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EFFECTS OF GIBBERELLIC ACID (GA3) ON YIELD AND QUALITY OF GRAPES

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Gibberellic acid (GA3) is used extensively to increase berry size of Thompson Seedless and other *Vitis vinifera* seedless table grapes (3,5,6,7,8,9, 10,13,14,15). These cultivars are usually treated with GA3 twice during the growing season: once during bloom to decrease fruit set and increase berry size, and again at berry shatter to further increase berry size (3,10,14,15). GA3 can also be used to thin the clusters of seeded *V. vinifera* cultivars (7,10, 11,12,15).

Very little information is available on the effects of GA3 on Concord and other *V. labrusca* cultivars (1,2_,4). GA3 has induced seedlessness and accelerated maturity in Delaware (4) and increased fruit set in Concord (2). The effects of GA3 on Concord grapes need to be further investigated, especially with the recent interest in the Concord cultivar as a table grape in the eastern U.S. In addition, there is a need for information on the effects of GA3 on Reliance, a new seedless table grape released by Dr. J.N. Moore of the Department of Horticulture at the University of Arkansas. The purpose of this research was to examine the effects of GA3 on the yield and quality of Concord and Reliance.

MATERIALS AND METHODS

Concord Study:

Gibberellic acid (GA3) alone and in combination with $MgSO_4$ was again applied at various application times in 1981. However, vines used in this study were 30 years old and GDC trained. Vine spacing in this vineyard was also 2.4 m between plants within the row and 3 m between rows. The following treatments were applied:

1) GA3 at 100 mg/L applied 4 days after peak bloom
2) GA3 at 100 mg/L applied 14 days after shatter
3) GA3 at 100 mg/L applied 14 days after peak bloom
4) GA3 at 100 mg/L applied 4 days after shatter
5) GA3 at 100 mg/L plus 3% (wt/v) $MgSO_4$ applied 14 days after peak bloom
6) GA3 at 100 mg/L plus 3% (wt/v) $MgSO_4$ applied 14 days after shatter
7) Control

The experimental design was completely randomized with 4 replications. At harvest, individual vine yields were determined and 3 basal clusters from each plot were frozen in polyethylene bags for later analysis.

The GA3 used was supplied by Abbot Laboratories (Chemical and Agricultural Products Division, North Chicago, Illinois). All treatments were applied to 1-vine plots using a 10 L hand sprayer and 0.1% Buffer-x (a surfactant supplied by Abbott). All fruit and foliage were wetted to the point of drip, which required approximately 2.4 L per vine.

At harvest (when the soluble solids of the control fruit reached 16%), 3 basal clusters were collected from each plot and frozen in polyethylene bags for later analysis. For analysis, berry weight and percent green berries were determined from the frozen samples. Samples were subsequently thawed overnight at 2^oC, blended and percent soluble solids determined on a Bausch and Lomb Abbe refractometer. Titratable acidity was determined by diluting a 5 mL sample to 125 mL with deionized water and titrating to pH 8.4 with 0.1 N NaOH. Titratable acidity is expressed as percent tartaric acid. Data were subjected to analysis of variance with Duncan's multiple range test (5%) used to separate means.

Reliance Study:

Commercial vineyards of Reliance grapes located in Altus, Arkansas, were used in this study. Vines were 5 years old and trained to a 6-arm Kniffen training system. Vines were spaced 2.4 m within the row with 3.4 m between rows. GA3 treatments were applied after berry shatter in 1983 and 1984. The treatments applied were: 1) 10 g GA3/acre applied 3 days after shatter; 2) 20 g GA3/acre applied 3 days after shatter; 3) 10 g GA3/acre applied 3 days after shatter and again 7 days later; 4) 20 g GA3/acre applied 3 days after shatter and again 7 days later; and 5) control.

All treatments were applied with 440 L water/acre (23 and 46 mg/L GA3) with a 1890-L commercial sprayer. Buffer-x was applied with each treatment at a rate of 0.1% (v/v). Each plot consisted of 15-20 vines. The experimental design was a randomized complete block with 3 blocks.

At commercial harvest, four vines in each treatment were harvested and the yield was determined. Two clusters from each of the four vines were frozen in polyethylene bags for later analysis. Fruit analysis was identical to the Concord analysis. Data were subjected to analysis of variance and F-tests, with Duncan's multiple range test (5%) used to separate means.

