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EFFECT OF GIBBERELLIC ACID AND SUCCINIC ACID ON RUBY SEEDLESS GRAPEVINE CULTIVAR: 2- YIELD, BUNCHES AND BERRIES QUALITY

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ABSTRACT

The effect of GA_3 and succinic acid on yield, bunches and berry quality of Ruby Seedless grapevines was studied during 2004, 2005 and 2006 seasons at the experimental vineyard, Faculty of Agriculture, Assiut University, Egypt

GA_3 at 5, 10, 15 & 20 ppm and succinic acid at 50, 100, 150 & 200 ppm were sprayed when cluster length reached about 10-12 cm.

The results showed that:

- **All GA_3 and succinic acid treatments significantly increased the berry set percentage and yield weight/vine and improved soluble solids (SS)/content compared with control.**
- **Bunch weight, length and bunch index, as well as compactness coefficient significantly increased in response to GA_3 or succinic acid spraying. All succinic acid treatments were more effective than GA_3 treatments on yield and bunch characters, while all GA_3 was more effective on compactness coefficient, which significantly reduced it.**
- **Spraying GA_3 at 10 ppm or succinic acid at 100 ppm gave the best values for berry quality, since both increased berry weight and anthocyanin contents, hence improved berry coloration.**
- **Spraying succinic at 100 ppm or GA_3 at 10 ppm gained the highest score record, 96.6 and 93.9 units, respectively, as a general evaluation of treatments.**

On the account of the present findings, it can be concluded that spraying succinic acid at 100 ppm or GA_3 at 10 ppm when flower cluster length reached 10-12 cm was the best economic treatment to obtain high yield with heavy bunch and good berry quality of Ruby Seedless grapevines under the conditions of this study.

INTRODUCTION

Ruby Seedless is a new cultivar which has medium cluster with small berries. Uneven ripening and poor coloration are the most problems facing the growers of this cultivar under Assiut climatic conditions. Loose clusters would be desirable to produce larger berries, encourage packing and reduce bunch rot. There are many factors which may help the growers to improve and maximize the productivity of this cultivar, i.e. fertilization, irrigation, pruning and other horticultural practices to enhance, regular bud break and improve cluster and berry quality.

Plant growth regulators, especially, gibberellic acid seemed to be very effective in enhancing growth and fruit development. Selecting the optimum concentration and date of spraying of gibberellic acid seemed to be of beneficial in grape development and yield of various seedless grapevine cultivars (Thomas, 1979).

Several studies indicated that GA_3 application on grapevines was more effective in increasing bunch weight, yield/vine. GA_3 at 25, 50 or 75 ppm application at full bloom and two weeks after full bloom improved the yield. GA_3 at 10 ppm applied pre-bloom increased the berry set of some seedless cultivars (Louis and Nickell, 1984; Ezzahouani *et al.*, 1985; Nilnomd and Sukumalandana, 1988; Uarma, 1991; Mansour, 1994 and Shehata and El-Barbary, 1996).

A single application of 2.5 ha^{-1} GA_3 near full bloom could be used to reduce fruit set and increase berry size of "Crimson Seedless" grapes without detrimental effect on packable yield or cluster number per vine during the subsequent year (Dokoozlian and Peacok, 2001).

Moreover, GA_3 at 10 to 50 ppm applied pre-bloom, at full bloom or at both times resulted in greatest bunch weight, bunch length. GA_3 at 10 ppm before bud burst flowed by GA_3 40 ppm treatment at fruit set gave loose clusters with large berries and less or equal shot berries than the tolerance level per cluster i.e. 5 berries (Singh *et al.*, 1994; Shehata and El-Barbary, 1996 and El-Hammady *et al.*, 1998). To obtaine clusters and berries of centennial seedless grapes with best morphological standard and superior quality only one doses of GA_3 between 20 to 30 ppm, 16 days after blooming should be applied (Pires *et al.*, 2000).

