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INFLUENCE OF GIBBERELLIC ACID AND VARIOUS MANAGEMENT PRACTICES ON BERRY, SEED AND CLUSTER DEVELOPMENT IN 'ORLAND SEEDLESS' GRAPE

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Abstract. **Three field studies were conducted to evaluate use of gibberellic acid (GA_3) alone, and in combination with other cultural practices, on 'Orlando Seedless' (*Vitis aestivalis* Michaux ssp. *simpsoni* Munson and ssp. *smalliana* Bailey; *labrusca* L.; *vinifera* L.) grape. Greatest berry weight was associated with single GA_3 applications of 75, 150 or 300 ppm at 7 days after capfall and 150 or 300 ppm at 14 days after capfall. Inhibition of seed development was most effective with 75, 150, or 300 ppm applications made once at 7 days after capfall. Combinations of GA_3 applications made at capfall (10 or 30 ppm) and 7 days after capfall (150 or 200 ppm) were equally effective in increasing berry weight by 56%, and decreasing seed weight by 94%, compared to non GA_3 treated fruit. Girdling reduced incidence of berry cracking and decreased soluble solids but had no effect on berry weight.**

'Orlando Seedless' is the first seedless bunch grape cultivar with resistance to Pierce's disease developed by the University of Florida grape breeding program at CFREC-Leesburg (1). Preliminary research indicates that 'Orlando Seedless' has limited market acceptability due to small berry size and occasional gritty seed traces (3). Research was initiated on the use of gibberellic acid (GA_3) to determine response of 'Orlando Seedless' to a range of application times and rates (2). Objectives of this research were to evaluate use of GA_3 in combination with standard commercial table grape production practices (i.e. girdling, cluster tipping) to determine effects on berry and seed development. Other parameters of cluster development including incidence of shot berry, berry cracking, and soluble solids, were examined because of their known response to such treatments in other grape varieties (4).

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Materials and Methods

Experiment 1. Six-year old vines of 'Orlando Seedless' grafted on Tampa (*Vitis aestivalis* ssp. *smalliana; V. labrusca; V. vinifera*) rootstock were grown in a drip irrigated vineyard. Vines were head-trained on a single-wire and pruned to 4-6 canes of 10 buds each. Individual treatments consisted of an application of GA_3 at one of 4 concentrations (38, 75, 150, or 300 ppm) made at one of 3 times after flowering (7, 14, or 21 days after capfall). Treatment combinations (12 total) were assigned in a completely randomized design among individual canes of a single plant. One additional cane on each plant was randomly selected as a control. Each cane was thinned to 2 clusters. Fourteen vines were used as replicates. Gibberellic acid was applied by hand spraying isolated canes. Capfall was defined as 50-70% open blooms on 50% of the clusters on the vine. After harvest fruit was stored in plastic bags at 4.4°C no longer than 2 weeks. Ten berries were randomly selected from each cluster to determine fresh weight of berries and seed traces. Analysis of variance was performed on all treatment combinations. Controls (1 per plant) were averaged over all replicates.

Experiment 2. Methods were the same as in Experiment 1 with the following exceptions. The experiment was designed as a split-split plot with rootstock as the main plot effect using Tampa and Florida CD12-31 (an experimental selection). The sub-plot effect was the presence or absence of a cane girdling treatment on one-half of the vine. Individual treatments using gibberellin consisted of an application of GA_3 at one of 2 concentrations (10 or 30 ppm) made at capfall followed by an application at one of two concentrations of GA_3 (150 or 300 ppm) made 7 days after capfall. Seven vines were used as replicates. In addition to berry and seed weights, number of shot berries per cluster and number of cracked berries per cluster were determined. Soluble solids were determined by refractometry.

Experiment 3. Methods were the same as in Experiment 2 with the following exceptions. Individual treatments using gibberellin consisted of an application of GA_3 (40 or 80 ppm) at the 4-5 mm stage of berry diameter followed by an application of the same concentration 7 days later. The second treatment factor was the presence or absence of cluster tipping (removal of 2/3 of main rachis). Six vines were used as replicates.

