Vitis 11, 124—130 (1972)

Department of Agriculture, Mildura, Victoria, Australia

Effects of time of application of GA + CCC on yield and splitting of Zante currant Vitis vinifera var.

by

B. M. EL-ZEFTAWI and H. L. WESTE

Der Einfluß des Anwendungszeitpunktes von GS + CCC auf den Ertrag und das Platzen der Beeren bei Vitis vinifera „Zante currant"

Zusammenfassung. — Während dreier Vegetationsperioden, 1968/69 bis 1970/71, wurden zwei Versuche über den Einfluß von Konzentration und Anwendungszeitpunkt der Kombination Gibberellinsäure (GS) und CCC auf den Ertrag und das Platzen der Beeren bei Zante currant durchgeführt.

Im ersten Versuch hatte die Anwendung von 0,5 ppm GS + 50 ppm CCC, spätestens während der vollen Blüte — definiert als die Blühphase 1 Tag nach dem Abwerfen von etwa 90—95% der Calyptren — dieselbe Wirkung wie Verdoppelung der Konzentration, abgesehen von der Anzahl Beeren je Traube (früheste Behandlung) und dem Zuckergehalt (letzte Applikation). Der zweite Versuch erbrachte in zwei Vegetationsperioden die höchste Rosinenausbeute, wenn 1 ppm GS + 100 ppm CCC zwischen vollem Erblühen und 10 Tage danach angewandt wurden. In dieser Zeit wird auch die Ringelung vorgenommen.

Das Aufplatzen der Beeren war mit der Niederschlagsmenge gekoppelt, die während der drei Wochen vom 11. Januar bis 1. Februar fiel, sowie von Art und Zeitpunkt der Beerenansatz und -größe fördernden Spritzungen abhängig. In der Regenperiode vor der Ernte 1971, während der ein erheblicher Teil der Beeren aufplatzte, wurde bei den mit 1 ppm GS + 100 ppm CCC zur Zeit der vollen Blüte oder 4 Tage danach behandelten Reben der geringste Anteil geplatzter Beeren beobachtet, nämlich 42—46% gegenüber 76% bei den mit GS + PCPA behandelten Reben.

Introduction

The co-application of gibberellic acid (GA) and 2-(chloroethyl)-trimethyl ammonium chloride (CCC) to Zante currant (*Vitis vinifera* L.) at full bloom has been found to increase dried fruit yield, by CCC increasing berry set and GA increasing berry size (EL-ZEFTAWI and WESTE 1970; CONSIDINE and EL-ZEFTAWI 1971). It also advanced maturity and colouring and reduced berry splitting compared with applications of GA plus parachlorophenoxyacetic acid (PCPA) (EL-ZEFTAWI 1971).

Zante currant vines grown for dried fruit in the irrigated areas of the Murray Valley in Australia are mostly watered according to quite strict rosters to fit in with district organization. This has caused some practical difficulties in applying spray at the right time. Accordingly two field trials were conducted for detailed examination of the effects of time of GA + CCC applications and they are reported here.

Materials and Methods

Trials were made on 12-year-old commercial Zante currant vines, which had been treated with GA + PCPA until 1966 and with GA + CCC since then.

The first trial was carried out in the 1968—69 season, the second trial in the 1969—70 and 1970—71 seasons. In both trials 12 single vine replications were used in a randomised block design.

In the first trial two concentrations, GA 0.5 ppm + CCC 50 ppm and GA 1 ppm + CCC 100 ppm, were compared at three times of application, two weeks and