However, spraying some seedless grapes cultivars with GA_3 at 5 or 10 ppm at 50% flowering and after fruit set as single or double treatments increased berry weight, acidity and soluble sugars, total soluble solids and anthocyanin. Such increase was partly caused by the reduction occurred in fruit set (Forlani *et al.*, 1995; Shehata and El-Barbry, 1996; Coleopietra *et al.*, 1996; El-Hammady *et al.*, 1998; El-Mogy, 2000; Thomas and Thomas, 2000; Abdel-Ghany, 2001; Marzouk and Kassem, 2002 and El-Akkad, 2004).

Therefore, this study was designed to find out the benefit concentration of GA_3 and succinic acid on yield and berry quality, as a tool for improving the yield, bunches and berry quality of Ruby Seedless grapevines.

MATERIALS AND METHODS

This investigation was carried out during 2004, 2005, 2006 seasons on Ruby Seedless grapevines grown in a vineyard at Faculty of Agriculture, Assiut University, Egypt, where the soil is clay and well drained. Thirty-six vines, 14 years-old were chosen according to their similarity in growth and vigor and trained according to the double bilateral cordon system and the trellis system was traditional three wires. The vines were pruned during the second week of February, leaving 48 buds/vine (16 fruiting spurs, 3 buds/each). The chosen vines were subjected to normal horticulture practices.

The experiment was designed in complete randomized block containing nine treatments with four replicates, one vine each. Both GA_3 (5, 10, 15 or 20 ppm) and succinic acid (50, 100, 150 or 200 ppm) and water were sprayed on the whole vine surface when clusters reached about 10-12 cm (in the first week of April).

GA_3 and succinic acid solutions were prepared by dissolving the assigned amounts in the required water. The vines received both GA_3 and succinic acid solutions till run off using Trition B at 0.1% as a wetting agent.

The tested treatments were evaluated through the following measurements:

Yield and its components:

- Berry set percentage was estimated by caging two clusters per vine in perforated white cheese bags before bloom start. At the end of berry stage, bags were removed and berry set percentage was calculated as follows:

  Berry set % = No. of berries/total No. of flowers x 100.

- Yield in terms of weight (kg) per vine were recorded at harvest date (when total soluble solids percentage at least reached about 16-17%) in the end of August during the three experimental seasons. Soluble solids percentage (SS) per vine was estimated according to Shaulis and Steel, (1969) as follows:

  SS/vine (kg) = soluble solids x yield (kg/vine) x 0.01

Bunch and berry characteristics:

Representative random samples of five bunches/vine (each replicate) were taken and brought to the laboratory to determine the quality aspects of bunches and berries.

Bunch characteristics were determined as average weight of bunch and its rachis. Bunch index was calculated by dividing them. Bunch compactness coefficient was calculated by dividing number of berries per bunch by average length of bunch according to Winkler *et al.* (1974).

Random samples of 100 berries/vine were used to determine the averages berry length (mm), berry weight (g) and juice volume of 100 berries. Berry juice was used for the determination of total soluble solids (TSS) expressed as Brix by using hand refractometer. Total acidity percentage and reducing sugars percentage, as outlined in A.O.A.C. methods (1985). Total anthocyanin content in the skin of berry (mg/g fw) were estimated, according to Markham (1982) and as pointed out in the Association of Official Agricultural Chemists (A.O.A.C., 1985).

General evaluation of the tested treatment:

Scoring evaluation of the studied concentrations of GA_3 and succinic acid was calculated through their effects on yield components, bunch and berries characters. Hundred unit were shared

between the following ten main characteristics, yield/vine, soluble solids (SS/vine), bunch weight, bunch compactness coefficient and cluster index, as well as berry weight, berry length, juice volume, total soluble and anthocyanin contents (10 unit for each). Within each of these parameters, the treatment that recorded the uppermost values received all the units specified for it, except the lowest for bunch compactness coefficient. Relative values due to the other tested treatments were calculated. The following equation was used to determine these characters:

$$Characters = \sum \frac{B}{A} x\ 10$$

A = the highest value recorded for studied character among all treatments (lowest for compactness coefficient).