Results and Discussion

Experiment 1. There was a significant effect of application date on berry weight ($P<0.05$) and a highly significant effect of concentration on berry weight ($P<0.01$). Application date and concentration had a highly significant effect on seed weight ($P<0.01$). There was no significant interaction of the main effects. Increases in berry weight were greatest with GA_3 applications at 7 or 14 *days after capfall* (Figure 1). Greatest berry weight was associated with GA_3 applications of 75, 150, or 300 ppm at 7 days after capfall and 150 or 300 ppm at 14 days after capfall. Maximum berry weight obtained in this study was 1.48 g, representing a 32% increase over untreated clusters with individual berry weights of 1.12 g. Inhibition of seed development by GA_3 was most effective with 75, 150 or 300 ppm applications made at 7 days after capfall (Figure 2). Seed weight of treated fruit was 75% lower than untreated clusters.

Experiment 2. Rootstock differences will not be reported here. There was a highly significant effect of GA_3 treatments on berry weight ($P<0.01$), seed weight ($P<0.01$), and incidence of shot berry ($P<0.01$) (Table 1). There was no interaction of the main effects on these parameters. Berry weights of clusters treated with GA_3 were greater than those of untreated fruit, although berry weights were not different among the 4 treatment combinations. Average percent increase of GA_3 treated berries was 56% over control fruit. Berry weights were not greater than those of Expt. 1 despite the larger increase compared to controls due to early harvest. If berries had reached full maturity, weights probably would have exceeded 1.5 g per berry. Seed weights were significantly lower among GA_3 treated fruit, however, no difference in seed weight was observed among the 4 GA_3 combinations. Seed weight was decreased by 94% among GA_3 treated berries compared to untreated fruit. The number of shot berries per cluster of GA_3