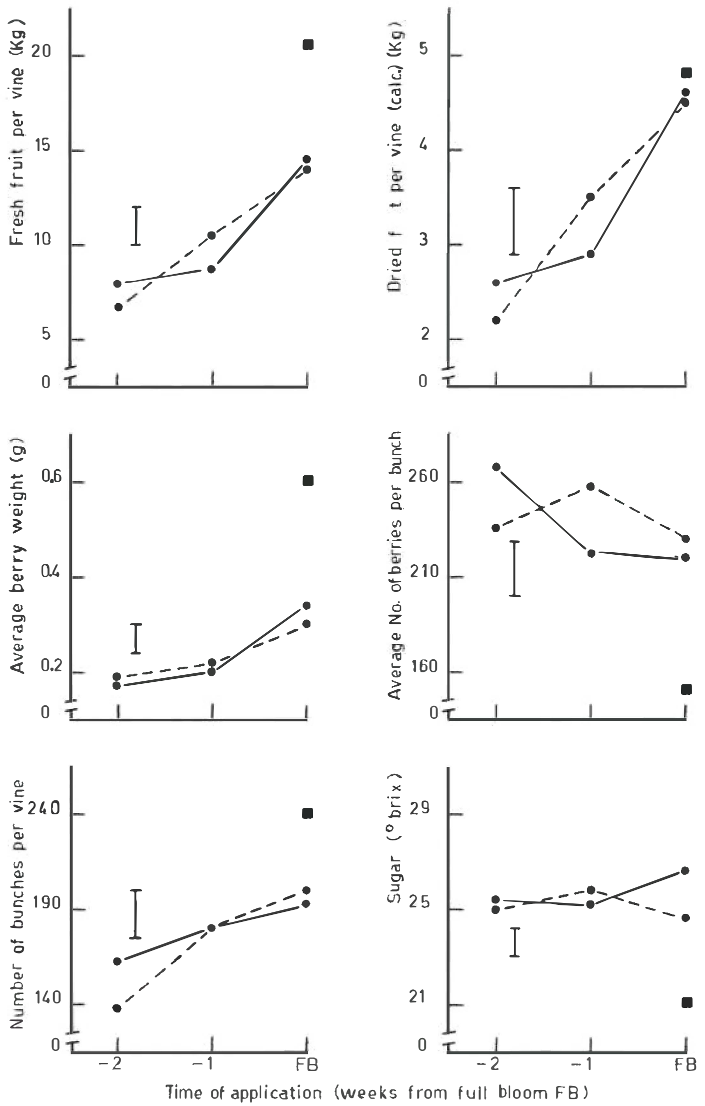

Fig. 1: Effects of GA + CCC in two concentrations applied two weeks and one week before full bloom, compared with GA + PCPA applied at full bloom, 1968—69 season.
● - - - - ● GA 0.5 ppm + CCC 50 ppm ●——● GA 1 ppm + CCC 100 ppm
■ GA 1 ppm + PCPA 20 ppm I L.S.D. ($P < 0.05$).

one week before full bloom and at full bloom. Full bloom in these trial was defined as the stage of flowering one day after an estimated 90 to 95 per cent of the calyptras had fallen.

In the second trial GA 1 ppm + CCC 100 ppm was compared at five times of application — ten and five days before full bloom, at full bloom, and four and ten days after full bloom. However, due to changeable weather in the 1970—71 season, the sprays before full bloom were actually 16 and 11 days before full bloom.

In each of the three years GA 1 ppm + PCPA 20 ppm, as first recommended departmentally in 1960, was applied at full bloom for comparison.

At harvest five bunches were collected at random from every vine for determination of bunch weight, number of berries per bunch (including undeveloped and split berries), splitting per cent, undeveloped berries per cent (defined as those berries which stopped at the setting stage), sugar (°Brix) and berry weight, as described by El-Zeftawi (1971).

The total yield of fresh fruit for each vine was recorded, undeveloped and split berries being included in this total, and the dried fruit yield was calculated from the relationship between fresh weight and sugar content of the juice described for sultanas by Lyon and Walters (1941). The number of bunches per vine was recorded.

Results

The results of the 1968—69 trial are shown in Fig. 1. GA 0.5 + CCC 50 was as effective as GA 1 + CCC 100 both on fresh and dried fruit yields and on berry weight at any time of application, but the effectiveness of both increased towards full bloom. GA 1 + CCC 100 compared with GA 0.5 + CCC 50 produced more berries per bunch when applied two weeks before full bloom and less berries per bunch one week before full bloom, and increased sugar percentage applied at full bloom.

GA + PCPA applied at full bloom increased fresh fruit yield, berry weight and bunches per vine but reduced berries per bunch and sugar content compared with any GA + CCC treatment. Consequently GA + PCPA did not increase dried fruit yield over GA + CCC except when GA + CCC were applied before full bloom.

The results of the second trial are shown for its two seasons in Figs. 2 and 3. Fig. 2 shows that GA + CCC produced maximum fresh fruit yields when applied from full bloom to ten days after, yields were as good as GA + PCPA in the first year and better than it the second. Sugar percentage tended to decrease with increases in yield but GA + PCPA produced lower sugar percentage in both seasons. For calculated dried fruit yields, Fig. 2 shows similar trends in both years of increasing yield until later application of GA + CCC, but in 1969—70 the only significant differences for timing of GA + CCC were between the earliest application and the two latest, and in 1970—71 between the earliest application and the one at full bloom. In the first season, dried yield from GA + PCPA was as good as GA + CCC but in the second it was significantly lower than the lowest-yielding GA + CCC treatment.

