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The Improvement of Grape Quality and Production : Fruiting Responses of Some Grape Varieties to Gibberellic Acid

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ABSTRACT

Fruiting responses to four concentrations of gibberellic acid were studied on seven grape varieties namely Sultana, Black Sultana, Beauty Seedless, Ruby Seedless, Delight, Early Muscat and Italia. These grape vines were grown at the private vineyard in Samut Sakhon province. Gibberellic acid at the concentrations of 0, 25, 50 and 75 ppm were sprayed to the flower clusters at two weeks after full bloom stage. The results showed that GA_3 applications were effective in improving clustersize and berry characters resulting in high yield. Berry quality of various grape varieties was less affected by GA_3 application.

INTRODUCTION

As a general practice of grape culture in Thailand, the growers prune their vines twice a year and harvest two crops, one in the rainy season (May to October) and another in the dry reason (November to April). However, in the dry season, the berry quality is superior to that in the rainy season. The quality improvement is then still needed. The use of growth regulators in commercial fruit production has become increasingly popular among fruit growers. There are many compounds presently available, with gibberllic acid (GA_3) as the most popular chemical spray in many grapegrowing countries. Gibberellic acid has been used for improving the fruit eating quality as well as yield of the vine. The desirable effects that could be obtained with the use of GA_3 depend on several factors including variety, concentration used and time of application.

Varied responses to GA_3 application were reported for both seedless and seeded grapes. In seeded varieties the effect of GA_3 application in increasing berry size is usually minimal. Lavee (1960), for example, had shown that GA_3 application on the seeded variety 'Queen of the Vineyard' after set partially compensates for decreases in berry weight associated with a reduction in the number of seeds. The amount of increase declined as seed number increased from one to four. kasimatis and Jensen (1973) reported that the 'Emperor' should be the only seeded variety recommended for GA_3 application. However, in Thailand, Nilnond (1977) reported that 'White Malaga' grapes treated with 50 ppm Ga_3 ten to fourteen days after full-bloom gave the best results on fruit size and quality. Similarly, in India, Dass and Randhawa (1968) reported that yields of seeded varieties were increased by GA_3 application. The response to GA_3 of other seedless varieties such as 'Black Monukka', 'Perlette', 'Delight', 'Beauty Seedless' and 'Seedless Concord', is generally similar to that of 'Thompson Seedless' (Kasimatis *et al.*, 1971).

Therefore, the objective of this study was to determine the effects of various GA_3 concentrations applied at the post-bloom stage of various grapevine varieties on cluster, berry characters and berry quality.

MATERIALS AND METHODS

One-year-old 'Sultana', 'Black Sultana', 'Beauty Seedless', 'Ruby Seedless', 'Delight', 'Early Muscat' and 'Italia' vines were grown at

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the private vineyard in Samut Sakhon province. 'Sultana', 'Black Sultana', 'Beauty Seedless', 'Ruby Seedless' and 'Delight' are seedless varieties whereas 'Early Muscat' and 'Italia' are seeded varieties. Pruning was done on October 27, 1986. The buds sprouted on November 10, 1986 and the flower cluster appeared about 15 to 20 days after bud sprout. About two weeks after full-bloom stage (100% cap fall) the flower clusters were selected for GA_3 application. The experiment was designed in the completely randomized with Duncan Multiple's range test to compare the treatment effects on the various parameters. The following treatments were used:

Treatment 1 Control
Treatment 2 GA_3 25 ppm
Treatment 3 GA_3 50 ppm
Treatment 4 GA_3 75 ppm

For each treatment, ten flower clusters were treated for each variety studied. After the application of GA_3 as in the above mentioned concentration, the berries in all treatments were allowed to develop until maturity. At harvest, the berries in all treatments were analyzed for quality such as sizes total soluble solids and total acidity.

RESULTS AND DISCUSSION

Fruit Cluster Characteristics

Tables 1 to 7 and Figures 1 to 7 show the fruit cluster characteristies of 'Sultana', 'Black Sultana', 'Beauty Seedless', 'Ruby Seedless', 'Delight', 'Early Muscat' and 'Italia' as affected by GA_3 application. All GA_3 applications were effective in significantly increasing cluster width and or cluster length led to the increase of cluster weight.

