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Effect of application of naphthaleneacetic acid on berry thinning of Carignane grapes

by

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Einfluß der Naphthylessigsäure-Behandlung auf das Ausdünnen der Trauben bei der Rebsorte Carignane

Zusammenfassung. — Wurden die Infloreszenzen der Sorte Carignane mit NES behandelt, wenn 70 % der Calyptren abgefallen waren, so waren sowohl der Beerenansatz als auch das Gewicht je Traube herabgesetzt. Der Traubenertrag je Rebe war bei Anwendung von 10 und 25 ppm NES zur Blütezeit und ebenso bei Behandlung mit 25 ppm NES 2 Wochen nach der Blüte verringert. Die gesamte titrierbare Säure war jedoch bei keiner Variante verändert. Die durch NES-Anwendung in der Blühphase erzielte Lockerbeerigkeit der Trauben verstärkte sich durch höhere Konzentrationen.

Das Umweltschutzamt der USA hat über die Zulassung von NES als Ausdünnungsmittel noch nicht entschieden.

Introduction

The utilization of chemical compounds as thinning agents is advisable on grapes where the environment is conducive to fungus development, especially on compact-clustered varieties. Bunch rot can be very injurious to grapes, adversely affecting their quality, appearance, and crop yield.

Presently many growers in California are using gibberellin on some compact clustered wine grapes at pre-bloom time (two or three weeks before bloom) at concentrations that vary with the variety. The use of other plant regulators to thin compact seeded varieties has not been done commercially. However, naphthaleneacetic acid (NAA) has shown promise in some earlier experiments (Weaver 1954, 1963, 1972, Samish and Lavee 1958, Zuluaga *et al.* 1968, Dhillon and Sharma 1973).

The objective of this research was to determine the most appropriate concentration of NAA and the best time to apply it to the vines, in order to achieve the desired thinning effect.

Materials and methods

Mature vines of Carignane were used in a vineyard of the University of California at Davis. The vines were head-trained, spur-pruned.

The solutions of NAA were sprayed on May 18 (bloom), June 1 (2 weeks after bloom), June 17 (4 weeks after bloom), and July 2 (6 weeks after bloom). Vines were completely wetted by the sprays using an 8-L Hudson sprayer.

NAA was obtained from Amchem Products, Inc. The parameters weight per cluster, °Brix, total titratable acidity, and cluster looseness were measured from

Table 1

Effect of NAA applied at four different concentrations and four different dates on crop yield (kg) per vine of Carignane grapes. Grapes were harvested on September 14, 1976

Einfluß der NES-Anwendung in vier verschiedenen Konzentrationen und zu vier verschiedenen Terminen auf den Traubenertrag je Rebe (kg) bei der Sorte Carignane. Traubenernte am 14. September 1976

Concentration of NAA	Time of application of NAA			
	Bloom[1]) May 18	2 weeks after bloom June 1	4 weeks after bloom June 17	6 weeks after bloom July 2
0[2])	17.92 1 a	20.10 1 a	21.12 1 a	19.70 1 a
5 ppm	16.30 1 ab	17.37 1 ab	20.97 1 a	21.77 1 a
10 ppm	11.50 2 bc	16.15 2 abc	18.90 1 a	18.02 1 a
25 ppm	8.47 2 c	11.25 2 c	21.45 1 a	18.47 1 a

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

[2]) Within a row, mean values followed by the same number are not significantly different at the 5 % level.

Table 2

Effect of NAA applied at four different concentrations and four different dates on weight (g) per cluster of Carignane grapes. Grapes were harvested on September 14, 1976

Einfluß der NES-Anwendung in vier verschiedenen Konzentrationen und zu vier verschiedenen Terminen auf das Gewicht je Traube (g) bei der Sorte Carignane. Traubenernte am 14. September 1976

Concentration of NAA	Time of application of NAA			
	Bloom[1]) May 18	2 weeks after bloom June 1	4 weeks after bloom June 17	6 weeks after bloom July 2
0[2])	277 1 a	317 1 a	294 1 a	326 b 1
5 ppm	191 2 b	320 1 a	323 1 a	387 1 ab
10 ppm	161 3 bc	265 2 a	298 2 a	384 1 ab
25 ppm	92 3 c	270 2 a	321 2 a	402 1 a

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[2]) Within a row, mean values followed by the same number are not significantly different at the 5 % level.

three tagged clusters in each vine. However, crop yield per vine was determined by weighing the total production of each vine.

