



## Influence of GA<sub>3</sub> Sizing Sprays on Ruby Seedless

### Introduction:

The majority of Ruby Seedless table grapes grown and marketed over the past thirty years have been naturals with no girdle or gibberellin (GA<sub>3</sub>) applied to increase berry size. The berry weight of a natural Ruby Seedless is about 3 to 4 grams, small compared to most other table grapes. For example, the berry weight of Thompson Seedless grown for table ranges from 5 to 6 grams. Ruby Seedless is marketed from August through January or February; historically it has had very little competition from other seedless cultivars, and the small berry did not discourage sales. However, in recent years the competition from imported Perlette, Flame, and Thompson Seedless grapes has increased demand for a larger Ruby Seedless berry. With the introduction of Crimson Seedless by U.S.D.A., a late, fall seedless table grape with good berry size, the pressure for Ruby Seedless growers to produce larger berries has increased.

The past five years, an increasing number of Ruby Seedless growers have applied a size girdle and GA<sub>3</sub> and have successfully increased berry size, but along with bigger berries have come problems with bunch rot, poor fruit color, berry shatter at harvest, and smaller and fewer clusters the following year. The objective of our research is to evaluate girdling along with different rates and timing of GA<sub>3</sub> to determine

how best to maximize berry weight while minimizing associated problems.

### Materials and Methods:

The experimental vines were located at the Kearney Agricultural Center and were uniform in vigor and productivity. The experiment was designed as a randomized complete block with eight treatments, eight replications, and using single vine plots. The eight treatments were as follows:

1. Control (no girdle and no GA<sub>3</sub>).
2. Girdle (no GA<sub>3</sub>).
3. G. + (16 grams GA<sub>3</sub> at Fruit Set).
4. G. + (32 grams GA<sub>3</sub> at F.S.).
5. G. + (16 grams GA<sub>3</sub> at F.S. + 10 days).
6. G. + (32 grams GA<sub>3</sub> at F.S. + 10 d.).
7. G. + (16 grams GA<sub>3</sub> at F.S. + 20 d.).
8. G. + (32 grams GA<sub>3</sub> at F.S. + 20 d.).

The girdle was applied at fruit set. GA<sub>3</sub> was applied to treatments 3 and 4 at fruit set, treatments 5 and 6 at fruit set + 10 days, and treatments 7 and 8 at fruit set + 20 days, and vertical bars were applied to all figures to quickly identify timing treatments.

The experiment continued for two years, 1995 and 1996, using the following cultural practices. Vines were pruned to 12 to 14 two-bud spurs. Shoots were thinned to two shoots per spur in early April. Crop load was adjusted to 28

clusters per vine soon after the completion of fruit set. Clusters were tipped to six shoulders and the wing removed. GA<sub>3</sub> was applied at 60% to 80% bloom using 1 gram per acre. The canopy was managed by removing lateral shoots and basal leaves below the last retained cluster soon after berry set. Fruit was exposed on the north side of the trellis by cutting canes just below the trellis wire and removing leaves from around the fruit in mid-August.

Fruit was harvested on 13 September 1995 and 10 September 1996. Packable and cull fruit were harvested and weighed. Fruit was culled for rot (too many berries to feasibly trim) and poor color. Two berry samples were collected at harvest: 75 berries per plot were collected for berry weight, sugar, and acid determination; 30 berries per plot were taken for berry firmness and berry length measurements. Berry shatter was evaluated by sampling three clusters from each plot. These clusters were weighed, dropped from a height of 1 meter, the shattered berries were collected and weighed, and percent shatter was calculated on a weight basis.