Table 1. Cluster and berry characters and berry quality of Sultana' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			TSS (%)	TA (%)	TSS:TA
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)			
0	8a	9.3a	118.6a	1.2a	1.4b	1.4b	20.4a	0.96a	21.3a
25	10a	14.6a	186.6a	1.3a	1.7ab	1.6	20.1a	0.89a	23.1a
50	9a	12a	196.6a	1.4a	1.9a	2.3a	19.8a	0.87a	23.7a
75	12a	11a	195.3a	1.3a	1.6ab	1.6b	20.5a	0.89a	23.0a
C.V.(%)	5.7	6.6	8.1	1	2.1	3.5	1.6	3.9	4.7

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 2. Cluster and berry characters and berry quality of 'Black Sultana' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			TSS (%)	TA (%)	TSS:TA
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)			
0	8.0a	15.6a	128.0a	1.5a	1.3b	1.4c	23.7a	0.43a	55.1a
25	9.0a	14.0a	154.6a	1.3a	1.6a	1.6bc	23.2a	0.50a	46.4a
50	6.8a	10.6a	80.6a	1.2a	1.7a	1.6bc	22.3a	0.53a	42.1a
75	8.1a	12.3a	130.6a	1.3a	1.8a	2.0a	22.7a	0.55a	41.3a
C.V.(%)	5.2	7.0	8.9	3.7	1.5	2.6	0.9	3.1	3.0

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 3. Cluster and berry characters and berry quality of 'Beauty Seedless' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			Berry Quality		
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)	TSS (%)	TA (%)	TSS:TA
0	8a	12.6a	101.3c	1.3a	1.3b	1.4b	20.0a	0.73a	27.9a
25	11a	12.0a	235.3a	1.4a	1.6a	1.9a	19.6a	0.65a	29.9a
50	9.6a	12.6a	134.0bc	1.4a	1.5a	1.6a	19.0a	0.57a	32.5a
75	9.3a	14.6a	185.3a	1.4a	1.5a	1.6a	19.8a	0.58a	34.1a
C.V.(%)	16.1	5.9	4.6	0.2	1.6	4.5	0.3	3.9	3.0

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 4. Cluster and berry characters and berry quality of 'Ruby Seedless' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			Berry Quality		
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)	TSS (%)	TA (%)	TSS:TA
0	10b	13a	135c	1.4a	1.7a	1.9a	17.9a	0.52a	34.1a
25	11a	14a	219b	1.4a	1.6a	1.9a	18.1a	0.52a	35.5a
50	12a	15a	338a	1.5a	1.7a	2.2a	17.1a	0.55a	31.0a
75	14a	13a	330a	1.6a	1.7a	3.8a	17.8a	0.57a	31.4a
C.V.(%)	3.1	4.8	9.8	1.7	4.4	4.1	0.4	0.4	3.0

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 5. Cluster and berry characters and berry quality of 'Delight' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			Berry Quality		
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)	TSS (%)	TA (%)	TSS:TA
0	7.3a	11.3a	132.7a	1.2a	1.3a	1.3b	22.4a	0.68a	31.1a
25	7.6a	11.0a	156.7a	1.3a	1.5a	1.4a	21.1a	0.62a	35.4a
50	8.3a	7.0a	109.0a	1.2a	1.6a	1.4a	20.6a	0.73a	28.1a
75	9.6a	9.0a	158.0a	1.3a	1.6a	1.6a	21.9a	0.79a	28.6a
C.V.(%)	5.9	5.1	8.7	1.0	4.3	2.7	2.9	3.5	4.9

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 6. Cluster and berry characters and berry quality of 'Early Muscat' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			Berry Quality		
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)	TSS (%)	TA (%)	TSS:TA
0	8.6a	15.0a	204.3a	1.5a	1.6a	2.1a	15.6a	0.94a	16.9a
25	11.3a	12.3a	169.3a	1.7a	1.7a	2.4a	16.0a	0.81a	19.8a
50	11.0a	12.3a	124.0a	1.5a	1.5a	1.8a	17.2a	0.70a	24.9a
75	10.6a	13.3a	268.0a	1.8a	1.8a	2.5a	16.0a	0.79a	20.3a
C.V.(%)	4.8	5.6	7.3	3.8	1.8	4.2	1.0	5.1	3.4

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

Table 7. Cluster and berry characters and berry quality of 'Italia' as affected by GA_3 application.

