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Effect of time of application of potassium gibberellate on cluster development of 'Zinfandel' grapes

by

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Einfluß des Anwendungszeitpunktes von Kalium-Gibberellat auf die Traubenentwicklung von Reben der Sorte Zinfandel

Zusammenfassung. — Reben der Sorte Zinfandel wurden mit 10 ppm Kalium-Gibberellat besprüht, und zwar wenn die Triebe 12, 25 oder 50 cm lang waren, oder wenn 50% der Blütenkäppchen abgefallen waren. An 13 verschiedenen Daten (29. April bis 10. Juni) sowie zur Beerenreife wurden mehrere Parameter ermittelt. Frühzeitige Anwendungen förderten das Längenwachstum der Triebe; bis zum 1. Juni waren die Unterschiede zwischen den Varianten jedoch wieder ausgeglichen. Die ersten drei Behandlungen hatten ein schnelleres Längenwachstum der Trauben zur Folge; bis zum 10. Juni waren aber auch diese Unterschiede gegenüber den Kontrollen nicht mehr signifikant. Die Entwicklung der basalen Geiztriebe verlief ähnlich. Die Beerenstiele wuchsen nach Behandlung schneller und waren am 10. Juni durchweg länger als die der Kontrolle. Bei der Reife waren die in den ersten drei Wachstumsphasen besprühten Beeren kleiner als die Kontrollbeeren. Der Wachstumsstillstand trat zuerst bei den Trauben, dann bei den Beeerenstielen, den Geiztrieben und zuletzt bei den Trieben auf.

Introduction

Some growers in California and other areas apply prebloom sprays of gibberellin to loosen clusters of 'Zinfandel' and other compact-clustered cultivars of wine grapes to prevent or diminish rotting. The loosening effect is attributed to a decrease in fruit-set and an increase in cluster length. The present recommendation is to spray vines 2 or 3 weeks before bloom, when the longer shoots are 38 to 41 cm in length and clusters average 7 to 10 cm (2). There is little information on effects of earlier or later treatments. The primary objective of this research was to study the effect of gibberellin applied at various stages from beginning of shoot growth to bloom, on cluster loosening and other parameters. Another objective was to follow the synchronization between growth of shoots and cluster parts.

Materials and Methods

Mature, head-trained spur-pruned, vines of 'Zinfandel' growing in an irrigated vineyard at the University of California, Davis, were used. The vines were sprayed with 10 ppm potassium gibberellate (KGA_3) in a solution containing 0.1% B-1956 as a wetting agent, on each of four dates: 1) April 19, 1971, when the average shoot length was approximately 12 cm, and the length of the average cluster was about 5 cm; 2) on April 30, when shoot length averaged 25 cm and cluster length 8 cm; 3) on May 13, 2 weeks prior to bloom, when the average shoot length was 50 cm and cluster length averaged 10 cm; and 4) on May 28, when the shoots were approximately 100 cm long, and the clusters were about 14 cm in length and at 50% bloom (50% of calyptra fall). There were 10 replicate vines per treatment, and a randomized block design was used.

At the beginning of the experiment, one shoot per vine was tagged and thinned to one cluster, and the wing, if any, removed. On 13 dates between April 29 and June 10, shoot length, cluster length, length of the basal lateral, and pedicel length (5 per cluster) were determined, and an estimate of percent bloom was made for

each vine. Measurements were discontinued after June 10 because shoot growth became very erratic. Prior to application of KGA_3 at bloom, individual clusters at 50% bloom were tagged for later identification.

Crop weight per vine was taken on September 13, when fruits were mature (Table). All clusters on the tagged shoots were harvested and the following values were determined: 1) weight per berry; 2) number of berries per cm of rachis; 3) weight of berries per cm of rachis; 4) lateral length; 5) looseness percent (estimate of percent of volume of cluster not occupied by berries); 6) soluble solids, measured by a hand refractometer; and 7) percent total acid as determined by titration with NaOH, using phenolphthalein as an idicator. All data were subjected to analysis of variance followed by DUNCAN's Multiple Range Test.

Results

Shoot length

Vines sprayed with KGA_3 on the earliest date initially developed longer shoots than did controls or vines treated at later dates (Fig. 1). However, by June 1, no differences in shoot length existed among any of the treatments, and even as late as June 22 the shoots were still actively growing.