B = value recorded for the specific character for considered treatments.

All obtained data were tabulated and subjected to the proper statistical analysis according to Gomez and Gomez (1984) and Snedecor and Cochran (1990) using the L.S.D. test at 0.05 for distinguishing the significance differences between various treatment means.

RESULTS AND DISCUSSION

Yield and its components:

Data in Table 1 show that all GA_3 and succinic acid treatments significantly increased the berry set percentage and yield expressed in weight (kg) per vine and consequently improved the soluble solids (SS)/vine compared with the untreated ones. Spraying GA_3 at 10 ppm was the most effective treatment than other GA_3 concentrations. The increment percentage of berry set due to GA_3 treatments over the untreated ones were 25.28, 30.01, 15.85 and 13.74% as an average of the three studied seasons with GA_3 at 5, 10, 15 and 20 ppm, respectively. The corresponding increment values of yield and SS/vine were 39.58, 52.08, 28.13 & 19.79 and 43.83, 64.20, 42.59 and 28.40% respectively.

These findings could be attributed to the effect of GA_3 in promoting the vegetative growth and leaf area, as well as regulating the availability of water and nutrients.

Table 1: Effect of spraying GA_3 and succinic acid on berry set, yield and SS/vine of Ruby Seedless grapevines during 2004, 2005 and 2006 seasons.

Treatment	Berry set %				Yield kg/vine				SS/vine			
	2004	2005	2006	Average	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	15.03	16.36	14.84	15.41	11.6	17.4	11.2	13.4	1.98	3.03	1.98	2.33
GA_3 (10 ppm)	15.61	16.98	15.41	16.00	12.3	18.0	13.5	14.6	2.30	3.30	2.52	2.66
GA_3 (15 ppm)	14.57	14.72	13.47	14.25	9.6	16.8	10.7	12.3	1.80	3.02	2.02	2.28
GA_3 (20 ppm)	13.44	14.91	13.63	13.99	11.0	13.8	9.8	11.5	1.60	2.40	1.84	2.08
Succinic acid (50 ppm)	17.13	16.81	18.46	17.47	16.5	17.2	12.5	15.5	2.90	3.20	2.25	2.73
Succinic acid (100 ppm)	18.14	19.62	17.91	18.56	18.2	18.0	12.4	16.2	3.50	3.30	2.36	3.05
Succinic acid (150 ppm)	16.51	17.36	16.40	16.76	14.6	16.8	12.1	14.5	2.81	2.90	2.20	2.65
Succinic acid (200 ppm)	15.63	17.38	15.43	16.15	14.8	14.9	11.3	13.7	2.70	2.70	2.06	2.44
Control (untreated vines)	11.92	13.63	11.35	12.30	9.6	10.4	8.8	9.6	1.43	1.58	1.50	1.62
Mean	15.33	16.42	15.21	15.65	13.13	15.9	11.36	13.48	2.34	2.83	2.08	2.43
$LSD_{0.05}$	0.62	0.97	1.26	1.39	0.33	0.92	0.54	1.11	0.14	0.06	0.06	0.16

These effects increased both berry set and ultimate berry set consequently increased bunch weight Table 2. Also, yield/vine as well as soluble solids (SS/vine) were increased.

All succinic acid concentrations were effective than GA_3 concentrations. The highest values of yield and its components were obtained by application of succinic acid at 100 ppm. The increment percentage of berry set were 42.03, 50.89, 36.26 and 31.30 as an average of the three seasons with succinic acid at 50, 100, 150 and 200 ppm, respectively. The corresponding values for yield and SS/vine were 61.46, 68.75, 51.04 & 42.71% and 68.52, 88.27, 63.58 and 50.62%, respectively.

Such results could be due to the simulative effect of GA_3 or succinic acid on vegetative growth, especially leaf area that improved berry set and consequently increased bunch weight hence increased yield and SS/vine.

