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IMPROVING QUALITY AND MARKETING OF RUBY SEEDLESS TABLE GRAPES

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ABSTRACT

CPPU at (0,3,5 and 7 ppm) and GA_3 at (0,5,10 and 20 ppm) were applied separately or in combination to bunches of 6-year-old Ruby Seedless grapevines supported by Spanish Paron trellis and located in Wadi El-Faregh region, Giza governorate during 1997 and 1998 seasons. The clusters were sprayed when berry size reached 6-8 mm in diameter. The CPPU and/or GA_3 treatments significantly increased berry weight, size, length and diameter. Bunch weight and yield/vine were also significantly increased. Poorly coloured berry percentage (PCBP) was increased and reached its maximum under 7 ppm CPPU x 20 ppm GA_3 treatments. TSS, TSS/acidity and anthocyanin were decreased while acidity showed a reverse trend. CPPU and/or GA_3 delayed grape ripening by 5 to 21 days compared to the control. This delay improved quality, colouration and increased the price.

INTRODUCTION

CPPU [N-(2-chloro-4-pyridyl)-N-phenyl urea] is a plant growth regulator of cytokinin type (Nickell, 1985 and 1986 a and b) which enhances cell division, growth and delays senescence (Nickell, 1986b). CPPU is a promising compound that positively affects the yield of Thompson Seedless grapes (Dokoozalian *et al.,* 1994 and Rizk, 1998), Flame Seedless and Muscat Seedless (Ortht, 1990). Lowers juice Brix, anthocyanin content and increases juice acidity of Simone and Sovereign Coronation grapes (Reynolds *et al*., 1992). In addition, it increases berry firmness of Honey Red grape (Yanshiang *et al.,* 1997).

GA_3 (Gibberellic acid) is applied in vineyards to increase berry weight and size, bunch weight and yield/vine in Thompson Seedless grapes (Colapietra *et al.*, 1995; Ezzahouani *et al*., 1985and Singh *et al.,* 1979), Flame Seedless (Wolf *et al.*, 1994), Muscat Seedless (Ortht, 1990 and Wolf *et al*., 1994) and Ruby Seedless (Ezzahouani *et al.*, 1985). Adherence, berry firmness and acidity were increased where TSS and TSS/acidity were decreased by GA_3 application on Thompson Seedless grapes (Abdel-Kawi, 1984). In the north of Italy, TSS of Ruby Seedless ripe berries was 14.5 (Manzo and Tamponi, 1979), while in the south of Italy TSS of the ripe berries was 17.4 (Liuni *et al*., 1982)

In the desert vineyards, *Ruby Seedless appears in the Egyptian markets in the later period of Thompson Seedless appearance. The competition of the two varieties is always in favour of Thompson Seedless. Hence, the delaying of Ruby Seedless crop in the markets is desirable.

*** Ruby Seedless is a hybrid of Emperor and Sultana Moscata (Pirovano-75) cultivars (Olmo *et al*., 1981).**

This investigation aimed to study the effect of CPPU and/or GA_3 in improving the quality of Ruby Seedless grapes and in raising the possibility of these two compounds in delaying its ripening.

MATERIALS AND METHODS

This investigation was conducted in a private vineyard located in Wadi El-Faregh, Giza governorate for two seasons, 1997 and 1998. One hundred and twenty eight uniform Ruby Seedless vines of 6-year-old grown in sandy soil were chosen. The vines were trained to cordon system, supported by Spanish Paron trellis. Distances between vines were 1.5 m and 4 m between rows. Thirty spurs with 2 buds each were left on each vine at pruning time. The number of clusters were adjusted to 20 clusters/vine. Fertilizers were added through drip irrigation system. Pesticides were applied whenever needed.

The design was randomized complete blocks. Experiments were 4 CPPU levels (0, 3, 5 and 7 ppm) x 4 GA_3 levels (0, 5, 10 and 20 ppm) factorial and the rest of the treatments, were the combination of CPPU x GA_3. The final number of treatments was 16 CPPU and GA_3 were applied to clusters when berry diameter reached 6.8 mm. Each treatment contained three replicates with two vines/replicate plus two vines/treatment for recording the delaying of crop ripening and colouration. Poorly coloured berries percentage (PCBP) was determined as an indicator for colouration. Total soluble solids (TSS) was determined when TSS of the control reached 16 (26 July in the first season and 24 July in the second season), then days needed for TSS of each treatment to reach 16 and 18 were recorded. The following data were recorded at TSS 16 for each treatment:

1- Berry weight and size.
2- Berry length and diameter.
3- Berry adherence strength and firmness at TSS 16 and 18.
4- Bunch weight.
5- Yield per vine.
6- Acidity was determined according to A.O.A.C. (1970) at TSS 16 and 18.
7- TSS/acidity at TSS 16.
8- Anthocyanin concentration in berry skin was determined at TSS 16 and 18 following the method described by Hisa and Chichester (1965).