The experiment had a factorial $4 \times 4 \times 4$, completely randomized design. Different sets of vines were treated at four different times: at bloom (about 70 % capfall); 2 weeks after bloom; 4 weeks after bloom, when berries averaged 9.5 mm wide; and at 6 weeks after bloom, when berries averaged 10.2 mm wide. Four different concentrations of NAA were used: 0, 5, 10, and 25 ppm. There were four replica-

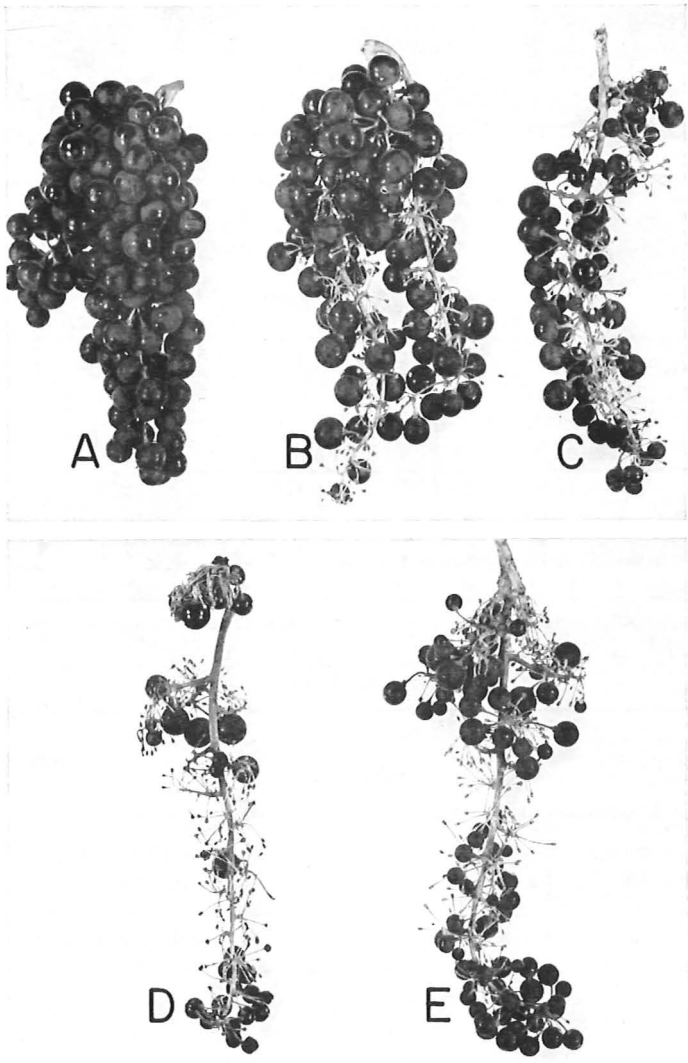

Fig. 1: Clusters of Carignane grapes sprayed at bloom with NAA at 0 (A), 5 (B), 10 (C), and 25 (D) ppm. [(E) is to be omitted. — Eds.]

Trauben der Sorte Carignane nach NES-Spritzung zur Blütezeit: A = 0, B = 5, C = 10, D = 25 ppm. [E entfällt. — Red.]

tions in each treatment. Each replication consisted of one vine. Three clusters on each vine were chosen and tagged.

After harvest on Sept. 14 and 15, 1976, the juice was extracted from samples of berries with a mortar and pestle, and then was squeezed through two layers of cheesecloth. The °Brix was measured with an Abbe-3L refractometer. The total titratable acidity was determined according to AMERINE and OUGH (1974). Looseness index was determined visually, and was estimated by the percentage of the cluster not filled with berries.

A two-way analysis of variance was used to test for significance among the treatments (STEEL and TORRIE 1960).

