

EFFECTS OF GIBBERELLIC ACID AND ETHEPHON ON RAISIN QUALITY

Harry Andris and Donna Hirschfelt

*Mailed to Growers
3/86 by Abbott Laboratories
Marketing Dept.
Taken from
85 Cal RAS Report*

ABSTRACT

HARRY L. ANDRIS

A comparative study of two plant growth regulators, gibberellic acid and ethephon, applied singularly and in combination was conducted to determine their effects on raisin quality. Two vineyard sights were selected based on their previous crop history. Gibberellic acid was applied as a bloom spray to enhance the natural thinning effects at rates of two, four, and eight grams active ingredient per acre. Ethephon was applied at the beginning of berry softening at a rate of one pint per acre formulated material.

Vineyard A developed significantly higher sugars with all singular or combination treatments over the untreated check. Significant increases in fresh berry weight were noted where gibberellic acid and ethephon sprays were applied. There was no significant decrease in the number of berries per cm of branch length following the treatments of gibberellic acid nor was there a significant difference in berry width. A significant increase in berry length developed with the increasing rates of gibberellic acid. The raisin yield per vine was not significantly changed; however, the raisin moisture was statistically higher at the eight gram gibberellic acid rate. All treatments significantly improved the percent B or better raisins while significantly reducing the percent C grade. A significant reduction in substandard raisins developed where gibberellin was used alone but there was no significance over the untreated vines where gibberellin and ethephon were used in combination.

Vineyard B developed greater soluble solids over the untreated check with all treatments except the two gram per acre treatment of gibberellic acid applied alone. Berry weight was significantly increased in all treatments except the untreated check and the ethephon alone treatment. There was no change in the cluster branch length; however, the number of berries per cm of branch length was significantly reduced where the gibberellin sprays were applied alone. Fewer berries developed per cm of branch length in the combination treatments but these were not significantly different from the check. Significant increases in berry length were noted where gibberellic acid was applied either alone or in combination with ethephon, but the ethephon treatment alone had no effect on berry length. There were no significant changes in berry width among any of the

treatments. No significant changes were found in raisin yield per vine, percent moisture, percent B or better, or C grade raisins. All treatments significantly reduced the percentage of substandard raisins.

OBJECTIVE

The emphasis on raisin quality has prompted many growers to seek methods for improving their raisin grades. Several years ago studies on vineyards with high percentages of substandard raisins showed that low rates of gibberellic acid at bloom could improve raisin quality. Following the rain disasters of 1976 and 1978 the growth regulator ethephon was shown to improve raisin quality by increasing soluble solids as much as one degree brix when applied at the beginning of berry softening. This study was developed to critically evaluate these materials alone and in combination to determine the most effective means of improving raisin quality.

PROCEDURE

Two vineyards were selected for this study based on their vigor and raisin production history. Vineyard A is located east of Freeway 99 on a Hesperia fine sandy loam soil with production in excess of three tons in many years with excellent raisin quality. Vineyard B is located west of Freeway 99 and is planted on an Atwater sandy loam soil. This vineyard has had a history of average (two ton) yields but a high amount of substandard raisin production.

The trial design used in these two experiments was a randomized complete block with six replications of eight treatments. Each plot consisted of two vines. The treatments were:

1. Untreated check
2. 2 gm a.i./ac. gibberellic acid
3. 4 gm a.i./ac. gibberellic acid
4. 8 gm a.i./ac. gibberellic acid
5. 1 pt./ac. ethephon (formulation)
6. 2 gm a.i./ac. gibberellic acid plus 1 pt./ac. ethephon (formulation)
7. 4 gm a.i./ac. gibberellic acid plus 1 pt./ac. ethephon (formulation)
8. 8 gm a.i./ac. gibberellic acid plus 1 pt./ac. ethephon (formulation)

The gibberellin used in these trails was Pro-Gibb® 2% liquid which was supplied by Abbott. The ethephon was supplied by Union Carbide and is sold under the trade name Ethrel®. All bloom sprays of gibberellic acid were applied as near to 50% full bloom as possible. Because of the unusual bloom which occurred in 1985, many clusters were in 100% bloom while other clusters had not yet begun to bloom, the bloom sprays were timed to reach what was considered to be optimum timing for the season. The ethephon sprays were applied at the beginning of veraison when about five percent or more of the berries had begun to soften.