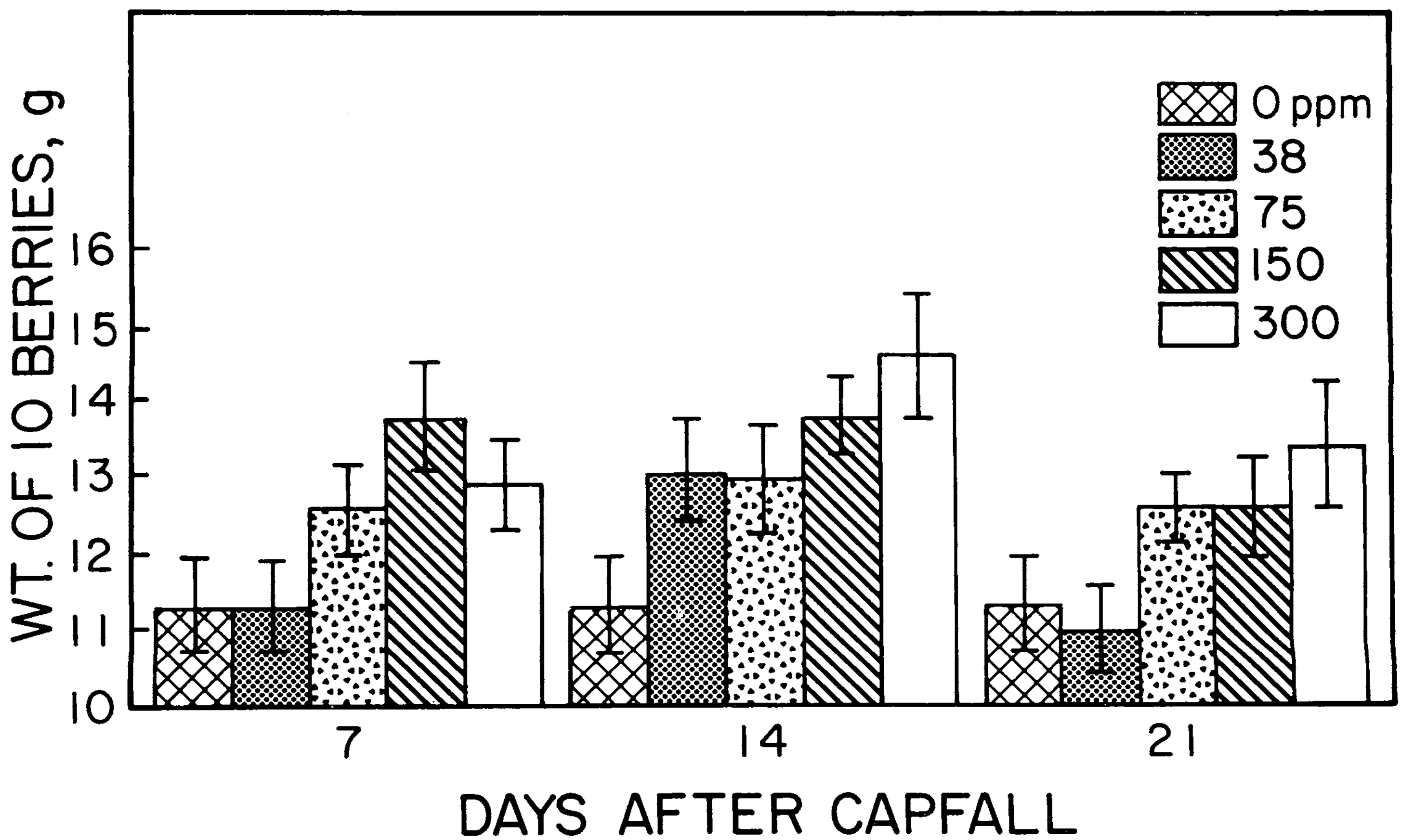

Fig. 1. Effect of GA_3 concentration and application date on weight of 10 berries of 'Orlando Seedless' grapes.