It can be stated that there is a positive correlation between leaf area and yield components. From the economic paint of view spraying succinic acid at 100 ppm or GA_3 at 10 ppm is of beneficial. These results are in accordance with those reported by Ezzahouani *et al.* (1985), Nilnomd and Sukumalandana (1988), Uarma (1991), Mansour (1994), Shehata and El-Barbary (1996) and El-Akkad (2004).

Bunch characters:

Data presented in Tables 2 and 3 indicate that all GA_3 and succinic acid treatments significantly increased bunch weight and its length. The heaviest and longest bunch were obtained by spraying GA_3 at 10 ppm or succinic acid at 100 ppm compared to vines treated with other concentrations or the untreated ones. The increment rate of bunch weight were 23.71, 63.31, 40.78, 34.68 and 77.82, 84.74, 65.24 ,54.07% as an average of the three seasons by spraying GA_3 at 5, 10, 15, 20 ppm or succinic acid at 50, 100, 150 and 200 ppm, respectively.

It can be noticed that all succinic acid treatments were more effective in increasing bunch weight comparable to GA_3 treatments. Such findings could be attributed to the increase in berry set and berry weight by succinic acid was superior than GA_3.

Table 2: Effect of spraying GA_3 and succinic acid on bunch weight and bunch length of Ruby Seedless grapevines during 2004, 2005 and 2006 seasons.

Treatment	Bunch weight (g)				Bunch length (cm)			
	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	283.0	380.3	280.5	314.6	20.7	26.8	24.1	23.9
GA_3 (10 ppm)	381.5	486.0	378.4	415.3	25.7	28.8	24.7	26.4
GA_3 (15 ppm)	299.0	480.0	295.0	358.0	21.6	25.4	21.7	22.9
GA_3 (20 ppm)	326.4	418.9	282.1	342.5	20.9	24.6	18.9	21.5
Succinic acid (50 ppm)	491.6	514.5	350.6	452.2	25.2	25.3	23.7	24.7
Succinic acid (100 ppm)	518.5	524.8	366.1	469.8	27.1	28.3	25.3	26.9
Succinic acid (150 ppm)	443.5	492.0	325.2	420.2	20.2	23.0	22.8	22.0
Succinic acid (200 ppm)	434.1	441.0	300.4	391.8	19.8	21.5	21.0	20.8
Control (untreated vines)	257.4	271.8	233.8	254.3	18.5	18.8	17.3	18.2
Mean	318.7	436.4	309.9	375.9	22.19	24.7	22.17	23.03
$LSD_{0.05}$	9.53	25.61	15.41	33.56	1.16	1.79	1.98	2.09

Table 3: Effect of spraying GA_3 and succinic acid on bunch index and compactness coefficient of Ruby Seedless grapevines during 2004, 2005 and 2006 seasons.

Treatment	Bunch index				Compactness coefficient			
	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	25.20	25.50	25.04	25.25	6.21	6.55	5.05	5.93
GA_3 (10 ppm)	31.79	31.76	27.82	30.46	5.64	6.42	5.62	5.91
GA_3 (15 ppm)	28.47	32.88	28.64	29.99	6.16	6.88	5.31	6.11
GA_3 (20 ppm)	28.88	30.36	28.21	29.15	6.31	6.92	6.04	6.42
Succinic acid (50 ppm)	39.90	37.83	33.48	37.07	7.99	8.23	6.15	7.46
Succinic acid (100 ppm)	36.80	37.75	34.21	36.25	7.55	7.36	5.59	6.83
Succinic acid (150 ppm)	40.32	38.43	32.85	37.20	9.18	9.04	6.53	8.25
Succinic acid (200 ppm)	40.60	39.73	32.44	37.59	9.64	9.21	6.64	8.49
Control (untreated vines)	24.16	24.49	23.68	24.45	6.66	7.13	6.08	6.62
Mean	33.00	33.19	29.60	31.93	7.32	7.57	5.94	6.95
$LSD_{0.05}$	0.11	0.14	0.09	0.16	0.48	0.21	0.55	0.43

The increase in such traits surely reflected on increasing the bunch weight of treated vine. Also, it could be observed that all succinic acid treatments were more effective in increasing the bunch index and its compactness coefficient compared to GA_3 treatments.