Table 3

Effect of NAA applied at four different concentrations and four different dates on °Brix of Carignane grapes. Grapes were harvested on September 14, 1976

Einfluß der NES-Anwendung in vier verschiedenen Konzentrationen und zu vier verschiedenen Terminen auf °Brix bei der Sorte Carignane. Traubenernte am 14. September 1976

Concentration of NAA	Time of application of NAA			
	Bloom[1]) May 18	2 weeks after bloom June 1	4 weeks after bloom June 17	6 weeks after bloom July 2
0[2])	23.1 1 b	22.4 1 b	21.9 1 a	22.0 1 a
5 ppm	24.6 1 ab	24.1 1, 2 ab	22.4 2 a	21.7 2 a
10 ppm	26.2 1 a	24.6 1, 2 a	23.2 2, 3 a	22.4 3 a
25 ppm	26.3 1 a	25.1 1, 2 a	23.0 2, 3 a	22.7 3 a

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

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Results

1. General observations

Hormonal responses within 24 h included a slight twisting of clusters at 5 ppm, some twisting of clusters and epinasty of shoot tips from the 10 ppm level, and bending of clusters and severe epinasty of shoot tips at the 25 ppm level. However, a few days after application of NAA some of these effects were not as noticeable. Where severe twisting and bending of clusters occurred, the symptoms generally persisted.

2. Data at harvest

The crop yield per vine was decreased by applications of NAA at 10 and 25 ppm when applied at bloom and by NAA at 25 ppm 2 weeks after bloom (Table 1). However, there were no significant differences, when NAA was sprayed at 4 and 6 weeks after bloom.

Crop weights were higher at the 4 weeks and 6 weeks treatments than at the first two applications, both at concentrations of 10 and 25 ppm (Table 1). At the 25 ppm level, the heaviest crops occurred at treatments 4 and 6 weeks after bloom.

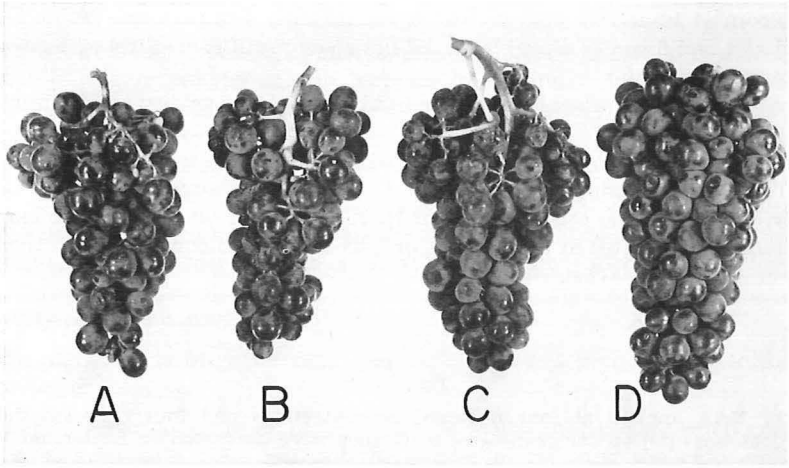

Fig. 2: Clusters of Carignane grapes sprayed with NAA at 25 (A), 10 (B), 5 (C), and 0 (D) ppm 2 weeks after bloom.

Trauben der Sorte Carignane, die 2 Wochen nach der Blüte mit NES gespritzt worden waren. A = 25, B = 10, C = 5, D = 0 ppm.

Table 4

Effect of NAA applied at four different concentrations and four different dates on total acidity (g tartaric acid/100 ml) of Carignane grapes. Grapes were harvested on September 14, 1976

Einfluß der NES-Anwendung in vier verschiedenen Konzentrationen und zu vier verschiedenen Terminen auf die Gesamtsäure (g Weinsäure/100 ml) bei der Sorte Carignane. Traubenernte am 14. September 1976

Concentration of NAA	Time of application of NAA			
	Bloom[1]) May 18	2 weeks after bloom June 1	4 weeks after bloom June 17	6 weeks after bloom July 2
0[2])	0.68 1 a	0.71 1 a	0.74 1 a	0.74 1 a
5 ppm	0.67 2 a	0.70 1, 2 a	0.73 1, 2 a	0.75 1 a
10 ppm	0.62 3 a	0.65 2, 3 a	0.71 1, 2 a	0.76 1 a
25 ppm	0.70 1 a	0.70 1 a	0.73 1 a	0.70 1 a

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[2]) Within a row, mean values followed by the same letter are not significantly different at the 5 % level.

The application of NAA on Carignane grapes at bloom time markedly reduced the weight per cluster (Table 2). The lowest cluster weights resulted from NAA at 10 and 25 ppm. Application of NAA at 2, 4, and 6 weeks after bloom did not lower weight per cluster.