Variances between treatments were tested using New LSD method as mentioned by Waller and Duncan (1969).

RESULTS AND DISCUSSION

1-Berry weight and size:

The results of berry weight and size are shown in Tables 1 and 2. The data clearly show that CPPU or GA_3 and their combinations significantly increased berry weight and size. The best results of berry weight were recorded with CPPU at 5 and 7 ppm for the first season where the increment

was 15% over the control for both treatments. In the second season CPPU at 7 ppm increased berry weight by 21% than control. Application of GA_3 at 20 ppm increased berry weight by 36% in the first season and 32% in the second one. The interaction between CPPU and GA_3 obviously induced more increases and the highest value was obtained by CPPU at 7 ppm x GA_3 at 20 ppm in both seasons and increments were 53 and 59% in the first and second season, respectively.

Table (1): Effect of CPPU and/or GA_3 on 50 berries weight (g) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	157.2 ^{i}	169.3 ^{h}	179.4 ^{g}	183.6 ^{g}	172.4 $^{D-}$	148.6 ^{j}	162.6 ^{i}	177.4 ^{h}	183.2 ^{h}	168.0 $^{C-}$
5	179.6 ^{g}	203.2 ^{f}	219.5 ^{d}	222.8 ^{d}	206.3 $^{C-}$	177.9 ^{h}	206.9 ^{fg}	209.3 ^{ef}	225.1 ^{cd}	204.8 $^{B-}$
10	210.6 ^{e}	233.8 ^{c}	234.5 ^{c}	233.0 ^{c}	228.0 $^{B-}$	197.5 ^{g}	216.6 ^{je}	231.4 ^{abc}	239.0 ^{a}	221.1 $^{A-}$
20	218.1 ^{d}	236.5 ^{bc}	244.2 ^{a}	241.0 ^{ab}	235.0 $^{A-}$	205.2 ^{fg}	217.3 ^{de}	227.8 ^{bc}	236.7 ^{ab}	221.8 $^{A-}$
Mean	191.4 ^{C}	210.7 ^{B}	219.4 ^{A}	220.1 ^{A}		182.3 ^{D}	200.3 ^{C}	211.5 ^{B}	221.0 ^{A}	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A^{-} …..for GA_3 a…..for CPPU x GA_3

The same trend was found for berry size. The biggest berries were noticed with CPPU at 5 and 7 ppm, GA_3 at 20 ppm, CPPU at 5 ppm x GA_3 20 ppm and CPPU at 7 ppm x GA_3 at 20 ppm in both seasons. CPPU induced an increase in berry weight and size when applied alone or in combination with GA_3 (Intrieri *et al*., 1993; Retamales *et al.,* 1993; Dokoozalian *et al*., 1994 and Retamales *et al.,* 1995). The increase in berry weight reached 75% over control (Rizk, 1994). GA_3 also increased berry weight and size (Weaver, 1972; Singh *et al*., 1979; Abdel-Kawi, 1984 and Basiouny, 1994). However, (Joublan, 1995) observed that CPPU + GA_3 did not affect berry weight or size.

Table (2): Effect of CPPU and/or GA_3 on 50 berries size (ml) of Ruby Seedless grapes.