Cluster length

There was a rapid increase in length of cluster in response to application of KGA_3 on all of the first three treatment dates (Fig. 2). The clusters became signi-

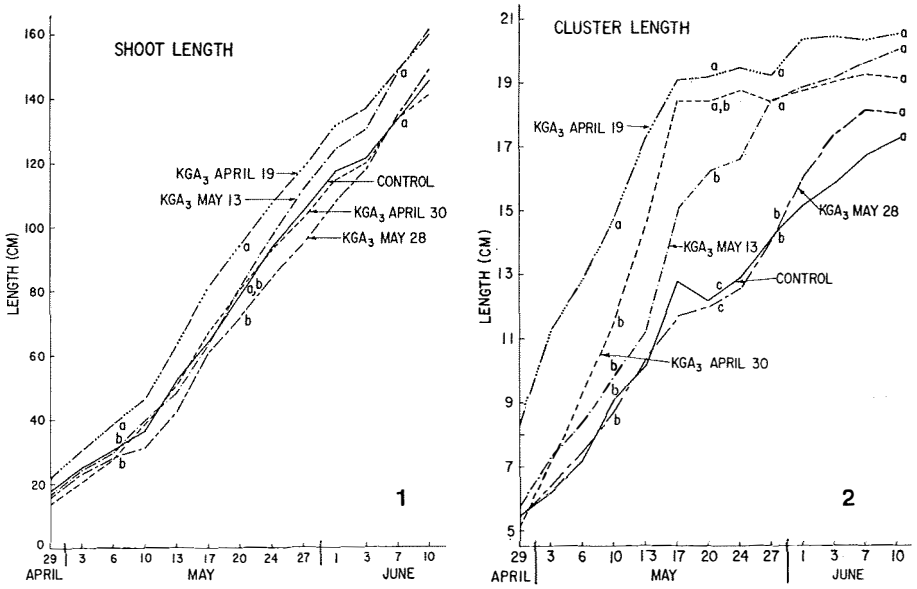

Fig. 1: Effect of time of application of KGA_3 at 10 ppm on shoot growth of 'Zinfandel' grapes.

Fig. 2: Effect of time of application of KGA_3 at 10 ppm on cluster length of 'Zinfandel' grapes.

Abb. 1: Einfluß des Anwendungszeitpunktes von 10 ppm Kalium-Gibberellat auf das Triebwachstum von Zinfandel-Reben.

Abb. 2: Einfluß des Anwendungszeitpunktes von 10 ppm Kalium-Gibberellat auf das Längenwachstum der Trauben von Zinfandel-Reben.

ficantly longer than those on the controls within 8 to 10 days after treatment. Growth of these treated clusters slowed appreciably after attaining a length of approximately 18 to 19 cm. The controls, however, continued to grow steadily; and by June 10, their mean value was not significantly different from that of any of the treatments. The slowing of cluster growth occurred in the first two treated sets of vines more than 3 weeks before a similar slowdown began in the controls.

Basal lateral length

Growth of the basal lateral in response to application of KGA_3 was similar to that of cluster length (Fig. 3). Although the earliest treatment resulted in significantly longer laterals initially, such differences were found to be temporary. Growth of laterals on both treated and control vines was steady until about June 7, when the average lateral length ranged from 4.1 to 4.9 cm.

Pedicel length

Pedicel length also increased in response to application of KGA_3 (Fig. 4). In the first three sets of treated vines there was a rapid increase in pedicel length, followed by a tapering off in the rate of elongation of the first two spray treatments on about May 27 while pedicels in the control and the last two treatments continued to elongate. However, unlike with cluster length, the rate of growth of control

