30.7	25.7**	0.49**	0.63**
PCPA 20 + CCC 100	—	25.9**	—	0.68**
GA 1	30.4	27.2*	0.42**	0.43**
GA 1 + CCC 100	29.6	27.2*	0.49**	0.44**
GA 1 + PCPA 20	28.0**	25.3**	0.64**	0.66**
GA 5	28.3**	28.2	0.73**	0.32
2 weeks after full bloom:				
CCC 100	30.3	28.4	0.26	0.29
PCPA 20	28.7*	26.4**	0.44**	0.47**
PCPA 20 + CCC 100	—	27.8	—	0.48**
GA 1	30.1	28.4	0.39**	0.28
GA 1 + CCC 100	29.9	28.2	0.45**	0.27
GA 1 + PCPA 20	25.3**	26.8**	0.59**	0.50**
GA 5	27.7**	27.8	0.59**	0.39**
Control	31.2	28.2	0.23	0.28
L.S.D. from Control				
$P < 0.05$ (*)	1.92	0.97	0.06	0.06
$P < 0.01$ (**)	2.60	1.28	0.08	0.07

Table 3

Yields of fresh and calculated dried fruit per vine, bunches per vine, calculated berries per bunch, sugar content of juice, and average berry weight at 1968 harvest in trial II

Treatment (ppm)	Fresh fruit per vine (kg)	Dried fruit per vine (kg)	Bunches per vine	Berries per bunch	Sugar content (°Brix)	Average berry weight (g)
GA 1 + PCPA 20	13.52	3.78	142	158	24.6	0.63
GA 1 + CCC 100	13.43	4.29	135	210**	26.5**	0.51*
PCPA 20 + CCC 100	13.04	4.00	155	162	26.0**	0.53*
L.S.D.						
$P < 0.05$ (*)	2.80	0.87	25	34	0.9	0.10
$P < 0.01$ (**)	3.80	1.17	34	46	1.2	0.13

maturity as indicated by the sugar content of the berries. The increase in yield of dried fruit over the two years of trial I compared with GA 1 + PCPA 20 was 37 per cent.

Although GA and CCC act in opposite ways on fruit set, berry size, and sugar content of the juice, in combination the net effect for two years at least is to increase yield of dried fruit. Apparently in combination CCC can increase set and GA can maintain berry size.

The absence of the sizing effect from GA 5 in the second year of trial I could be because of the depletion of metabolites from the vines in the first year without any compensation for these lost metabolites in the second year, especially as this grower used no fertilizer during the trial. The lack of response from all the late treatments in the second year suggests a very critical time of application or an association with weather, which at that time was much cooler than usual.

Summary

The results of two trials with Zante currant vines (*Vitis vinifera* var. Zante currant, Black Corinth) are reported. Trial I was for two seasons on ten-year-old vines which had never been cinctured (girdled) but until this trial had been sprayed with GA ½ ppm + PCPA 20 ppm at full bloom. Trial II was for one season only on forty-year-old vines which had been cinctured up to 1960, then sprayed with GA ½ ppm + PCPA 20 ppm at full bloom until this trial.

In the first trial GA at 1 ppm + CCC at 100 ppm applied at full bloom increased the yield of dried fruit over two seasons by 37 per cent and 32 per cent compared with GA at 1 ppm + PCPA at 20 ppm and GA at 1 ppm respectively, while maintaining acceptable berry size and sugar content. The second trial suggests that this increase in yield is largely due to an increase in the number of berries per bunch with GA + CCC at the concentrations used here. There was little difference between overall sprays and bunch-directed sprays.

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