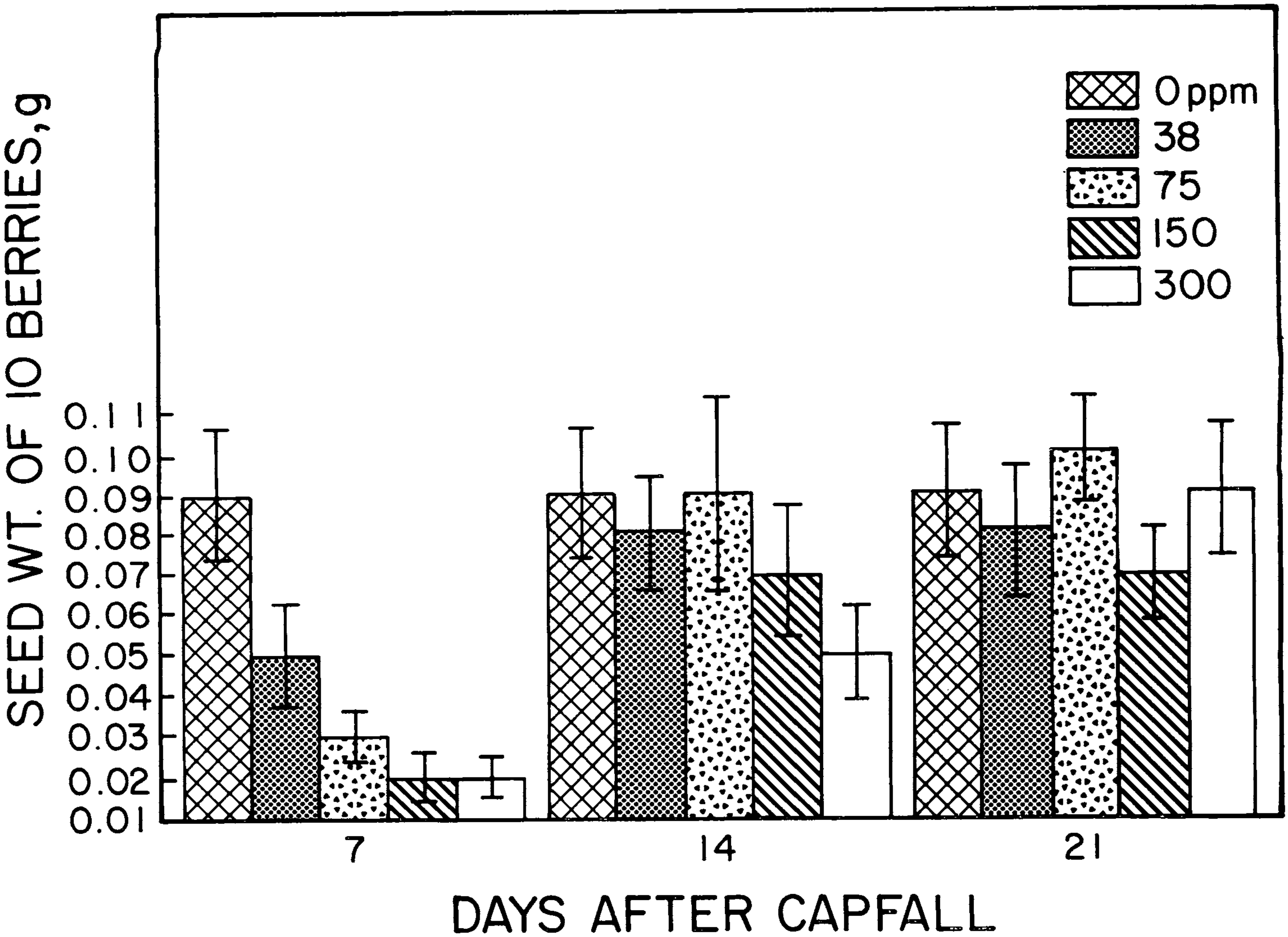

Fig. 2. Effect of GA_3 concentration and application date on seed weight of 10 berries of 'Orlando Seedless' grapes.

treated fruit was reduced by a factor of 6 compared to controls.

There was a significant effect of girdling treatment on berry cracking ($P<0.01$) and soluble solids ($P<0.01$) (Table 2). There was no interaction of the main effects on these parameters. Girdling reduced the number of cracked berries per cluster to less than 1/2 that of non-girdled clusters.

Table 1. Effect of GA_3 treatments on berry and seed development in 'Orlando Seedless' grape. Values are averages over both girdling treatments and rootstocks.

GA_3 treatments		Berry wt. (g)	Seed wt.[z] (g)	Shot berries (No. per cluster)
Capfall	Capfall + 7 days			
10 ppm	150 ppm	1.27 **	0.006[y] **	1.51[x] **
30 ppm	150 ppm	1.33 **	0.005 **	1.12 **
10 ppm	200 ppm	1.22 **	0.004 **	1.70 **
30 ppm	200 ppm	1.30 **	0.004 **	2.05 **
Mean		1.28	0.005	1.60
Control		0.82	0.079	9.49

[z]of 10 berries.
[y]Statistical analysis conducted with sq. rt. transformation.
[x]Statistical analysis conducted with ln transformation.
**Significantly different from controls at 1% level.

Girdling also lowered the soluble solids in fruit by 2° Brix compared to control fruit.

Experiment 3. No data are presented here due to hail damage which occurred during veraison. However observations were made on fruit which was undamaged and reached full maturity. Berry size among some GA_3 treated fruit was over 2 g. This represents a 100% increase in berry weight compared to untreated fruit (0.8-1.0 g per berry). This is the largest berry weight that has been obtained in these studies.

Table 2. Effect of girdling on berry development in 'Orlando Seedless' grape. Values are averages over all GA_3 treatments and both rootstocks.