GA_3 ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	137.3 ^{h}	150.0 ^{g}	155.7 ^{fg}	162.3 ^{f}	151.3 $^{D-}$	125.0 ^{j}	142.7 ^{i}	152.7 ^{h}	159.0 ^{h}	144.9 $^{D-}$
5	158.3 ^{fg}	193.3 ^{de}	208.0 ^{bc}	200.0 ^{cd}	189.9 $^{C-}$	152.0 ^{hi}	185.0 ^{fg}	195.0 ^{e}	195.0 ^{e}	181.8 $^{C-}$
10	187.7 ^{e}	208.0 ^{bc}	220.7 ^{a}	225.0 ^{a}	210.4 $^{A-}$	180.0 ^{g}	195.0 ^{e}	211.7 ^{bc}	205.0 ^{cd}	197.9 $^{B-}$
20	196.0 ^{de}	200.0 ^{cd}	215.5 ^{ab}	224.0 ^{a}	208.8 $^{A-}$	191.3 ^{b}	198.3 ^{de}	220.0 ^{a}	218.0 ^{ab}	206.9 $^{A-}$
Mean	196.8 ^{C}	187.8 ^{B}	199.7 ^{A}	202.8 ^{A}		162.1 ^{C}	180.3 ^{B}	194.9 ^{A}	194.3 ^{A}	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A^{-} …..for GA_3 a…..for CPPU x GA_3

2- Berry length and diameter:

Berry length and diameter were significantly increased in response to CPPU, GA_3 and their combinations (Tables 3 and 4). The highest increment of berry length was 6% in 1997 and 12% in 1998 resulted from the application of 7 ppm CPPU. The increase over the control was 16% and 15% in the first and the second season, respectively obtained by the application of 20 ppm

GA_3. More increases in berry length were achieved as a result of the combined application of CPPU and GA_3.

Table (3): Effect of CPPU and/or GA_3 on berry length (mm) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	18.0 f	19.3 e	19.7 e	20.7 di	19.4 C-	18.0 h	20.0 g	20.3 fg	21.0 ef	19.8 D-
5	21.0 d	21.3 cd	21.7 bc	22.3 ab	21.8 B-	20.0 g	21.3 cde	21.7 cd	21.7 cd	21.2 C-
10	21.7 bc	22.3 ab	22.3 ab	22.3 ab	22.2 A-B-	21.7 cd	22.0 bc	22.0 bc	23.0 a	22.2 B-
20	22.3 ab	22.7 a	22.7 a	22.7 a	22.6 A-	22.0 bc	22.7 ab	23.0 q	23.3 a	22.8 A-
Mean	20.8 C	21.4 B	21.6 AB	22.0 A		20.4 C	21.5 B	21.8 B	22.8 A	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

Table (4): Effect of CPPU and/or GA_3 on berry diameter (mm) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	13.8 h	14.3 gh	15.4 e	15.8 e	14.8 D-	13.8 j	14.2 i	15.2 gh	15.8 fg	14.8 C-
5	14.8 fg	16.4 d	17.4 c	18.5 b	16.8 C-	15.0 h	15.9 f	17.3 cd	17.8 bc	16.7 B-
10	15.1 f	16.4 d	18.7 ab	18.5 b	17.2 B-	15.3 gh	16.4 ef	18.6 a	18.7 a	17.3 A-
20	15.3 ef	17.1 c	18.5 b	19.2 a	17.6 A-	15.3 gh	16.8 de	18.3 a	18.8 a	17.3 A-
Mean	14.8 D	16.1 C	17.5 B	18.0 A		14.8 D	15.8 C	17.4 B	17.8 A	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

Berry diameter positively responded to CPPU application. The higher concentration of CPPU (7ppm) increased berry diameter by 22% in both seasons of the study. Meanwhile, GA_3 at 20 ppm induced 19% increase in diameter in the first season and 17% in the second one. The most increments were found after the application of CPPU at 7 ppm x GA_3 at 20 ppm and CPPU 5 ppm x GA_3 10 ppm in both seasons (Table 4). Our results for CPPU are in agreement with those obtained by (Nickell, 1985 and Diaze and Maldonado, 1992) and for GA_3 by (Dokoozalian *et al.*, 1994 and Cooper *et al*., 1993).

3- Berry adherence strength and firmness:

Berry adherence strength and firmness were significantly increased as a result of the application of CPPU and/or GA_3 (Tables 5 and 6). The

Table (5): Effect of CPPU and/or GA_3 on berry adherence strength (gs) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	342.3 i	357.7 fg	363.3 de	364.6 cde	357.0 C-	332.0 h	345.3 f	352.0 de	357.3 e	346.7 D-
5	351.0 h	362.0 de	365.7 cd	365.7 cd	361.1 C-	343.0 g	347.7 f	353.7 cde	361.3 a	351.4 C-
10	355.3 g	362.7 cde	366.3 cbe	370.3 cb	363.7 B-	346.3 f	351.0 e	356.7 cd	362.3 a	354.1 B-
20	361.3 ef	363.7 cde	370.3 b	382.0 a	369.3 A-	352.0 de	355.3 cd	359.0 b	363.0 a	357.3 A-