RESUITS AND DISCUSSION

There was an increase in Concord berry size when GA3 was applied at 100 mg/L, 4 or 14 days after shatter with or without the addition of 37 $MgSO_4$ (Table 1). However, the most consistent positive response of Concord grapes to the application of GA3 was the reduction of uneven ripening (% green berries).

Table 1. Effects of GA3 alone and in combination with $MgSO_4$ on the yield and quality of Concord grapes, 1981.

Treatment	Yield (MT/ha)	Berry weight (g)	Green berries (%)	Soluble solids (%)	pH	Acidity (% tartaric)
Control	6.7a[z]	2.86b	33.4a	13.6b	3.40a	1.05a
GA3 at 100 mg/L 4 days post peak bloom	3.4a	2.31c	41.4a	15.5a	3.36a	1.00a
GA3 at 100 mg/L 14 days post shatter	7.8a	3.47a	12.6b	14.8ab	3.50a	0.84b
GA3 at 100 mg/L 14 days post peak bloom	4.5a	2.54bc	14.9b	15.9a	3.50a	0.83b
GA3 at 100 mg/L 4 days post shatter	9.0a	3.42a	15.6b	14.7ab	3.54a	0.88b
GA3 at 100 mg/L + 3% Mg504 14 days Post peak bloom	6.7a	2.55bc	12.6b	15.7a	3.51a	0.86b
GA3 at 100 mg/L + 3% MgS04 14 days After shatter	6.2a	3.45a	5.2b	15.6a	3.54a	0.79b

[z]Means separated by Duncan's multiple range test at the 5% level.

As expected, Reliance, a seedless grape released by Dr. J.N. Moore of the Department of Horticulture at the University of Arkansas, had a significant increase in yield from the application of GA3. Applications of GA3 at 10 g or 20 g per acre at 3 and 7 days after shatter resulted in increases in berry size and yields over the control (Table 2). There was little significant effect on quality of this cultivar from the GA3 sprays.

In summary, it is obvious from these results that GA3 could be used if larger berry size is desired. Also increased yields can be expected with the significant quality loss with the Reliance cultivar. In 1981, uneven ripening was reduced in the Concord cultivar.

Table 2. Effects of GA3 on the yield, berry weight and quality of Reliance grapes (2 yr. means).

Treatment[z]	Yield (t/ha)	Berry weight (g)	Soluble solids (%)	pH	Aciditv (% tartaric)
10g GA3 - 3 days post shatter	16.2bc	2.68c[y]	17.0a	3.51a	0.52b
20g GA3 - 3 days post shatter	17.5bc	3.03b	17.3a	3.54a	0.52b
10g GA3 - 3 days post shatter + 7 days later	19.0ab	2.98b	17.1a	3.48a	0.53b
20g GA3 - 3 days after shatter + 7 days later	20.9a	3.28a	16.5a	3.48a	0.57a
Control	15.4c	2.38d	17.7a	3.60a	0.53b

[z] Calculated on a per acre basis.
[y] Means separated by Duncan's multiple range test at the 5% level.

I feel that it would be appropriate to briefly discuss the recommendations for use of GA3 in California. They are as follows: 1) For cluster elongation ("stretch"), looser cluster forms, and reducing cost of thinning, when used in conjunction with established girdling and thinning practices. Guide: Apply 3 to 8.5 grams/A before bloom when flower clusters are 3 to 5 inches long; 2) For decreased berry set ("thinning"), reducing hand-thinning costs, and hastened maturity. Guide: Apply 3 to 12 g/A during bloom. Higher amounts may cause an excess of shot berries or overthinning, except in high density plantings; 3) For larger berries ("sizing") and larger clusters when used in conjunction with established girdling and thinning practices. Guide: Apply 32 to 80 g/A when average berry size is 13/64" in diameter or as two applications of equal amounts with the first made at or 2 to 3 days after shatter, followed during the next two weeks by the second application. Timing of the second spray will be dictated by experience in the vineyard to be sprayed and temperatures occurring during the interim between sprays. Potential effect will be reduced if the second spray occurs more than two weeks after the first application; 4) For all grapes, application is recommended by ground sprayer. Use 100 to 500 gallons as a dilute spray according to foliage density, or 30 to 80 gallons as a concentrate spray. Do not exceed maximum rates. It is important to wet all berries thoroughly.

Additional research will be needed to establish guidelines for the proper use of gibberellic acid for the new seedless grape cultivars that have been released by Dr. J.N. Moore. However, it should be remembered that it will be extremely important to determine not only yield responses but also the influence of this growth regulator on product quality.

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