Treatment	Berry cracking (No. per cluster)	Soluble Solids (°Brix)
Girdle—yes	8.10[z] **	13.1 **
Girdle—no	20.58	15.0

[z]Statistical analysis conducted with sq. rt. transformation.
**Significantly different from no girdle treatment at 1% level.

Conclusions

Gibberellic acid, used alone and in combination with girdling and cluster tipping, was effective in increasing berry size and inhibiting development of gritty seed traces. Greatest increases in berry weight, and lowest seed weights, were associated with GA_3 applications made at capfall and followed by a second application 7 days later. No effect of GA_3 on fruit set was found suggesting little potential for use of GA_3 as a bloom thinning agent. Girdling was not effective as a means of further increasing berry size. The combination of GA_3, girdling and cluster tipping merits further study as berry weight increases over 100% were observed with these treatments.

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YIELD AND FRUIT QUALITY EVALUATIONS OF SEVEN PEACH CLONES IN TWO ORCHARD SYSTEMS

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Abstract. **Seven low chill peach [*Prunus persica* (L.) Batsch] clones, selected for short fruit development periods and probable adaptation to north-central Florida, were evaluated. Trees were planted at high density (3333 trees/ha) and standard (350 trees/ha) orchard spacings and were evaluated in their 3rd and 4th leaf. The high density trees were annually topped to 0.75m in early June after harvest, and the standard orchard spaced trees were winter pruned to an open vase. Fruit yield per hectare of trees in the high density system was significantly larger than for those in the standard system. Trunk diameter, flower bud production and fruit set differed significantly among clones within each orchard system. These parameters did not exhibit consistent differences between orchard spacings for both years. Increased tree population delayed bloom and harvest of some clones. Fruit quality varied significantly among clones and was higher for fruit from standard spaced trees. Fruit from standard spaced trees was significantly larger than fruit from high density trees. 'Flordagold', the only cultivar that yielded fruit of marketable size when planted at high density, shows promise for use in that system. These tests indicated good potential for some clones at standard orchard spacing, specifically 'Flordagold', 'Fla. 8-6' and 'Fla. 9-15N'.**

During the past two decades, intensified orchard systems have received increasing attention. Much of the initial work was done with apple (2, 8) but characteristics inherent to this species, such as the inability of most apple cultivars to bear fruit on one-year-old wood, have made it relatively unattractive for systems that employ severe annual pruning (9). Peaches, because they do bear normally on wood grown the previous season, are potentially suited to systems such as the meadow orchard which combines extremely high tree populations with severe post-harvest pruning (5). Still, the lack of dwarfing rootstocks to control peach tree vigor is a problem that has led researchers to investigate alternative cultural methods of controlling tree size. Variations in pruning techniques (11, 12, 13), especially summer pruning (4, 10), post-harvest topping (10, 14, 15), and closer spacing (1, 3, 11, 12) have been investigated. For north-central Florida growers these innovations in orchard systems offer advantages over traditionally trained, low population systems that may offset the initial cost of orchard establishment. Increases in yield (1, 4, 11, 13, 15), earlier bearing trees (1, 4, 15), delay of bloom (5), decrease in disease problems (11, 15) and increased ability to mechanize the operation (5, 7, 15) have been demonstrated.

An objective of this study was to identify peach and nectarine clones that performed well in a high density system in combination with severe post-harvest topping. Because of the long growing season in north-central Florida, and the use of early ripening cultivars, cultivars with the ability to produce a high percentage of flower buds can accomplish substantial regrowth before frost if pruned immediately after harvest. These cultivars have the potential to produce sizeable annual crops despite severe summer pruning.

Materials and Methods

An experimental planting was established in February, 1984, at the horticulture farm on Hull Road in Gainesville, Florida to examine the yield and fruit quality of seven peach and nectarine clones in two orchard systems. Clones selected for use were those having chilling requirements of less than 450 hours and fruit development periods of 70-

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