GA_3 Concentration (ppm)	Cluster			Berry			Berry Quality		
	width (cm)	length (cm)	weight (cm)	width (cm)	length (cm)	weight (g)	TSS (%)	TA (%)	TSS:TA
0	8.6a	11.6a	200.0a	1.6a	1.9a	4.3a	12.9a	1.25a	10.7a
25	11.0a	16.0a	268.0a	1.8a	2.1a	4.6a	12.0a	1.43a	8.9a
50	11.6a	14.6a	243.3a	1.8a	2.1a	4.6a	12.6a	1.24a	10.2a
75	9.6a	13.3a	222.6a	1.9a	2.1a	4.9a	13.6a	1.21a	12.3a
C.V.(%)	4.0	5.6	4.1	1.4	8.9	1.7	2.6	4.4	3.6

Means in each column followed by the same letter are not significantly different at 5% level (DMRT)

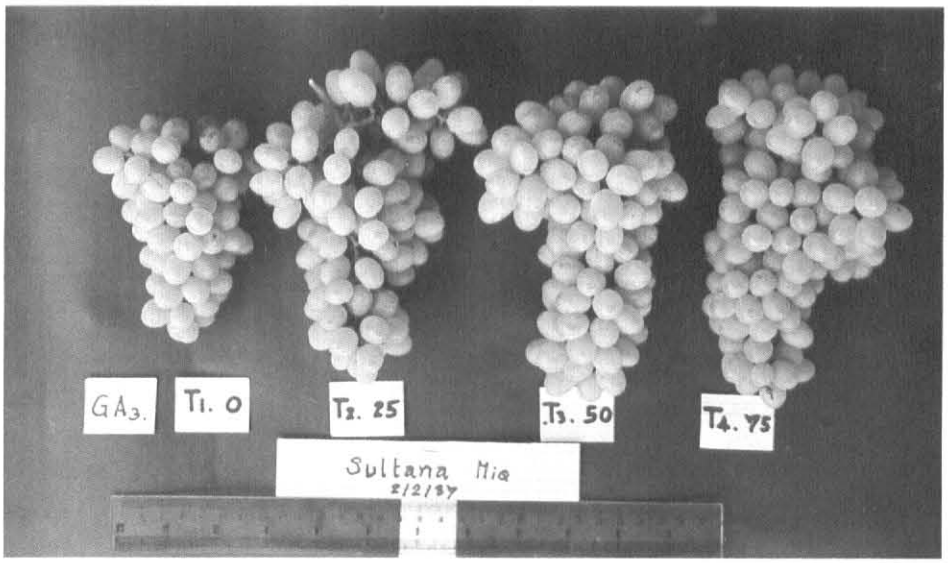

Figure 1. Cluster sizes of 'Sultana' grape treated with gibberellic acid.