The increment rate of bunch index were \3.27, 24.58, 22.66, 19.22 and 51.61, 48.26, 52.15 , 53.74% as an average of the three seasons on spraying GA_3 at 5, 10, 15, 20 ppm and succinic acid at 50, 100, 150 and 200 ppm, respectively. The increase in bunch weight in response of succinic acid application (Table, 2) could b explained the present results.

All GA_3 treatments were more effective in reducing compactness coefficient than succinic acid. The decrement percentage on bunch compactness coefficient were 10.42, 10.27, 7.70 , 3.02% as an average of the three seasons) due to GA_3 applications at 5, 10, 15, 20 ppm respectively. Such results could be due to GA_3 induce better increase in bunch length than in number of berries per bunch.

The results concerning the positive action of GA_3 on bunch traits are in agreement with those obtained by Uarma (1991), Singh *et al.* (1994), Shehata and El-Barbary (1996), El-Hammady *et al.* (1998), El-Mogy (2000) and El-Akkad (2004). They revealed that spraying of GA_3 produced heavy, long and loosey bunches in different grape cultivars investigated.

Berry properties:

A – Physical properties:

Data in Table 4 show that GA_3 treatments significantly increased berry weight and juice volume compared to the unsprayed ones. The increment rate in berry weight were 6.34, 24.88, 14.15 and 7.32% as an average of the three seasons on spraying GA_3 at 5, 10, 15 and 20 ppm, respectively. The corresponding increment rate of juice volume were 12.78, 29.81, 16.33 and 7.50%, respectively.

All GA_3 treatments enhanced the berry length compared to unsprayed ones. The increment percentage of berry length were 6.67, 10.00, 5.33 and 5.33% as an average of the three seasons with GA_3 at 5, 10, 15 and 20 ppm, respectively. This is possibly due to the positive action of GA_3 on stimulation of cell elongation process and

Table 4: Effect of spraying GA_3 and succinic acid on berry weight, berry length and juice volume/100 berries of Ruby Seedless grapevines during 2004, 2005 and 2006 seasons.

Treatment	Berry weight (g)				Berry length (mm)				Juice volume (cm^3)/100 berry			
	2004	2005	2006	Average	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	2.14	2.16	2.30	2.18	15.5	16.4	16.0	16.0	114.8	118.0	13.26	121.8
GA_3 (10 ppm)	2.54	2.54	2.61	2.56	15.9	16.8	16.8	16.5	138.3	141.9	140.5	140.2
GA_3 (15 ppm)	2.17	2.40	2.45	2.34	15.3	16.1	16.0	15.8	119.3	128.1	129.5	125.6
GA_3 (20 ppm)	2.13	2.08	2.38	2.20	15.3	16.2	15.9	15.8	118.7	109.5	120.1	116.1
Succinic acid (50 ppm)	2.38	2.41	2.33	2.37	15.5	16.3	15.9	15.9	132.0	126.1	122.2	126.8
Succinic acid (100 ppm)	2.41	2.41	2.43	2.42	15.8	16.6	16.6	16.3	136.0	130.5	127.2	131.2
Succinic acid (150 ppm)	2.33	2.30	2.22	2.28	15.5	16.6	16.3	16.1	120.0	124.5	120.3	121.6
Succinic acid (200 ppm)	2.23	2.18	2.24	2.22	15.4	16.3	15.8	15.8	116.7	115.9	119.0	117.2
Control (untreated vines)	2.03	1.97	2.15	2.05	14.5	15.6	15.0	15.0	110.7	101.1	112.3	108.0
Mean	2.27	2.28	2.35	2.30	15.4	16.3	16.0	15.9	122.9	121.7	124.9	123.2
$LSD_{0.05}$	0.088	0.077	0.064	0.093	0.84	0.68	0.78	0.79	5.69	6.40	6.15	6.58

enhancing the water absorption as well as promoting the biosynthesis of proteins.