## Results:

Berry weight was increased by both the girdle and GA<sub>3</sub>, and the response was similar for both 1995 and 1996 ([Figure 1](#)). The girdle increased berry weight about 20% over the control. GA<sub>3</sub>, applied in addition to the girdle, further increased berry weight, and the most effective time of application was berry set plus 10 days and the most effective rate was 16 grams per acre. Applying 16 grams of GA<sub>3</sub> 10 days after fruit set increased berry weight 52% compared to the ungirdled control (average for both seasons). This treatment resulted in Ruby Seedless berries averaging over 5.5 grams,

which is similar to the berry weight of table Thompson Seedless.

Applying GA<sub>3</sub> increased fruit shatter at harvest in 1995 ([Figure 2](#)). Applying GA<sub>3</sub> at berry set, berry set + 10 days, or berry set + 20 days resulted in 55%, 45%, and 37% shatter, respectively, compared to 32% for the ungirdled control. There was no significant difference in berry shatter comparing the 16 and 32 grams per acre rates of GA<sub>3</sub>.

The application of GA<sub>3</sub> also influenced vine fruitfulness the following year ([Figure 3](#)). The largest decrease (29%) in flower clusters occurred when GA<sub>3</sub> was applied at berry set, and there was a greater decrease in fruitfulness with the high rate of GA<sub>3</sub>. The application of GA<sub>3</sub> not only reduced the number of clusters the following year but also reduced cluster size ([Figure 4](#)) when applied at berry set or berry set plus 10 days.

[Figure 6](#) shows the total, packable, and cull yield for the 1995 season the bar for each treatment in the figure is stacked with cull weight on top of packable weight and total weight indicated by the total height of the bar. The total yield (packable + cull) was increased by both the girdle and GA<sub>3</sub> treatments, and the yield increase was directly proportional to increases in berry weight ([Figure 1](#)). However, the only treatment that significantly increased packable yield over the ungirdled control was GA<sub>3</sub> applied at fruit set. The reason for the low packable yield in relationship to total yield was bunch rot. Bunch rot was severe in 1995 and nearly all cull fruit was a result of bunch rot rather than poor color. In the ungirdled control, 32% of the total yield was culled because of rot.

Girdling increased the level of culled fruit to 43%. Applying GA<sub>3</sub> at fruit set + 10 days and fruit set + 20 days further increased the level of cull fruit to 40% and 69%, respectively. Applying GA<sub>3</sub> at fruit set resulted in a level of culled fruit similar to the ungirdled control.

The 1996 harvest results are shown in [Figure 7](#). Total yield was down for GA<sub>3</sub> applied at fruit set (fewer and smaller clusters), and the percentage of total fruit culled was also greater than the other treatments (poor fruit color). Packable fruit was highest for treatment 2 (girdle at fruit set) and treatments 5 and 7 (girdle + GA<sub>3</sub> applied at fruit set + 10 or 20 days). GA<sub>3</sub> applied at 32 grams per acre reduced fruit color compared to the 16 gram rate, and therefore reduced the yield of packable fruit. This rate effect was most pronounced at fruit set.

The yield of packable and cull fruit averaged for the 1995 and 1996 season is shown in [Figure 8](#). The yield of packable fruit was highest for treatment 2 (fruit set girdle) and treatment 5 (fruit set girdle + 16 grams GA<sub>3</sub> applied at fruit set + 10 days). Maturity (°brix) was inversely related to total yield both years ([Figure 9](#)). The fruit from the ungirdled control was about 4 °brix greater than high yielding treatments both years. This delay in maturity and, subsequently, delay in harvest increases the weather risk and the potential for decay.

### **Summary:**

There are potential risks associated with applying GA<sub>3</sub> to Ruby Seedless to increase

berry size: bunch rot, shatter at harvest, delayed maturity, and reduced vine fruitfulness the following year. To maximize berry size while minimizing these associated problems, our research indicates that GA<sub>3</sub> is best applied at fruit set + 10 days (when berry diameter averages 10 mm) using a rate of 16 grams per acre. This treatment increased berry weight about 50% compared to a natural (no girdle and no GA<sub>3</sub>) and resulted in berries as large as table Thompson Seedless. The packable yield for this treatment was 34 and 62 pounds per vine for the 1995 and 1996 seasons, respectively. In 1995, the low packout resulted from bunch rot with half of the fruit being culled. The risk of increased bunch rot, delayed maturity, increased shatter, and reduced vine fruitfulness varies widely from year to year. Growers considering the use of GA<sub>3</sub> and/or girdle to increase berry size should be fully aware of potential risks associated with their use.