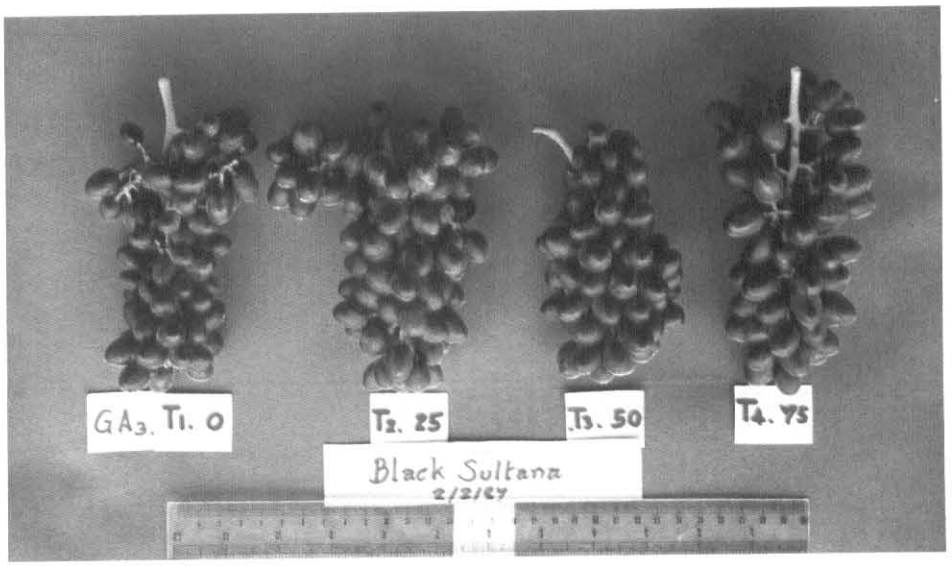

Figure 2. Cluster sizes of 'Black Sultana' grape treated with gibberellic acid.

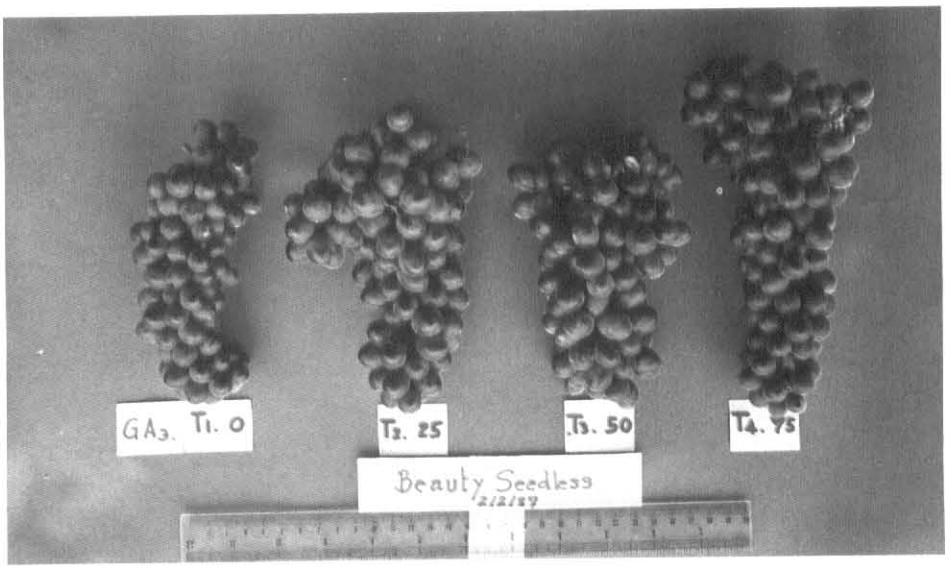

Figure 3. Cluster sizes of 'Beauty Seedless' grape treated with gibberellic acid.

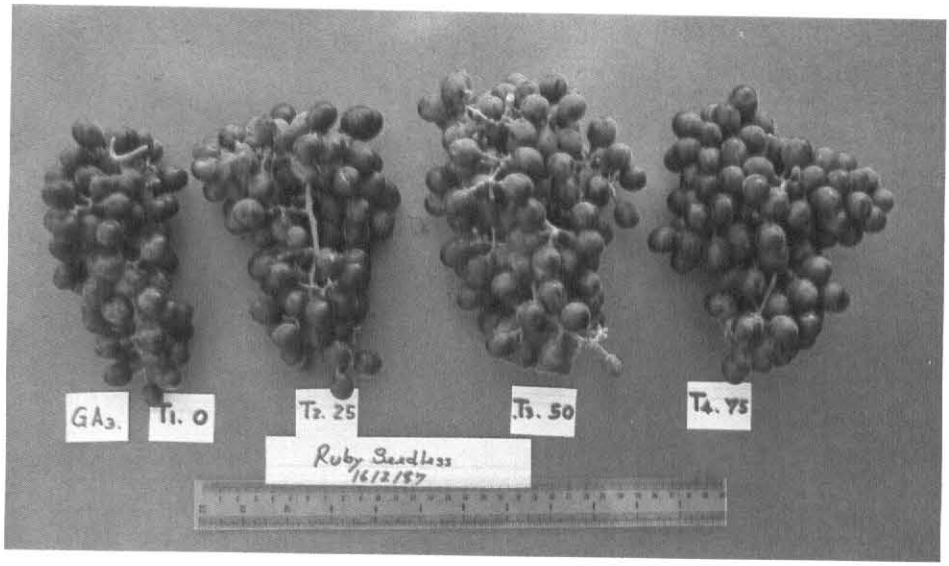

Figure 4. Cluster sizes of 'Ruby Seedless' grape treated with gibberellic acid.

