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The Effect of Single and Double Application of Gibberellin Treatments on Thompson Seedless Fruit Characteristics and Post-Harvest Shatter

Fred Jensen, Extension Viticulturist, Parlier
Don Luvisi, Farm Advisor, Kern County
Robert Beede, Staff Research Associate, Parlier

SUMMARY

Gibberellin berry enlarging sprays were applied at a total concentration of 80 ppm at the fruit stage and one week later in various combinations. Only when no gibberellin was applied at the fruit set stage was the weight of post-harvest shattered fruit reduced significantly. The reduction in shattered fruit, compared to double 40 ppm sprays, was 21 and 40 percent respectively in two vineyards while the reduction in berry weight was 8 percent in one vineyard and not significant in the other.

Delaying double applications of the berry enlarging gibberellin sprays a week after the fruit set stage on table Thompson Seedless reduced post-harvest shatter as compared to normal sprays in 1979 trials. However, with the delayed sprays, berry weight was also reduced to some extent and in two of three trials, a considerable amount of berry discoloration was encountered. Thus, for the 1980 trials, no gibberellin application was made later than one week after fruit set.

The effectiveness of gibberellin is decreased by delaying applications after fruit set. Instead of delaying all of the gibberellin treatment for one week, the trials were established to test the benefit of applying lower concentrations of gibberellin at the fruit set stage, followed by higher applications a week later. A full range of treatments was tested as follows:

Gibberellin Concentration		
	Applied at fruit set June 1 or 2	Applied at fruit set plus one week June 8 or 9
1	0 ppm	0 ppm
2	0 ppm	80 ppm
3	10 ppm	70 ppm
4	20 ppm	60 ppm
5	40 ppm	40 ppm
6	60 ppm	20 ppm
7	80 ppm	0 ppm

Both trials were located in vineyards in the Delano area. The gibberellin bloom application, girdling and thinning practices were those normally followed by the grower.

The gibberellin sprays were applied by a single-row "U" boom spray rig at a rate of 200 gallons per acre.

Methods

The trials were designed as randomized complete blocks with eight replications of each treatment. Each replication consisted of 10 vines.

Just prior to harvest, a 200 berry sample was taken for analysis. The overall fruit appearance was rated visually on a scale of one to 10, one representing poor quality, five average quality and 10 superior quality. For the shatter test, one box of fruit was harvested and field packed by the grower's crew. Two workers harvested the fruit and one person packed the fruit. The weight per box was kept within a tolerance of one-quarter pound of the 23 pounds net weight desired. The fruit was packed in TKV lugs, bottom cleated, with a bottom cushion, wrapper, and snap lid.

The boxes were taken to a 60°F holding room, vibrated at a force of 3 gravity acceleration for 20 seconds. The purpose of this treatment was to

separate those berries from the stems which were loosened but not detached during packing. The boxes were then carefully inverted, the shattered berries counted and weighed. The soluble solids were later determined on these shattered berries. Details of the treatments are as follows:

Vineyard 1

First spray - June 2, predominant berry diameter 3-6 mm.

Second spray - June 9, predominant berry diameter 6-8 mm on previously untreated fruit.

Vines were girdled on June 7 and thinned on June 10.

Material - 2% Gibrel®. Adjuvant - 4 oz. Triton B1956 per 100.

Vineyard 2

First spray - June 1, predominant berry diameter 4-6 mm.

Second spray - June 8, predominant berry diameter 6-8 mm on previously untreated fruit.

Material - 2% Gibrel®. Adjuvant - 4 oz. Triton B1956 per 100.

Results

The results of trial 1 are given in Tables 1 and 2. So far as berry weight is concerned, all of the double sprays were superior to the 0-80 spray but only two, the 20-60 and 60-20, were superior to 80-0. The treatment producing the higher weight berries tended to produce lower soluble solids. The visual quality evaluation follows the same general pattern as do berry weights. Although the length-width ratio did not vary among the gibberellin treatments, there were differences in both length and width of berries generally following the same trends as berry weight.

The two harvests were analyzed factorially, Tables 3 through 5. Number of shattered berries and weight of shattered berries per box increased with the second harvest as compared to the first. The unsprayed vines had significantly less shatter, both in number of berries and weight, than did any

of the gibberellin treatments. Only the single gibberellin treatment, 0-80, showed less weight of shattered berries than did most of the gibberellin treatments.

The summary of vineyard 2 is also given in Tables 1 and 2. The berry weights show that all sprayed treatments are larger than the unsprayed, but there is only one significant difference among the treatments, the 20-60 being superior to 0-80 or 10-70.

The berry length, widths, and length-width ratios generally follow the same trends as the berry weights.