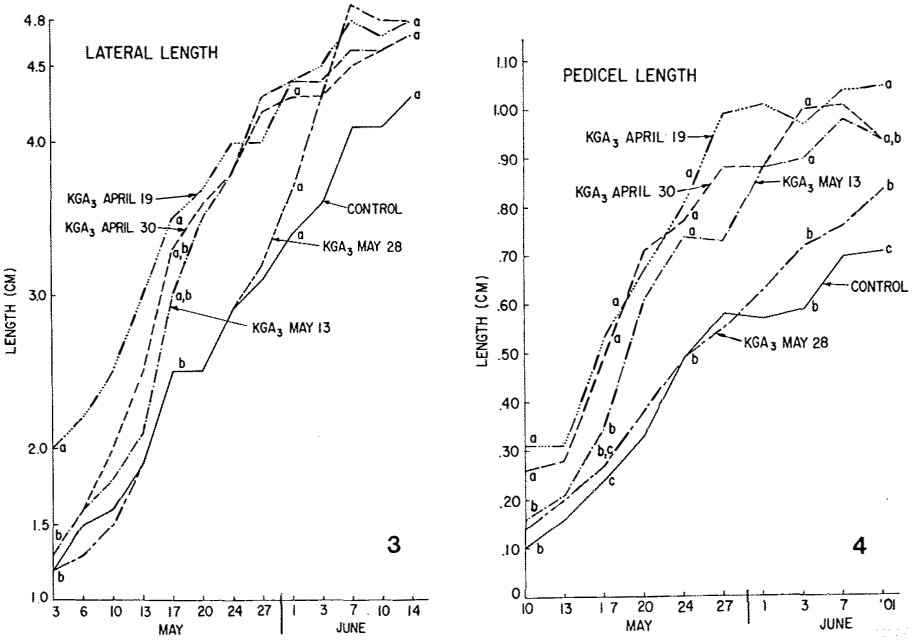

Fig. 3: Effect of time of application of KGA_3 at 10 ppm on elongation of a basal lateral of 'Zinfandel' grapes.

Fig. 4: Effect of time of application of KGA_3 at 10 ppm on pedicel length of 'Zinfandel' grapes.

Abb. 3: Einfluß des Anwendungszeitpunktes von 10 ppm Kalium-Gibberellat auf das Längenwachstum der basalen Geiztriebe von Zinfandel-Reben.

Abb. 4: Einfluß des Anwendungszeitpunktes von 10 ppm Kalium-Gibberellat auf das Längenwachstum der Beerenstiele von Zinfandel-Reben.

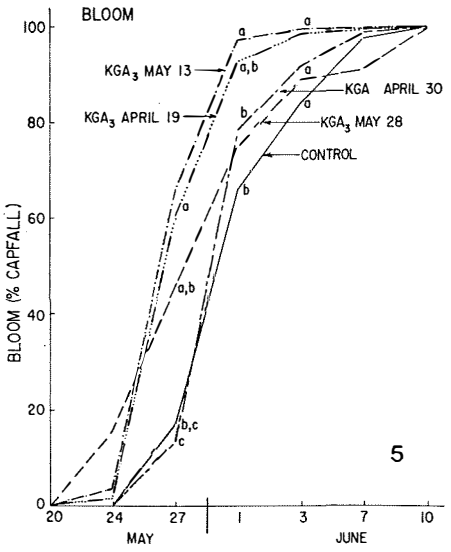

Fig. 5: Effect of time of application of KGA_3 at 10 ppm on time of bloom of 'Zinfandel' grapes.

Einfluß des Anwendungszeitpunktes von 10 ppm Kalium-Gibberellat auf den Blühbeginn bei Zinfandel-Reben.

pedicels decreased to such a point as to cause the final pedicel lengths for the treated vines to be significantly higher than those of the untreated.

Effect on bloom

Application of KGA_3 on April 19 and May 13 hastened significantly the onset of bloom (Fig. 5). Vines in these two treatments bloomed approximately half a week ahead of those in the other treatments.

Clusters at harvest

At harvest, there were no significant differences among vines in any of the treatments with respect to crop weight per vine, number or weight of berries per cm of rachis, or length of laterals (Table). Berries in all KGA_3 treatments except bloom application were significantly decreased in weight. All treatments tended to decrease cluster compactness; but only the second treatment, when the shoots were approximately 25 cm in length, caused the clusters to be significantly loosened. KGA_3 treatments also tended to increase levels of soluble solids, but the increase was significant only for the treatment 2 weeks prior to bloom. Total acid was decreased by KGA_3 when applied on any of the first three treatment dates.

Discussion

It is well documented that gibberellin sprays applied at prebloom stage to compact-clustered wine grapes cause loosening of clusters by reducing fruit-set and increasing cluster length (1, 3, 4, 5, 8). In California, the present recommendation is to apply gibberellin 2 or 3 weeks before bloom when shoots are 38 to 41 cm long (2). However, there have been few detailed studies comparing results obtained by earlier or later sprays, with those obtained by using the recommended time of application.

In the present study, there was no slackening of shoot growth of control or treated vines until after June 10, but increase in cluster length dropped sharply after May 17. Growth of laterals ceased or slowed down by June 7. By May 27 a drop off in pedicel elongation began. Thus the clusters were first to slow down in growth, followed by pedicels, lateral length, and shoots, respectively.