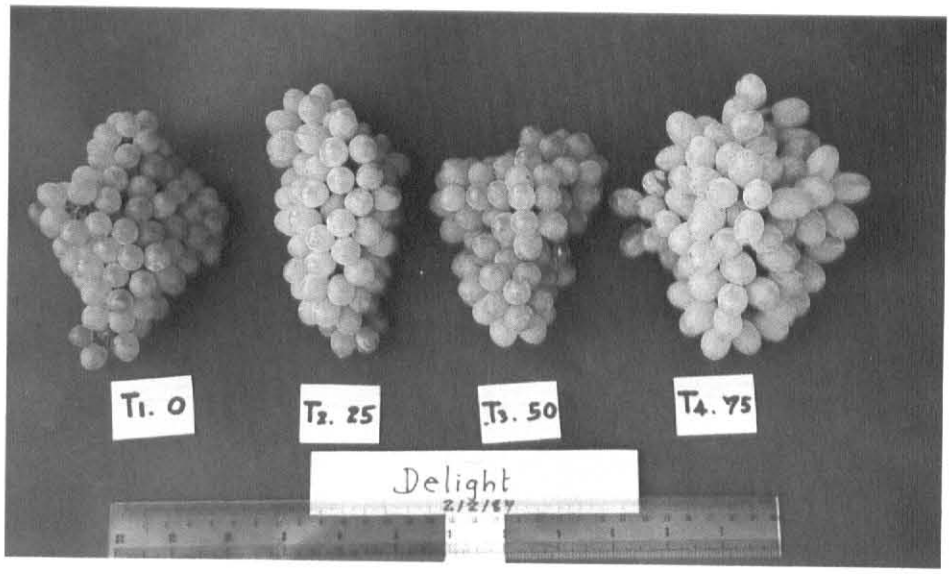

Figure 5. Cluster sizes of 'Delight' grape treated with gibberelic acid.

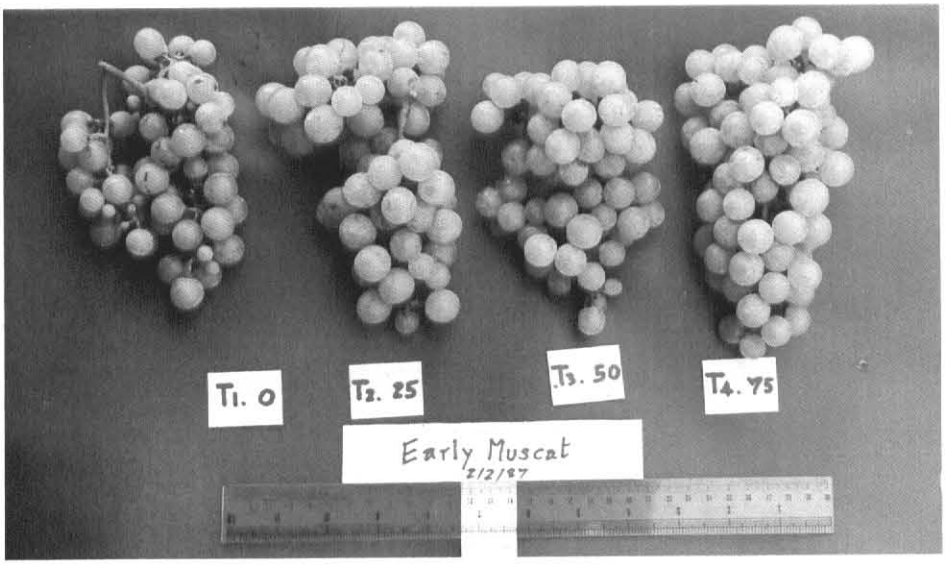

Figure 6. Cluster sizes of 'Early Muscat' grape treated with gibberellic acid.