Similarly, succinic acid showed significantly positive effects on such berry traits comparing with unsprayed ones. The increment percentage of berry weight due to succinic acid spraying were 15.61, 18.05, 11.22 and 6.83% as an average of the three seasons with succinic acid at 50, 100, 150 and 200 ppm, respectively. The corresponding increment percentage of juice volume and berry length were 17.41, 21.15, 15.59 , 8.52% and 6.00, 8.67, 7.33 , 5.33%, respectively. These results could be attributed to succinic acid effects on activating the biosynthesis of total carbohydrates and proteins as well as auxinic action on cell division which lead to an increase in berry weight and juice volume as well as berry shape.

A gradual increase on such traits was observed with increasing GA_3 or succinic acid concentration from 0 to 10 or 100 ppm, respectively. Raising GA_3 concentration from 10 to 20 ppm or succinic acid concentrations from 100 to 200 ppm had no significant stimulation on physical berry quality. Therefore, either GA_3 at 10 ppm or succinic acid at 100 ppm could be the best in this regard since, the increase in berry weight is the most important target than total yield in grape production, because the increase in berry weight result in an increase in backable yield.

B - Chemical constituents of berry juice:

It is clear from obtained data in Tables 5 and 6 that spraying vines with GA_3 significantly increased total soluble solids, acidity reducing sugars and anthocyanin contents compared to the unsprayed ones. There was a gradual increase on these traits with increasing GA_3 from 0 to 15 ppm. No significant promotions were observed on these traits at 10 and 20 ppm concentration of GA_3. Such results could be attributed to the effect of GA_3 on the hydrolysis of starch resulting from the production of α-amylase that might increase the concentration of sugar, thus raising total soluble solids of berry juice and improving berry skin coloration.

Table 5: Effect of spraying GA_3 and succinic acid on total soluble solids % and titratable acidity % of Ruby Seedless grapes during 2004, 2005 and 2006 seasons.

Treatment	TSS %				Titratable acidity %			
	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	17.1	17.4	17.7	17.4	0.646	0.659	0.565	0.622
GA_3 (10 ppm)	18.3	17.7	18.5	18.2	0.638	0.632	0.557	0.609
GA_3 (15 ppm)	18.7	18.0	18.9	18.5	0.625	0.605	0.543	0.591
GA_3 (20 ppm)	18.3	17.2	18.8	18.1	0.625	0.592	0.536	0.584
Succinic acid (50 ppm)	17.4	17.3	18.0	17.6	0.566	0.534	0.521	0.540
Succinic acid (100 ppm)	19.4	17.8	18.3	18.5	0.580	0.539	0.515	0.545
Succinic acid (150 ppm)	19.3	17.3	18.2	18.3	0.563	0.532	0.510	0.535
Succinic acid (200 ppm)	17.9	17.2	18.2	17.8	0.527	0.518	0.495	0.513
Control	16.8	16.6	17.2	16.9	0.463	0.473	0.465	0.467
Mean	18.1	17.4	18.2	17.9	0.581	0.569	0.532	0.556
$LSD_{0.05}$	0.51	0.52	0.43	0.53	0.042	0.050	0.041	0.051

Table 6: Effect of spraying GA_3 and succinic acid on reducing sugar % and anthocyanin of Ruby Seedless grapes during 2004, 2005 and 2006 seasons.