The fruit set girdle alone (no GA<sub>3</sub>) increased berry weight about 20% over a natural, and vine fruitfulness and fruit shatter were not affected. The added berry size resulted in very attractive fruit, and the delay in maturity was less than the GA<sub>3</sub> x girdle combination. Unfortunately, the girdle still increased the potential for bunch rot. The delay in maturity resulting from GA<sub>3</sub> and/or a girdle is of particular concern for Ruby Seedless produced in northern districts since a delay of harvest into September or October greatly increases the possibility of inclement weather and increased decay.

Figure 1. Berry weight as influenced by GA<sub>3</sub> and girdling.

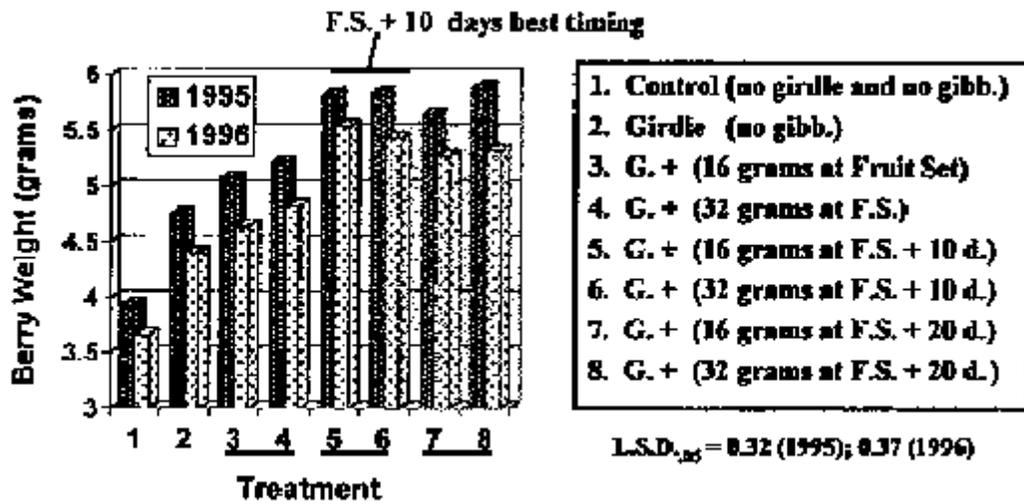


Figure 2. Fruit shatter at harvest as influenced by GA<sub>3</sub> and girdling (9/11/95)