Vineyard A

This vineyard was bloom sprayed on May 10, 1985. The poor uniformity of bloom which developed during the 1985 season required that the bloom sprays be timed to include as many of the blooming clusters as possible. Unfortunately, many clusters had not yet begun to bloom when others were ready for treatment. The bloom treatments of two, four and eight grams of gibberellic acid were applied with a hand gun using a Myers sprayer set at 200 psi. The spray volume was equivalent to 125 gallons per acre which offered good coverage without excessive run off. The application of ethephon was applied to the respective vines on July 3, 1985 when approximately five percent berry softening had occurred. A rate of one pint per acre of Ethrel was applied in 200 gallons of water per acre. Berry samples and the upper most branch from ten cluster rachises per treatment were taken to the laboratory for evaluation on September 4, 1985. Raisin yeilds were taken on the dried fruit by weighing the trays on Septmber 27, 1985. Subsamples were taken from each raisin tray in each plot and blended for U.S.D.A. raisin quality evaluation.

Vineyard B

Bloom sprays of two, four, and eight grams active ingredient gibberellic acid were applied on May 9, 1985 using a Myers sprayer. An applicaiton of 125 gallons per acre at 200 psi was applied with a hand gun. This produced full wetting without excessive run off. There appeared to be no optimum time for bloom spraying in 1985. Many clusters were in full bloom while others had not yet begun to bloom. May 9 appeared to be the best date for gibberellin application in this vineyard. Treatments of Ethrel were applied on July 2, 1985 at a rate of one pint per acre with a volume of 200 gallons per acre. Berry softening was estimated to be about 50 percent. Berry sampling and the removal of ten of the upper most branches from cluster rachises was performed on August 28, 1985 the day before harvest. The raisins were harvested on August 29 and the dried

fruit was weighed and subsamples removed for U.S.D.A. raisin quality grading on September 19, 1985 .

RESULTS

Vineyard A produced higher soluble solids, which were significantly higher than the untreated check, where gibberellic acid and Ethrel® treatments were applied at bloom or berry softening. There was no significant difference in increased sugar levels among the gibberellin treatments applied by themselves or with Ethrel® applied alone. Soluble solids increased significantly when the combination of gibberellin bloom spray and an Ethrel® treatment at berry softening was applied. The larger the dosage of gibberellin used the higher the soluble solids developed; however, there was no significant difference between the combination treatments where two or four grams of gibberellic acid were used. These combination treatments were not significantly greater than using ethephon alone. The weight per berry increased significantly over the untreated check with many of the gibberellin treatments but was most dramatic when ethephon was applied following a gibberellin bloom spray. The increase in fresh berry weight appeared to be nearly linear. The uppermost branch of the cluster rachis was removed from ten clusters in each treated plot and taken to the laboratory where the berries were removed and counted . The branch length was then measured to develop a figure for the number of berries per centimeter of branch length. This gives an indication of the amount of thinning which took place from the bloom sprays. In Vineyard A there was no significant difference among treatments. This might be attributed to the unusual bloom period experienced in 1985. Significant increases in berry length occurred with the higher rates of gibberellin, but there was no significant change in berry diameter following these treatments. The values on fresh berry weight are given in Table 1. Raisin quality information is given in Table 2. There were no differences noted in raisin yield per treatment. Raisin moisture was significantly higher where eight grams of gibberellic acid had been applied. This higher moisture level was greater than the untreated check or the ethephon alone treatment. This higher moisture level was also obvious in the field when handling the raisins. All treatments improved the percentage of B of better raisins over the untreated fruit. All treatments reduced the percentage of C grade raisins which developed. There was no significant difference in the percent substandard where ethephon had been applied; however, where the

gibberellin treatments were applied singularly all rates were significantly lower than the untreated check.