Treatment	Reducing sugar %				Anthocyanin (mg/g.f.wt*)			
	2004	2005	2006	Average	2004	2005	2006	Average
GA_3 (5 ppm)	12.8	13.5	12.4	12.9	0.52	0.48	0.50	0.50
GA_3 (10 ppm)	13.8	14.1	13.5	13.8	0.56	0.58	0.55	0.56
GA_3 (15 ppm)	14.1	14.4	13.6	14.0	0.46	0.56	0.59	0.54
GA_3 (20 ppm)	13.2	14.1	12.9	13.4	0.42	0.46	0.47	0.45
Succinic acid (50 ppm)	12.8	14.6	13.7	13.7	0.50	0.49	0.57	0.52
Succinic acid (100 ppm)	14.4	14.7	13.8	14.3	0.56	0.57	0.61	0.58
Succinic acid (150 ppm)	13.9	14.0	13.6	13.5	0.56	0.63	0.58	0.59
Succinic acid (200 ppm)	12.8	13.8	12.4	13.0	0.53	0.49	0.51	0.51
Control	11.7	11.2	11.2	11.5	0.37	0.36	0.36	0.36
Mean	13.3	13.8	13.0	13.3	0.50	0.51	0.53	0.51
$LSD_{0.05}$	0.49	0.80	0.59	0.93	0.034	0.029	0.016	0.036

* g.f.wt = Gram of fresh weight of berries.

Similarly, spraying Ruby Seedless grapevines with succinic acid significantly increased the above mentioned traits compared to the untreated ones. There was a gradual increase in these traits with increasing succinic acid from 50 to 100 ppm. No significant improvement was found with increasing succinic acid concentration from 100 to 200 ppm. This might be due to the increase in the leaf surface area as a result of succinic acid spraying accordingly enhanced photosynthesis activity and the production of more sugars that translocated to the berries.

It can be concluded that spraying GA_3 10 ppm or succinic acid at 100 ppm is the best suggested one to improve the chemical quality of berries, since the berry coloration is more important target to improve the berry marketing. The present results are in accordance with those obtained by Uarma (1991), Mansour (1994), Singh *et al.* (1994), Shehata and El-Barbary (1996), Colepietra *et al.* (1996), Thomas and Thomas (2000), Dokoozlian *et al.* (2001), Abdel-Ghany (2001), Marzouk and Kassem (2002) and El-Akkad (2004).

General evaluation of GA_3 and succinic acid effects:

It is quite evident from Table 7 that general evaluation of the studied GA_3 and succinic acid as an average of the three seasons, according to yield, bunch and berry quality emphasized that spraying GA_3 at 10 ppm or succinic acid at 100 ppm gained the highest score recording 93.9 and 96.6 units, respectively. All succinic acid treatments increased the yield and bunch attribute compared to GA_3 or the control ones. These scores could be arranged in a descendingly order as follow 96.6, 93.9, 92.0, 90.7, 87.0, 86.6, 85.3, 81.9 and 73.9 unit due to succinic acid at 100 ppm, GA_3 at 10 ppm, succinic acid 50 ppm, succinic acid 150 ppm, GA_3 15 ppm, succinic acid 200 ppm, GA_3 5 ppm, GA_3 20 ppm and unsprayed ones, respectively.

Finally it may be concluded that spraying succinic acid at 100 ppm or GA_3 at 10 when average cluster length reached 10-12 cm were the best economic treatments for Ruby Seedless grapevines to obtain the high yield with heavy bunch and good berry quality.

Table 7: General evaluation of GA_3 and succinic acid effects yield, bunch and berry characters of Ruby Seedless grapevines during 2004, 2005 and 2006 seasons.