°Brix of juice of clusters that were sprayed with NAA at bloom and 2 weeks after bloom at 10 and 25 ppm increased significantly from control (Table 3). NAA applied at 4 and 6 weeks after bloom did not show significant difference among the four treatments.

There was no significant difference in total titratable acidity among treatments (Table 4).

The clusters that received application of NAA at bloom were loosened considerably. The loosest clusters resulted from the 25 ppm treatment (Table 5) (Fig. 1). Usually, the higher the concentration of NAA the higher was the cluster looseness. When NAA was applied at 2 (Fig. 2), 4, or 6 weeks after bloom, however, there was no thinning of clusters (Table 5).

Table 5

Effect of NAA applied at four different concentrations and four different dates on cluster looseness (%) of Carignane grapes. Grapes were harvested on September 14, 1976
Einfluß der NES-Anwendung in vier verschiedenen Konzentrationen und zu vier verschiedenen Terminen auf die Lockerbeerigkeit (%) bei der Sorte Carignane. Traubenernte am 14. September 1976

Concentration of NAA	Time of application of NAA			
	Bloom[1]) May 18	2 weeks after bloom June 1	4 weeks after bloom June 17	6 weeks after bloom July 2
0[2])	2.7 1 c	2.7 1 a	2.0 1 a	2.0 1 a
5 ppm	32.5 1 b	2.5 2 a	2.2 2 a	1.5 2 a
10 ppm	33.2 1 b	2.2 2 a	2.0 2 a	1.2 2 a
25 ppm	41.2 1 a	2.0 2 a	2.0 2 a	1.5 2 a

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

[2]) Within a row, mean values followed by the same number are not significantly different at the 5 % level.

Discussion

WEAVER (1954) reported that NAA acts as a berry thinning agent on Zinfandel grapes. SAMISH and LAVEE (1958) found that application of NAA at 5 ppm at berry-set produced good thinning, but that at 10 ppm it caused straggly clusters. WEAVER (1963) stated that NAA at 5 to 10 ppm produced proper thinning at bloom and 10 ppm at the berry-set stage in Zinfandel grapes. ZULUAGA *et al.* (1968) applied NAA at 30

ppm on Flame Tokay grapes 3 d before the beginning of bloom stage, and noted there was an inhibitory action on the growth of parthenocarpic berries. DHILLON and SHARMA (1973) applied NAA on seedless Perlette variety at the low concentrations of 0.5, 1, and 2 ppm, 7 d after the full bloom stage. NAA caused thinning and increased the percentage of shot berries. These results are similar to those reported here in our experiment.

We showed that NAA at 5 ppm applied at bloom caused a relatively large decrease in cluster weight and an increase in looseness, with clusters becoming straggly. At 2 weeks after bloom, however, it was necessary to use NAA at 10 ppm to cause a small decrease in weight per cluster. The crop yield per vine, however, did not accompany the same pattern as of weight per cluster. This can be explained by the large variability of cluster development on grapevines.

The data presented in Tables 1 and 2 show that NAA at bloom can cause overthinning unless the concentration is carefully controlled. Also, it can cause injury to the foliage. NAA applied at post-bloom in range from 5 to 10 ppm presents less possibility of overthinning.

The higher °Brix of clusters sprayed with NAA was probably due to the lower crop yield per vine.

There is a period, between bloom and 2—3 weeks after bloom, when grapevines can be sprayed with NAA without the danger of reducing the crop yield to an undesirable extent and with an improvement in quality.

The optimum concentration of NAA used can be from less than 5 ppm to about 10 ppm, varying mainly with the development stage of the vines.

Summary

Application of NAA on Carignane grapes at 70 % calyptra fall reduced berry-set and weight per cluster. Crop yield per vine was decreased both by application of NAA at bloom at 10 and 25 ppm and at 2 weeks after bloom at 25 ppm. °Brix was usually increased by NAA applied at bloom or 2 weeks after bloom. However, total titratable acidity did not change as a result of NAA in any of the treatments. The looseness of clusters treated at the bloom stage tended to increase with higher levels of NAA.

NAA has not been cleared for use on grapes as a thinning agent in the United States by the Environmental Protection Agency.

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