In 1969—70 GA + CCC applied four days after full bloom produced more bunches per vine than any other treatment (Fig. 2), but in 1970—71 the only significant differences were between this treatment and 16 days before, and GA + PCPA. Fig. 2 also shows berry weight increasing with later times of application in both seasons to a maximum at four days after, but GA + PCPA giving bigger berries than any GA + CCC treatment.

The total number of berries per bunch also shows a similar pattern in both years according to time of application of GA + CCC, but the lowest number occurs with the full bloom application (Fig. 2). GA + PCPA gave more berries per bunch than any GA + CCC treatment in the first year, but in the second year fewer berries per bunch than the two early treatments.

Fig. 3 shows how the highest percentage of undeveloped berries occurred "at full bloom" or "four days after" for GA + CCC. In 1969—70 the amount of undeveloped berries with PCPA was as much as this and even higher in 1970—71.

Fig. 3 also shows the effects of treatment timing on splitting, which was very different in the two seasons. In 1969 there was no rain in the three weeks before

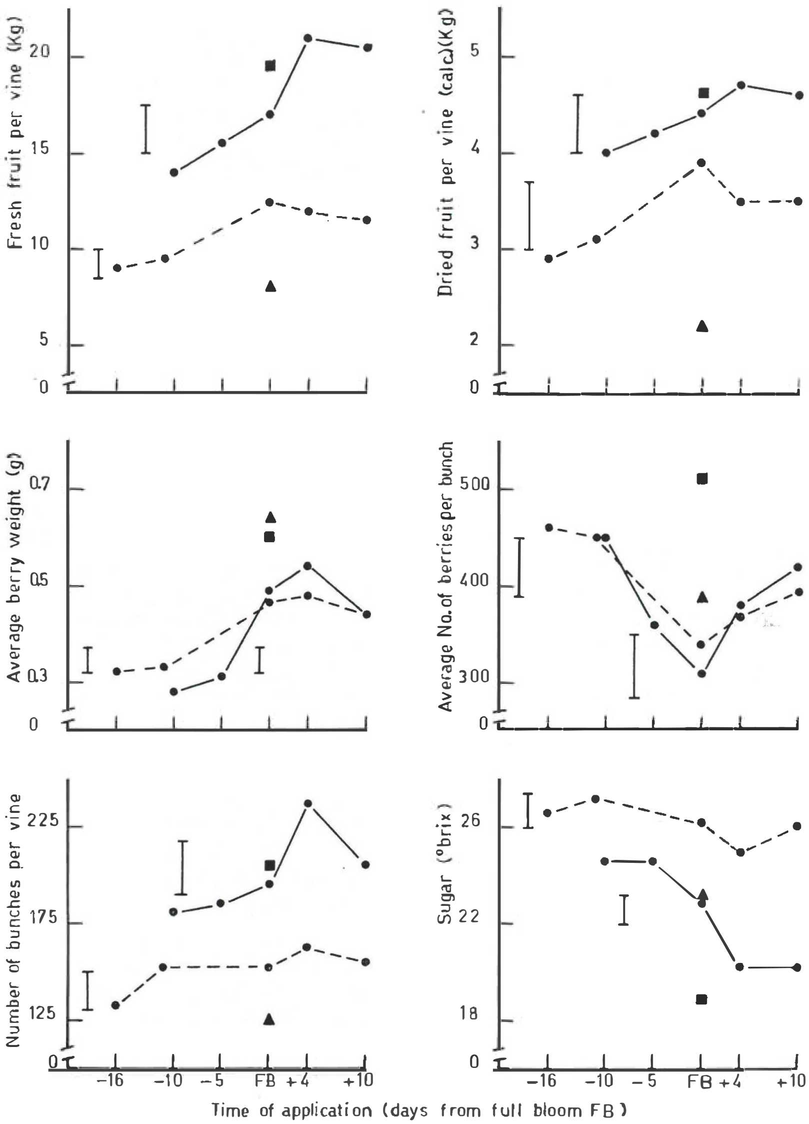

Fig. 2: Effects of time of GA + CCC application on yield of fresh fruit, calculated yield of dried fruit, sugar content of fruit, number of bunches per vine, average number of berries per bunch and average berry weight in 1969—70 and 1970—71 seasons.