WEAVER and POOL (7) reported that bloom sprays of gibberellin on 'Zinfandel' or 'Tokay' failed to increase cluster length, in agreement with results with 'Zinfandel' in the present study. Therefore, fruit-set is apparently a major factor involved in cluster loosening. However, in the present experiment, an increase in pedicel length as a result of KGA_3 application may have enhanced the loosening.

T a b l e

Data at harvest (September 13) for 'Zinfandel' vines sprayed at various times with KGA_3 at 10 ppm[1])

Werte für Zinfandel-Reben zur Zeit der Lese (13. September), nach Besprühen mit KGA_3 10 ppm zu verschiedenen Zeitpunkten

Time of treatment	Crop weight (lb)	Wt per berry (g)	No. of berries per cm rachis	Wt of berries per cm rachis	Lateral length (cm)	Looseness[2]) %	Soluble solids (%)	Total acid (%)
Control	45.8a	2.3a	7.2a	16.7a	4.6a	11.0b	16.8b	1.09a
Shoot length 12 cm	39.8a	1.8b, c	8.1a	14.5a	4.5a	17.1a, b	19.1a, b	0.94b
Shoot length 25 cm	38.7a	1.8b, c	6.1a	10.9a	4.0a	32.0a	19.2a, b	0.92b
2 weeks prebloom	32.6a	1.6c	8.1a	12.8a	4.9a	20.5a, b	21.1a	0.90b
50% bloom	32.5a	2.2a, b	6.9a	15.0a	4.7a	20.0a, b	19.3a, b	1.0a, b

[1]) Within a column, means followed by the same letter are not significantly different at the 5% level.

[2]) Cluster looseness increases with higher values.

The decrease in berry size resulting from the first three applications of KGA_3 was not unexpected. Previous research (6) had indicated that gibberellin decreases berry size, and that the reduction is associated with a lower seed number.

Although KGA_3 hastened flowering by 3 or 4 days, this factor would be of little importance in advancing harvest dates. The daily heat units in the hot summer months contribute far more to the total heat requirements required for grapes to reach maturity than do the smaller heat units accumulated in the spring.

Summary

'Zinfandel' grapevines were sprayed with KGA_3 at 10 ppm when shoots were about 12, 25, or 50 cm long, or at bloom (50% calyptra fall). On 13 subsequent dates (April 29 to June 10), and at fruit maturity, various parameters were measured. Early applications of KGA_3 increased shoot length, but by June 1 there were no differences among treatments. The first 3 treatments caused rapid increases in cluster length, but by June 10 lengths were not significantly different from the controls. Development of the basal lateral followed a similar trend. Pedicel length increased rapidly as a result of treatment, and on June 10 all treated pedicels were longer than those of the controls. At maturity, berries sprayed at the first 3 stages were smaller than control berries. The cessation of growth in length occurred first in clusters, followed by pedicels, laterals, and shoots, respectively.

Acknowledgment

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Literature Cited

1. ALLEWELDT, G., 1960: Die Wirkung der Gibberellinsäure auf Reben. Kali-Briefe 5, 1—8. Bern: Internationales Kali-Institut.
2. BARNES, M. M. *et al.*, 1973: Pest and disease control program for grapes. Ext. Serv. Exp. Sta., Div. Agricult. Sci., Univ. Calif.
3. JULLIARD, B. and BALTHAZARD, J., 1965: Effets physiologiques de l'acide gibbérellique sur quelques variétés de vigne (*Vitis vinifera* L.). Ann. Amélior. Plantes 15, 61—78.
4. RIVES, M. et POUGET, R., 1959: Action de la gibberelline sur la compacité des grappes de deux variétés de vigne. C. R. Séances Acad. Agricult. France 45, 343—345.
5. WEAVER, R. J. and MCCUNE, S. B., 1959: Response of certain varieties of *Vitis vinifera* to gibberellin. Hilgardia 28, 297—350.
6. — — and — — , 1960: Further studies with gibberellin on *Vitis vinifera* grapes. Bot. Gaz. 121, 155—162.
7. — — and POOL, R. M., 1971: Thinning 'Tokay' and 'Zinfandel' grapes by bloom sprays of gibberellin. J. Amer. Soc. Hort. Sci. 96, 820—822.
8. WILHELM, A. D., 1959: Über die Wirkung von Gibberellinsäure auf Reben. Wein-Wiss. 13, 45—54.

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