Vineyard B developed significantly higher soluble solids over the control with all treatments except the two gram rate of gibberellic acid applied by itself which was higher but not significantly greater than the control. All treatments of gibberellin alone or in combination with Ethrel® were significantly higher in berry weight than either the untreated check or the Ethrel® alone treatments. The number of berries per centimeter of branch length indicate a reduction in berry number from the thinning sprays of gibberellin with significant reductions appearing where gibberellin was applied alone but with no significant reduction occurring for the combination treatments. In each instance where gibberellin was applied there was a significant increase in berry length which does not develop in the untreated or ethephon alone treated vines. There was no significant difference noted among any of the treatments in berry diameter. The effects of each treatment on the fresh berries are given in Table 3. Table 4 presents data on the raisin quality which developed in Vineyard B. There was no significant difference in the total raisin yield per vine for any of the treatments. No significant differences were noted in percent moisture, percent B or better raisin grades, or percent C grade. Any and all treatments reduced significantly the percentage of substandard raisins which developed as compared to the untreated check.

CONCLUSION

The use of the two growth regulators, gibberellic acid and ethephon, appear to improve raisin quality generally but the greatest gains appear when the two are used in combination. The 1985 season presented difficulties for growers in the timing of their gibberellin bloom sprays and the somewhat mixed results in Tables 1-4 reflect this less than hoped for thinning. In both trial locations the fruit maturity was very high ranging from 21.6 to 23.0 in the untreated plots. The enhanced maturity produced by applying gibberellic acid or ethephon alone or in combination is a good endorsement of these materials; however, it should be pointed out that some of the greatest gains in maturity occurred with the eight gram a.i./ac. rate of gibberellic acid which is above the labeled tolerance for this material. This eight gram rate was included only for experimental purposes and is not an endorsement in any way. The greatest responses were developed in Vineyard A; however, both vineyards showed trends

Table 1
Effects of Gibberellic Acid and Ethephon Sprays on
Thompson Seedless Raisin Grapes
Vineyard A

<u>Treatments</u>	<u>Soluble Solids (Brix)</u>	<u>Weight per Berry (gms)</u>	<u>Length of Uppermost Cluster Branch (cm)</u>	<u>Number of Berrie per cm Branch Length</u>	<u>Berry Length (cm)</u>	<u>Berry Width (cm)</u>
1. Untreated Check	21.6 A	1.74 A	13.8 A	4.8 A	2.01 A	1.69 A
2. 2 gm A.I./Ac. Gibberellic Acid	22.5 B	1.91 BC	9.5 A	5.4 A	2.09 AB	1.73 A
3. 4 gm A.I./Ac. Gibberellic Acid	22.6 B	1.87 ABC	10.9 A	3.7 A	2.11 AB	1.71 A
4. 8 gm A.I./Ac. Gibberellic Acid	22.5 B	2.01 CD	12.3 A	4.3 A	2.18 BC	1.73 A
5. 1 pt./Ac. Ethephon	22.7 BC	1.79 AB	9.1 A	4.7 A	2.03 A	1.73 A
6. 2 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	23.4 CD	1.90 BC	11.2 A	4.7 A	2.04 A	1.71 A
7. 4 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	23.4 CD	1.99 CD	10.8 A	3.9 A	2.11 AB	1.74 A
8. 8 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	23.5 D	2.13 D	9.4 A	4.7 A	2.24 C	1.76 A

Gibberellic acid treatments were applied at approximately 50% full bloom on May 10, 1985. Ethephon treatments were applied at 5% berry softening on July 3, 1985.