● ——— ● GA 1 ppm + CCC 100 ppm applied in 1969—70
● - - - - ● GA 1 ppm + CCC 100 ppm applied in 1970—71
■ GA 1 ppm + PCPA 20 ppm applied in 1969—70
▲ GA 1 ppm + PCPA 20 ppm applied in 1970—71
I L.S.D. ($P < 0.05$).

harvest (from January 11 to February 1), and split berries averaged 7 per cent over the trial, while in 1971 there was 10 mm of rain in the same period and 60 per cent

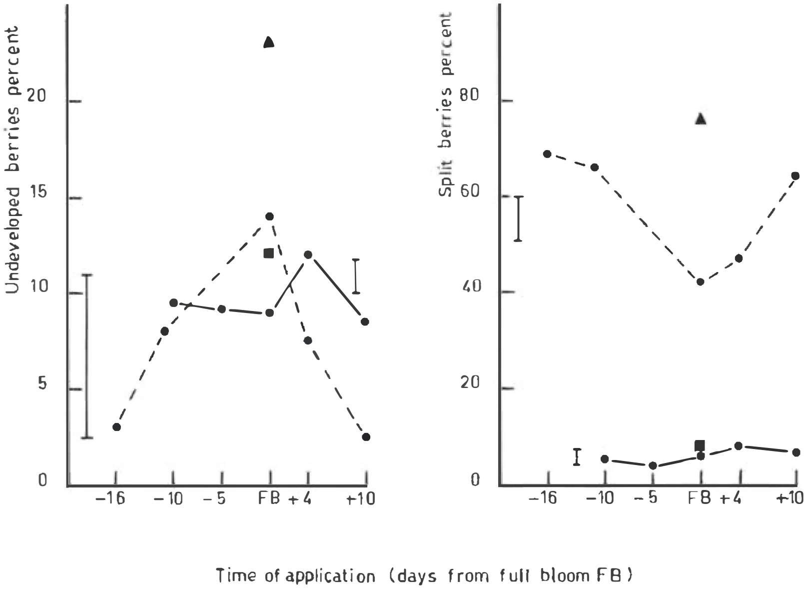

Fig. 3: Effects of time of GA + CCC application on split berries per cent and undeveloped berries per cent in 1969—70 and 1970—71 seasons.

● ——— ● GA 1 ppm + CCC 100 ppm applied in 1969—70
● - - - - ● GA 1 ppm + CCC 100 ppm applied in 1970—71
■ GA 1 ppm + PCPA 20 ppm applied in 1969—70
▲ GA 1 ppm + PCPA 20 ppm applied in 1970—71
I L.S.D. ($P < 0.05$).

split berries. In the first season, the pre-bloom sprays gave less splitting than GA + PCPA or post bloom GA + CCC, with full bloom GA + CCC intermediate in effect. In the wetter season, all GA + CCC treatments reduced berry splitting compared with GA + PCPA, but "at full bloom" and "four days after" gave far less splitting than any other treatment.

Discussion

From these trials GA 1 + CCC 100 applied at full bloom or up to ten days later is clearly superior for production of dried currants to GA 1 + PCPA 20 applied at full bloom and to earlier applications of GA 1 + CCC 100, confirming earlier findings of El-Zeftawi and Weste (1970 a), El-Zeftawi (1971), and Considine and El-Zeftawi (1971). The general effect of timing of GA + CCC on yield and on the standard components of yield, except number of berries per bunch and sugar content, is to increase from pre-bloom towards full bloom and four days later. The effect of GA + CCC timing on berry splitting was quite different in the two seasons, splitting in the second season being worse than in the first, but in the bad season GA + CCC at full bloom or four days after gave much less splitting than any other treatment including GA + PCPA.

Comparing GA 0.5 + CCC 50 with GA 1 + CCC 100 at full bloom, two weeks before and one week before, there were no significant differences due to concentrations at any time, except for the number of berries per bunch and sugar content.

Time of application and concentration used seem to influence these yield components. Lower concentrations than GA 1 + CCC 100 seem to be less effective in developing the berries, thus causing the collapse of the whole bunch during the growing season (El-Zeftawi 1971). In the 1968—69 trial GA 1 + CCC 100 applied one week before full bloom application reduced the number of berries per bunch compared with the two weeks before full bloom application. This partly agrees with the effective time of two to three weeks before full bloom for CCC application suggested by Coombe (1965) and partly with GA effects on decreasing set (Weaver and Sachs 1968).