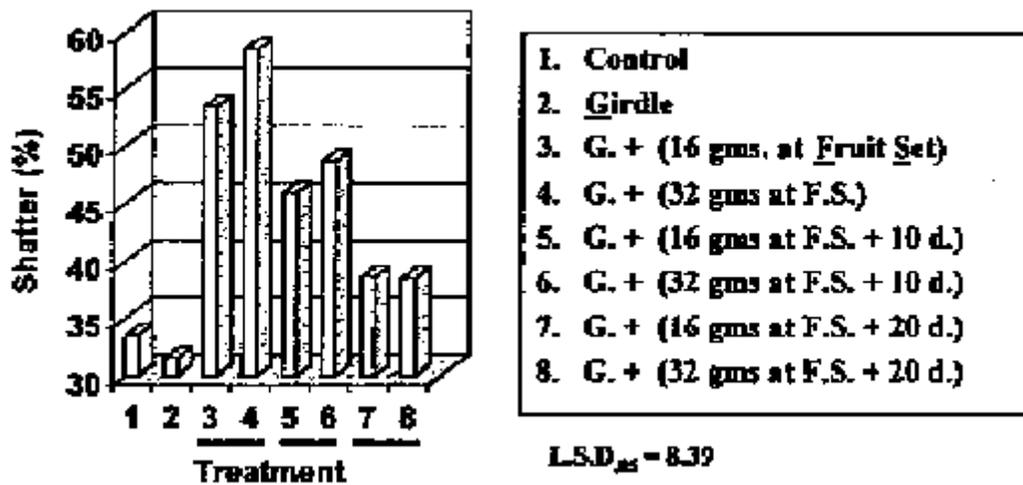


Figure 3. Flower cluster counts as influenced by GA<sub>3</sub> and girdling (4/23/96).

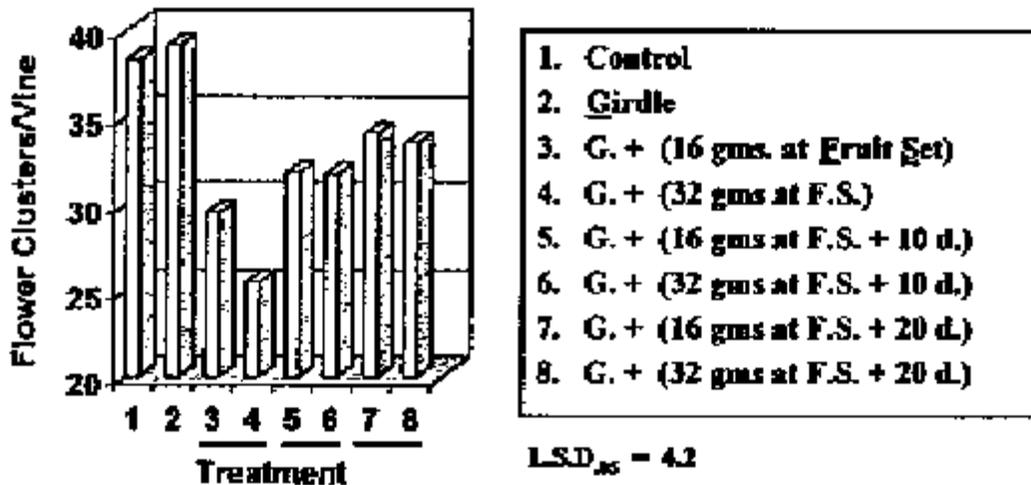


Figure 4. Number of berries per cluster as influenced by GA<sub>3</sub> and girdling (9/20/96).

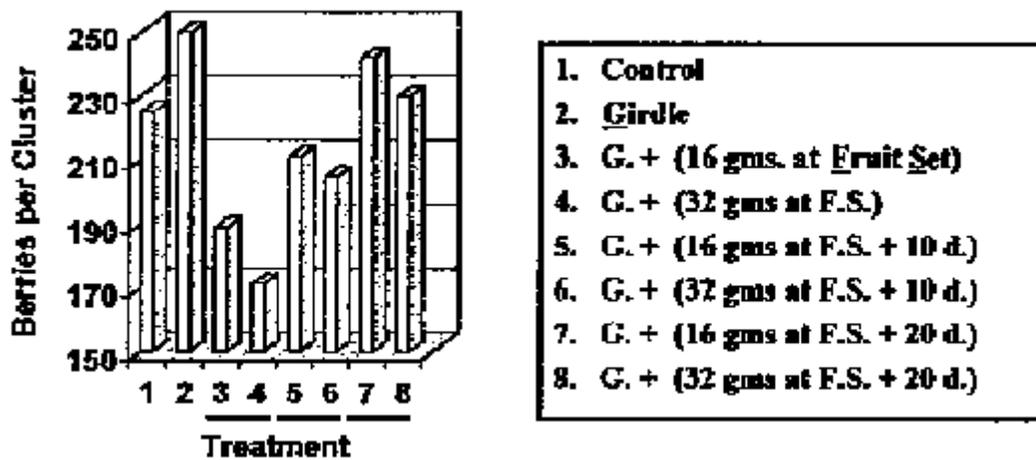


Figure 5. Berry firmness as influenced by GA<sub>3</sub> and girdling (9/12/95).