Characters	Yield component			Bunch characters					Berry quality					Grand total
Score (units) / Treatments	Yield kg/ vine	SS/ vine	Total	Bunch weight	Bunch index	Incompact-ness coeff.	Total	Berry weight	Berry length	Juice volume	TSS	Anthocyanin	Total	
	10	10	20	10	10	10	30	10	10	10	10	10	50	100
GA_3 5 ppm	8.3	7.6	15.9	6.7	8.2	9.4	24.3	8.8	9.7	8.7	9.4	8.5	45.1	85.3
GA_3 10 ppm	9.0	8.7	17.7	8.8	8.1	10.0	26.9	10.0	10.0	10.0	9.8	9.5	49.3	93.9
GA_3 15 ppm	7.6	7.5	15.1	7.6	8.0	9.7	25.3	9.1	9.6	8.7	10.0	9.2	46.6	87.0
GA_3 20 ppm	7.0	6.8	13.8	7.3	7.8	9.2	24.3	8.6	9.6	8.2	9.8	7.6	43.8	81.9
Succinic acid 50 ppm	9.5	8.9	18.4	9.6	9.9	7.9	27.4	9.3	9.6	9.0	9.5	8.8	46.2	92.0
Succinic acid 100 ppm	10.0	10.0	20.0	10.0	9.6	8.5	28.1	9.5	9.9	9.3	10.0	9.8	48.5	96.6
Succinic acid 150 ppm	8.9	8.7	17.6	8.9	9.8	7.2	25.9	8.9	9.8	8.6	9.9	10.0	47.2	90.7
Succinic acid 200 ppm	8.5	8.0	16.5	8.3	10.0	7.0	25.3	8.7	9.6	8.3	9.6	8.6	44.8	86.6
Control	5.9	5.3	11.2	6.5	7.3	8.9	22.7	8.0	9.1	7.7	9.1	6.11	40.0	73.9

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تأثير حمض الجبريليك وحمض السكسنيك على العنب صنف روبى سيدلس ٢ – المحصول وخصائص العناقيد والثمار

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أجرى هذا البحث خلال مواسم ٢٠٠٤ ، ٢٠٠٥ ، ٢٠٠٦ على كروم العنب صنف الروبى سيدلس بمزرعة كلية الزراعة – جامعة أسيوط – وذلك بهدف معرفة تأثير رش كل من حمض الجبريليك وحمض السكسنيك على المحصول وخصائص العناقيد والحبات . حيث تم رش شجيرات العنب بكل من حمض الجبريليك بتركيزات ٥ ، ١٠ ، ١٥ ، ٢٠ جزء فى المليون بينما تم رش حمض السكسنيك بتركيزات ٥٠ ، ١٠٠ ، ١٥٠ ، ٢٠٠ جزء فى المليون وذلك عندما وصل طول النورة إلى ١٠-١٢ سم .

وتتلخص نتائج هذه الدراسة كالآتى :

- أدى الرش بكل من حمض الجبريليك أو السكسنيك إلى زيادة مؤكدة فى كل من نسبة عقد الحبات والمحصول والمواد الصلبة لكل شجيرة .

- سبب الرش بحمض الجبريليك أو الرش بحمض السكسنيك زيادة مؤكدة فى وزن وطول ودليل العناقيد بينما أدى إلى حدوث نقص فى معامل تزاحم العناقيد مقارنة بعناقيد الشجيرات الغير معاملة .
- أظهرت النتائج أن الرش بحمض السكسنيك أكثر تأثيراً على المحصول وخصائص العناقيد مقارنة بالرش بحمض الجبريليك .
- أعطى الرش بحمض الجبريليك ١٠ جزء فى المليون أو الرش بحمض السكسنيك بتركيز ١٠٠ جزء بالمليون أحسن جودة للحبات من حيث الخصائص الطبيعية والخصائص الكيميائية ودرجة التلوين .
- سجلت المعاملة بحمض السكسنيك ١٠٠ جزء بالمليون وحمض الجبريليك ١٠ جزء بالمليون أعلى الدرجات (٩٦,٦ ، ٩٣,٩ وحدة) على الترتيب مقارنة بالمعاملات الأخرى فى التقييم العام للمعاملات المستخدمة حيث أعطت أحسن النتائج طبقاً للمحصول وخصائص العناقيد وخصائص جودة الحبات .

ولذا يمكن التوصية برش شجيرات العنب صنف الروبى سيدلس عندما يصل متوسط طول العنقود الزهرى ١٠-١٢ سم بحمض السكسنيك بتركيز ١٠٠ جزء بالمليون أو الرش بحمض الجبريليك بتركيز ١٠ جزء بالمليون حيث يؤدى ذلك إلى إنتاج محصول عال ذو عناقيد وحبات ذات خصائص جودة جيدة .