The single spray, 0-80, had less weight of shatter per box than any other gibberellin treatment and the number of shattered berries per box was less than any of the double sprays.

During the harvest, separate boxes of fruit were packed from Treatment 5, 40 ppm + 40 ppm. These were not vibrated but simply inverted, the shattered berries counted and weighed. The results of the comparisons, Table 6, between vibrated and non-vibrated boxes shows that vibration increased the numbers of berries that shattered by 15 percent and the weight of shattered berries by 17 percent compared to non-vibrated fruit. This confirms our knowledge that most of the immediate shatter is produced by the packing operation. However, the previous estimates generally used were that the packing produced about 75 percent of the shatter rather than the 85 percent shown in this trial.

Conclusion

Considering both trials, it appears that something like a 30 percent reduction in weight of shattered fruit can be obtained if no gibberellin is applied at the fruit set stage but rather applied one week later. The sacrifice in berry weight due to this delay is in the order of 7 percent. These results are briefly shown in Table 8.

Part of the shatter reduction with the delayed spray is probably due to the smaller berries which have a lower shatter potential, and part due to the stronger attachment of the berry to the pedicel (capstem). Using double sprays, with lower concentrations at the fruit set stage such as 10-70 or 20-60, gave essentially no benefit in reducing shatter. Thus, any gibberellin applied at the fruit set stage increases the shatter potential.

Table 1. The effect of timing of gibberellin sprays on fruit characteristics of Thompson Seedless in two vineyards.

	Gibberellin, ppm		Berry weight			Berry length	Berry width	Length/ width	Visual evalu-
	June 1	June 8	gms	°Brix	Total acidity	mm	mm	ratio	ation[1/]
Vineyard 1, Aug. 15									
1	0	0	3.58a[2/]	19.1a	.54ab	22.2a	15.9a	1.40:1a	3.9a
2	0	80	4.88 b	17.7 b	.54a	25.5 b	17.6 b	1.45:1 b	5.9 b
3	10	70	5.33 cd	17.4 bc	.52 bc	26.1 bc	17.9 bc	1.46:1 b	6.8 bc
4	20	60	5.49 d	16.8 d	.53ab	26.6 c	18.2 c	1.46:1 b	7.6 d
5	40	40	5.30 cd	17.1 cd	.50 d	26.3 bc	17.9 bc	1.47:1 b	7.0 cd
6	60	20	5.50 d	17.5 bc	.51 cd	26.5 c	17.9 bc	1.47:1 b	7.0 cd
7	80	0	5.10 bc	17.6 b	.53ab	25.7 bc	17.6 b	1.46:1 b	6.4 bc
Vineyard 2, Aug. 22									
	June 2	June 9							
1	0	0	3.59a	17.5a	.67a	23.1a	16.4a	1.41:1a	
2	0	80	4.76 b	15.5 b	.70 d	25.0 b	17.6 b	1.42:1a	
3	10	70	4.81 b	15.4 b	.70 cd	25.2 bc	17.5 b	1.44:1 b	
4	20	60	5.19 c	15.5 b	.69 bcd	25.8 bc	17.8 b	1.45:1 bc	
5	40	40	5.08 bc	15.8 b	.68ab	26.1 c	17.9 b	1.47:1 c	
6	60	20	5.07 bc	15.9 b	.68ab	25.6 bc	17.5 b	1.46:1 bc	
7	80	0	4.95 bc	15.5 b	.68abc	25.6 bc	17.5 b	1.46:1 bc	

1/ Evaulation on a scale of 1 to 10: 1 = poor quality fruit, 5 = average quality, and 10 = superior quality.

2/ Mean separation by Duncan's Multiple Range Test, 5% level. Means not sharing a common letter are significantly different.

Table 2. The effects of timing of gibberellin sprays on post-harvest shatter of Thompson Seedless in two vineyards.

	Gibberellin, ppm		Packed and vibrated boxes		Shattered fruit from vibrated boxes	
	June 1	June 8	No. shattered berries per box	Weight shattered berries per box, gms	Berry weight gms	°Brix
Vineyard 1, Aug. 18 and 25						
1	0	0	171a	609a	3.58a	20.2a
2	0	80	235 b	1095 b	4.65 b	18.6 bc
3	10	70	242 b	1242 bc	5.19 c	18.5 bc
4	20	60	265 b	1384 c	5.28 c	17.9 c
5	40	40	276 b	1386 c	5.05 c	18.0 bc
6	60	20	274 b	1440 c	5.29 c	18.6 bc
7	80	0	265 b	1297 c	5.05 c	18.8 b
Vineyard 2, Aug. 27						
	June 2	June 9				
1	0	0	137a	506a	3.71a	18.2a
2	0	80	167ab	785 b	4.67 b	16.6 b
3	10	70	241 cd	1175 c	4.90 bc	16.2 b
4	20	60	216 cd	1118 c	5.17 c	16.6 b
5	40	40	256 cd	1312 c	5.16 c	16.6 b
6	60	20	262 d	1287 c	4.90 bc	16.6 b
7	80	0	212 bc	1105 c	5.20 c	16.6 b

Table 3. The effects of timing of gibberellin treatments and harvest date on number of shattered berries per box, Vineyard 1.