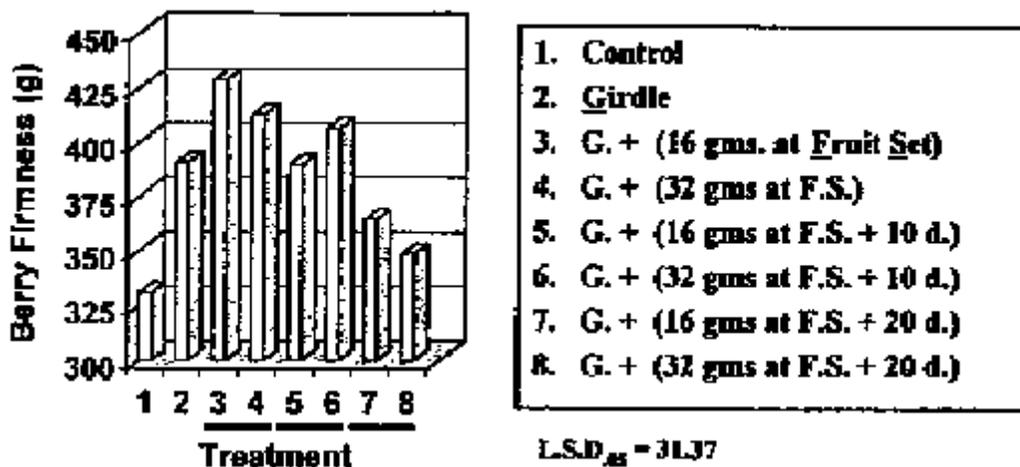


Figure 6. Yield of packable and cull fruit as influenced by GA<sub>3</sub> and girdling (9/13/95).

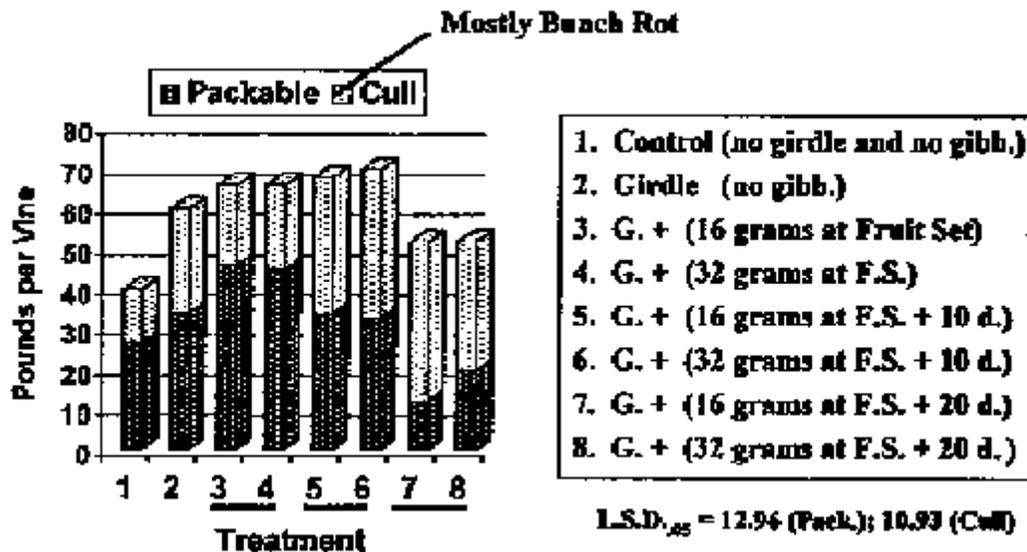


Figure 7. Yield of packable and cull fruit as influenced by GA<sub>3</sub> and girdling (9/10/96).