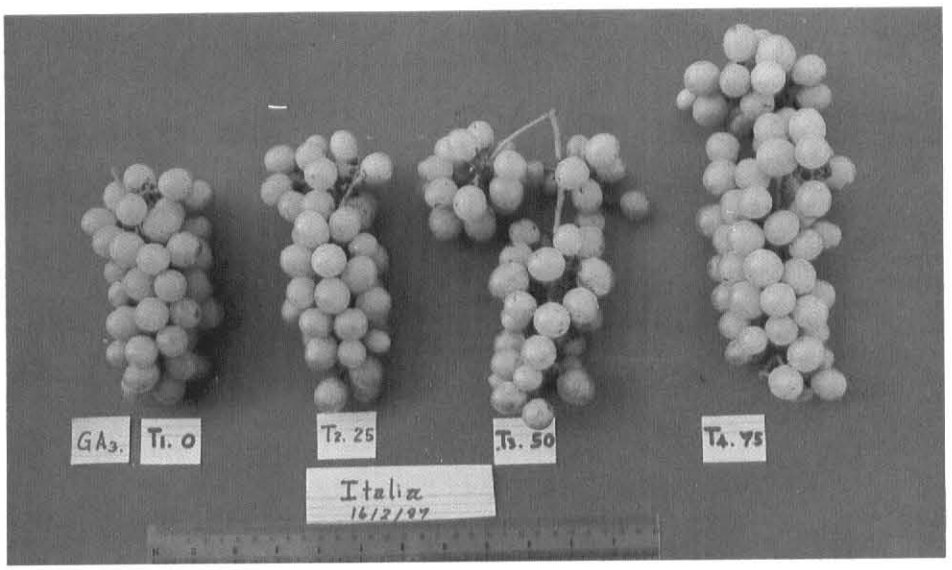

Figure 7. Cluster sizes of 'Italia' grape treated with gibberellic acid.

At harvest, cluster length, width and weight were slightly increased in all varieties by GA_3 application. This study and that of many other researches has shown that GA_3 application at full-bloom and post-bloom stages did not significantly increase cluster length and width (Kasimatis and Jensen, 1973). However, the cell size of berries was also affected by GA_3 application. The increase in berry size and weight led to a slight increase in cluster weight (Weaver, 1958, 1972).

Berry Characteristics

The size of berry expressed as berry width, berry length and berry weight of one berry was shown to increase in response to GA_3 application. Berry width, berry length and berry weight of all grape varieties responded to various GA_3 application. The untreated berry tended to give lower size of berry characteristics. The increase in berry width and lenght led to the increase in berry weight (Tables 1 to 7) and (Figures 1 to 7).

All varieties affected by different GA_3 treatments at post-bloom stage of application are shown in Tables 1 to 7. GA_3 application tended to increase berry size in all grape varieties. Although higher GA_3 concentration tended to increase berry size, varying concentrations produced no significant difference on it. This finding supports previous reports of Weaver (1958), Stuart and Cather (1961), Jensen (1969), Weaver and Pool (1965), Bertard and Weaver (1972), Weaver (1972), Kasimatis and Jensen (1973) and El-Banna and Weaver (1979).

Berry Quality

TSS, TA and TSS:TA were not significantly affected by all GA_3 concentrations in all varieties. GA_3 application tended to give lower TSS and TA than untreated one (Tables 1 to 7).

When GA_3 was applied at post-bloom stage, no significant effects on TSS, TA and TSS: TA were obtained in any grape varieties. These findings are similar to those of Weaver and Pool (1971) on 'Thompson Seedless' and 'Perlette' and El-Banna and Weaver (1979) on 'Thompson Seedless'. They added that GA_3 application may result in delayed fruit maturation.

CONCLUSIONS

Experiment was conducted on 'Sultana', 'Black Sultana', 'Beauty Seedless', 'Ruby Seedless', 'Delight', 'Early Muscat' and 'Italia' grapes to determine the effects of various GA_3 concentrations applied at two weeks after full-bloom stage on various cluster and berry characters and berry quality.

GA_3 applications tended to increase cluster width and length in all varieties resulted in higher cluster weight. GA_3 applications increased berry width and length in all grape varieties resulting in a higher berry weight. GA_3 concentrations tended to give lower TSS and TA. However. this study has shown that GA_3 applied at post-bloom stage increased the berry size resulting in high yeild.

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