However, our application at one week before full bloom may not have given comparable results to that of Coombe because of the difference in the definition of full bloom, which was in our case about three to seven days after that of Coombe.

In combination GA + CCC acts additively through increasing the number of berries by CCC and enlarging them by GA (El-Zeftawi and Weste 1970 a, Considine and El-Zeftawi 1971). However, the berries obtained with the combination are larger and fewer than those obtained with CCC alone, but smaller and more numerous than those with GA alone (El-Zeftawi and Weste 1970 a).

The differences in the number of bunches per vine due to the time of application are probably due to the very small bunches that set, where they would normally disappear without treatment (El-Zeftawi 1971).

It is of interest to note that the most effective timing of GA + CCC is the same as for cincturing (El-Zeftawi and Weste 1970 b). It is possible that both treatments act on the balance of growth regulators in the vine in a similar way at that time, and Weaver and Pool (1965) have in fact reported a change in the type of gibberellin-like substances 48 hours after cincturing.

GA + PCPA was found to increase berry set compared with GA + CCC only under favourable seasonal conditions (El-Zeftawi 1971). This increased set was accompanied by an increase of undeveloped berries, partly offsetting the value of the increased number of berries. GA + PCPA also produced less dried fruit yield in one year out of three, and in all years the berries produced were too large for commercial acceptance and of low sugar content. Further, GA + PCPA increased berry splitting in general and especially in the rainy pre-harvest period of the 1970—71 season.

It has been suggested (El-Zeftawi 1971) that splitting is associated with berry size and the amount of rain that fell during the last three weeks in January. Here the association of splitting with rain has been confirmed, but not with berry size. Berry size increased with time of application of GA + CCC up to four days after full bloom and decreased with the later application, while splitting in the rainy pre-harvest season of 1970—71 was exactly opposite, it decreased up to four days after full bloom then increased. This shows that spraying time influenced the GA + CCC effect on splitting. However, with GA + PCPA, where berry size was larger and sugar content was lower than that of GA + CCC, splitting did occur with nearly 80 per cent of the berries in the 1970—71 season. This suggested that for all treatments berry size and sugar content could be related to splitting, but regression analysis of a composite sample of 72 bunches from all treatments taken as an average of five bunches per vine failed to establish any significant correlations.

From the data presented here and from that of a previous trial (El-Zeftawi 1971), we suggest that splitting would only be related to the amount of rain in the last three weeks in January and the berry development chemical used.

Considine and Kriedemann (1972) have shown a relation between degrees Brix and osmotic pressure of berry juice, suggesting that berries should be more susceptible to splitting as their sugar content increases. In practice this does not happen as it seems that there is a susceptible stage during ripening at a certain degree Brix, beyond which no splitting will occur, apparently because the berry stem starts to senesce, preventing the intake of water which would cause enough pressure to split.

Summary

To find out the effect of the concentration and of the time of application of GA + CCC on yield and splitting of Zante currant, two trials were conducted over three seasons, 1968—69 to 1970—71.

In the first trial, in applications up to the time of full bloom (defined as the stage of flowering 1 day after an estimated 90—95 per cent of the calyptras had fallen) GA 0.5 ppm + CCC 50 ppm was as good as twice the concentration except for berries per bunch (earliest application) and sugar content (latest application). The second trial showed over two seasons that GA 1 ppm + CCC 100 ppm gave the highest yields of dried fruit if applied between full bloom and ten days later. This timing is the same as for cincturing.

Splitting was found to be associated with the amount of rain that fell during the three weeks from January 11 to February 1 and with the nature and timing of the berry setting and sizing spray. In the rainy pre-harvest season of 1970—71 when splitting of currants was very bad, least splitting occurred with GA 1 + CCC 100 at full bloom or four days after — 42 to 46 per cent, compared with 76 per cent with GA + PCPA.

Acknowledgements

Acknowledgements are due to Mr. H. M. Tankard for permission to use his vines. We are indebted to Mr. R. Jardine for statistical analysis, to Mr. J. G. Baldwin for help with the manuscript and to Miss D. Hahn for technical assistance. GA and CCC were supplied by ICIANZ and Cynamid DHA Ltd.

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Eingegangen am 17. 11. 1971

B. M. El-Zeftawi
Horticultural Research Station
Department of Agriculture
Mildura, Victoria, 3500
Australia