	Gibberellin, ppm		No. shattered berries per box		Average effect
	June 1	June 8	Aug. 18 harvest	Aug. 25 harvest	of gibberellin
1	0	0	161	181	171
2	0	80	221	250	235
3	10	70	224	261	242
4	20	60	235	295	265
5	40	40	256	296	276
6	60	20	270	279	274
7	80	0	246	284	265
Avg. effect of harvest date			230	264	

LSD .05 Gibberellin = 41, Harvest Date = 22, Interaction = NS (58)[1/]

1/Although not significant (NS), the interaction term is reported in parenthesis since this figure may be used to compare any two means. The interaction LSD is the same as the LSD of an analysis of variance.

Table 4. The effect of timing of gibberellin treatments and harvest date on weight of shattered fruit per box.

	Gibberellin, ppm		Weight shattered fruit per box, gms		Average effect
	June 1	June 8	Aug. 18 harvest	Aug. 25 harvest	of gibberellin
1	0	0	571	647	609
2	0	80	1047	1114	1095
3	10	70	1170	1314	1242
4	20	60	1235	1532	1384
5	40	40	1317	1456	1386
6	60	20	1432	1450	1440
7	80	0	1222	1370	1297
Avg. effect of harvest date			1142	1273	

LSD .05 Gibberellin = 183, Harvest Date = 98, Interaction = NS (259)

Table 5. The effects of timing of gibberellin treatments and harvest date on berry weight of shattered fruit.

	Gibberellin, ppm		Berry weight, gms, of shattered fruit		Average effect
	June 1	June 8	Aug. 18 harvest	Aug. 25 harvest	of gibberellin
1	0	0	3.55	3.61	3.58
2	0	80	4.72	4.59	4.65
3	10	70	5.23	5.09	5.19
4	20	60	5.30	5.27	5.28
5	40	40	5.17	4.93	5.05
6	60	20	5.34	5.25	5.29
7	80	0	5.12	4.99	5.05
Avg. effect of harvest date			4.92	4.82	

LSD .05 Gibberellin = 0.26, Harvest Date = NS, Interaction = NS (.37)

Table 6. The effect of timing of gibberellin treatments and harvest date on soluble solids of shattered fruit.

	Gibberellin, ppm		Soluble solids, °Brix, of shattered fruit		Average effect
	June 1	June 8	Aug. 18 harvest	Aug. 25 harvest	of gibberellin
1	0	0	19.9	20.4	20.2
2	0	80	18.5	18.7	18.6
3	10	70	18.4	18.6	18.5
4	20	60	17.8	18.1	17.9
5	40	40	17.7	18.2	18.0
6	60	20	18.5	18.8	18.6
7	80	0	18.7	18.8	18.8
Avg. effect of harvest date			18.5	18.8	

LSD .05 Gibberellin = 0.5, Harvest Date = 0.3, Interaction = NS (0.8)

Table 7. A comparison of post-harvest shatter of fruit packed only with fruit packed and vibrated.

Treatment	No. of shattered berries	Wt. of shattered berries, gms	Berry weight gms	°Brix
1 Packed only	228	1120	4.91	16.4
2 Packed and vibrated	262	1312	5.17	16.6
Percent difference	15	17		

Table 8. Summary of principal gibberellin timing treatments on berry weight and weight of shattered berries in two Thompson Seedless vineyards.

Gibberellin, ppm											
	Sprayed at	Sprayed at fruit set	Berry weight gms		% Reduction in berry weight compared to 40+40		Wt. shattered berries gms		% Reduction in weight of shattered berries compared to 40+40	
	fruit set	+ 7 days	Vyd. 1	Vyd. 2	Vyd. 1	Vyd. 2	Vyd. 1	Vyd. 2	Vyd. 1	Vyd. 2
1	0	0	3.58a	3.59a	32	29	609a	506a	56	61
2	0	80	4.88 b	4.76 b	8	6	1095 b	785 b	21	40
3	80	0	5.10 bc	4.95 bc	6	3	1297 c	1105 c	6	16
4	40	40	5.30 cd	5.08 bc	-	-	1386 c	1312 c	-	-