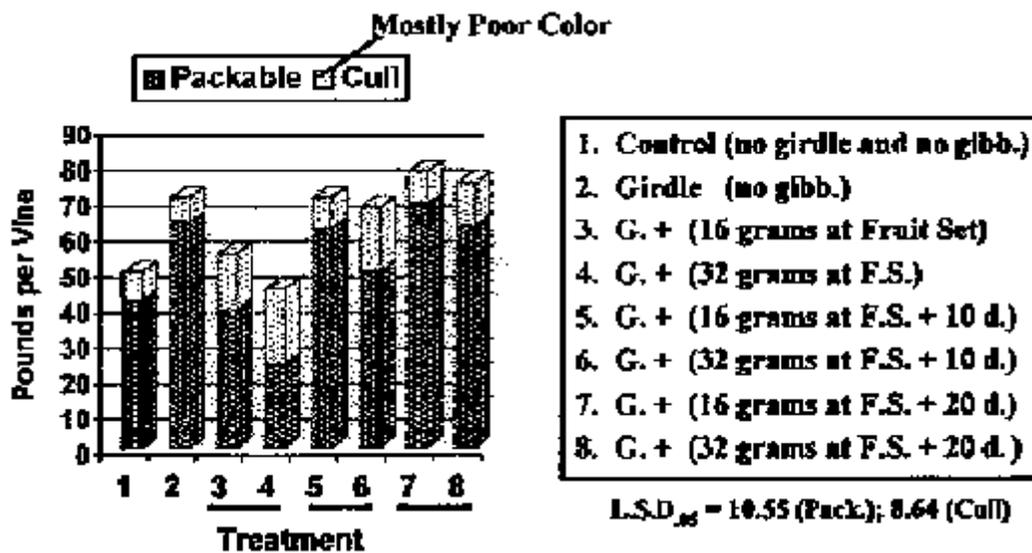


Figure 8. Yield of packable and cull fruit as influenced by GA<sub>3</sub> and girdling (Average for 1995 and 1996).

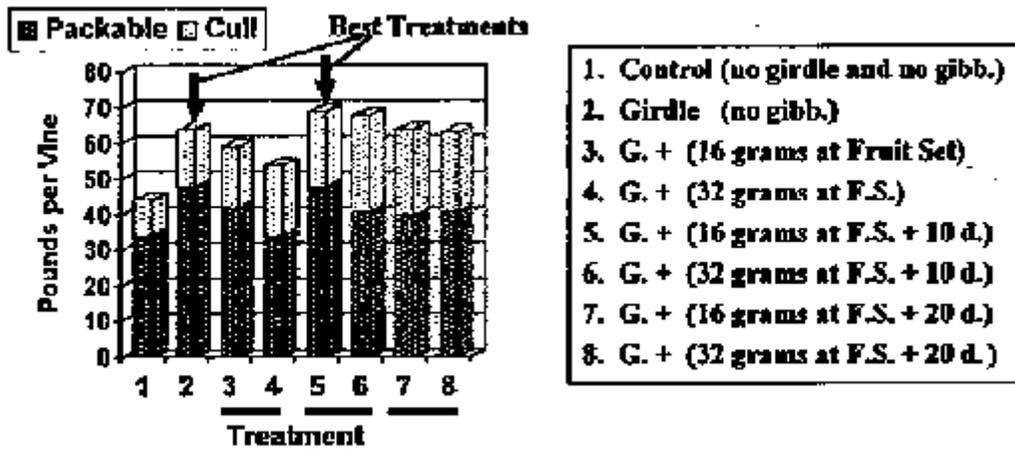


Figure 9. Maturity ( $^{\circ}$ brix) as influenced by GA<sub>3</sub> and girdling for 1995 and 1996.