Table 2
Effect of Gibberellic Acid and Ethephon Sprays on
Raisin Quality
Vineyard A

<u>Treatments</u>	<u>Raisin Yield Per Vine (lbs)</u>	<u>RAISIN QUALITY</u>			
		<u>% Moisture</u>	<u>% B or Better</u>	<u>% C Grade</u>	<u>% Substandard</u>
1. Untreated Check	16.8 A	10.1 A	80.7 A	16.7 B	2.6 C
2. 2 gm A.I./Ac. Gibberellic Acid	16.4 A	11.7 AB	93.9 B	5.6 A	0.5 A
3. 4 gm A.I./Ac. Gibberellic Acid	17.0 A	11.0 AB	91.0 B	7.7 A	1.3 A
4. 8 gm A.I./Ac. Gibberellic Acid	16.2 A	12.5 B	93.1 B	5.7 A	1.2 A
5. 1 pt. Ac. Ethephon	15.8 A	10.4 A	90.1 B	7.8 A	2.0 BC
6. 2 gm. A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	16.9 A	11.3 AB	94.9 B	3.6 A	1.5 ABC
7. 4 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	16.6 A	11.6 AB	95.4 B	2.9 A	1.7 BC
8. 8 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	16.9 A	12.7 B	93.3 B	4.7 A	2.0 BC

Gibberellic acid treatments were applied at approximately 50% full bloom on May 10, 1985. Ethephon treatments were applied at 5% berry softening on July 3, 1985.

Table 3
Effects of Gibberellic Acid and Ethephon Sprays on
Thompson Seedless Raisin Grapes
Vineyard B

<u>Treatments</u>	<u>Soluble Solids (Brix)</u>	<u>Weight per Berry (gms)</u>	<u>Length of Uppermost Cluster Branch (cm)</u>	<u>Number of Berries per cm Branch Length</u>	<u>Berry Length (cm)</u>	<u>Berry Width (cm)</u>
1. Untreated Check	23.0 A	1.45 A	13.7 A	4.9 B	1.78 A	1.61 A
2. 2 gm A.I./Ac. Gibberellic Acid	23.6 AB	1.66 B	11.6 A	3.4 A	1.96 B	1.67 A
3. 4 gm A.I./Ac. Gibberellic Acid	24.5 B	1.76 BC	10.4 A	3.3 A	2.02 B	1.64 A
4. 8 gm A.I./Ac. Gibberellic Acid	23.9 B	1.77 BC	10.6 A	3.1 A	2.05 B	1.68 A
5. 1 pt./Ac. Ethephon	24.3 B	1.53 A	10.9 A	4.9 B	1.82 A	1.63 A
6. 2 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	24.3 B	1.68 BC	10.1 A	3.6 AB	1.96 B	1.69 A
7. 4 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	24.2 B	1.70 BC	10.6 A	3.7 AB	2.03 B	1.70 A
8. 8 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	24.2 B	1.80 C	9.1 A	3.7 AB	2.05 B	1.66 A

Gibberellic acid treatments were applied at approximately 50% full bloom on May 9, 1985. Ethephon treatments were applied at 50% berry softening on July 3, 1985.

Table 4
Effect of Gibberellic Acid and Ethephon Sprays on
Raisin Quality
Vineyard B

<u>Treatments</u>	<u>Raisin Yield Per Vine (lbs)</u>	<u>RAISIN QUALITY</u>			
		<u>% Moisture</u>	<u>% B or Better</u>	<u>% C Grade</u>	<u>% Substandard</u>
1. Untreated Check	14.3 A	11.5 A	67.1 A	28.5 A	4.4 B
2. 2 gm A.I./Ac. Gibberellic Acid	12.6 A	12.0 A	74.9 A	23.0 A	2.1 A
3. 4 gm A.I./Ac. Gibberellic Acid	12.9 A	11.4 A	82.7 B	16.1 A	1.2 A
4. 8 gm A.I./Ac. Gibberellic Acid	11.5 A	11.1 A	76.8 A	21.6 A	1.6 A
5. 1 pt./Ac. Ethephon	13.2 A	11.5 A	75.1 A	23.1 A	1.8 A
6. 2 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	12.3 A	10.9 A	82.2 A	16.2 A	1.6 A
7. 4 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	14.4 A	10.7 A	77.4 A	20.5 A	2.1 A
8. 8 gm A.I./Ac. Gibberellic Acid + 1 pt./Ac. Ethephon	14.8 A	12.6 A	85.1 A	13.4 A	1.5 A

Gibberellic acid treatments were applied at approximately 50% full bloom on May 9, 1985. Ethephon treatments were applied at 50% berry softening on July 3, 1985.