Mean	352.5 D	361.5 C	366.4 B	370.7 A		343.3 D	349.8 C	355.4 B	361.0 A	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

Table (6): Effect of CPPU and/or GA_3 on berry firmness (kg/cm^2) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	0.61 k	0.81 h	0.85 f	0.96 c	0.81 D-	0.60 k	0.72 h	0.79 e	0.86 c	0.74 D-
5	0.62 k	0.81 h	0.86 f	1.02 b	0.83 C-	0.61 k	0.74 g	0.81 d	0.87 bc	0.76 C-
10	0.66 j	0.81 h	0.88 e	1.04 a	0.85 B-	0.64 j	0.77 f	0.81 d	0.88 b	0.78 B-
20	0.68 i	0.83 g	0.90 d	1.05 a	0.87 A-	0.67 i	0.77 f	0.81 d	0.90 a	0.79 A-
Mean	0.64 D	0.82 C	0.87 B	1.02 A	0.84	0.63 D	0.75 C	0.81 B	0.88 A	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

application of CPPU obviously induced a significant increase in adherence strength of Ruby Seedless berries. This increment goes parallel with the increasing CPPU concentrations. The highest value was recorded in CPPU treatment at 7 ppm in both seasons. Similar responses were found with GA_3 treatment. The combined application of CPPU and GA_3 maximized the adherence strength response. The highest value was obtained from application of CPPU at 7 ppm x GA_3 at 20 ppm. The same trend was found when TSS reached 18 (Table 10). Berry firmness followed the same trend of adherence strength response. (Yanshiang *et al.,* 1997) discussed two possible explanations to interpret the produced increment on berry firmness. The first, assumes that cytokinin or CPPU increased flesh firmness by maintaining the total pectin and Ca contents at higher concentrations. The second is increasing the number of flesh layer. It seems that these explanations could be acceptable to clarify our results. The effect of CPPU on increasing berry firmness was reported by (Yanshiang *et al.*, 1997), where the increases in berry adherence and firmness induced by GA_3 application were reported by (Singh *et al*., 1979; Youssef *et al.*, 1983 and Abdel-Kawi *et al.*, 1984).

4-Bunch weight:

The CPPU application significantly increased bunch weight of Ruby Seedless grapevine (table 7). The most effective treatment was CPPU at 7 ppm, which raised bunch weight by 39% than the control in both seasons. In a similar way, GA_3 at 20 ppm induced an increase reached 35% and 38% than control in the first and the second season, respectively. More significant increases in bunch weight were obtained when CPPU interacted with GA_3. The combined application of CPPU and GA_3 produced a synergistic response in bunch weight exceeding that obtained with CPPU or GA_3 alone. CPPU at 7 ppm x GA_3 at 20 ppm produced the heaviest bunch weight. The increments were 79% and 88% in the first and the second season, respectively. The increase in bunch weight is a result of the increase in berry weight and size (Tables 1 and 2).

Our results were in a agreement with those found by (Rizk, 1994 and Rong *et al.,* 1998).

Table (7): Effect of CPPU and/or GA_3 on bunch weight (g) of Ruby Seedless grapes.

GA_3 Ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	642.3 ^{p}	685.7 ^{h}	765.3 ^{kl}	787.3 ^{jk}	720.2 $^{D-}$	636.0 ^{h}	678.3 ^{j}	718.0 ^{hi}	750.0 ^{fg}	695.0 $^{D-}$
5	676.7 ^{o}	848.7 ^{hi}	913.7 ^{f}	971.7 ^{e}	852.7 $^{C-}$	688.3 ^{ij}	836.7 ^{e}	869.7 ^{je}	944.3 ^{c}	834.8 $^{C-}$
10	722.3	851.7 ^{h}	1051.7 ^{b}	1018.3 ^{cd}	911.0 $^{B-}$	735.0 ^{gh}	844.7 ^{e}	1073.3 ^{b}	1059.3 ^{b}	928.1 $^{B-}$
20	790.1	895.0 ^{fg}	1045.0 ^{bc}	1150.0 ^{a}	970.0 $^{A-}$	780.0 ^{f}	883.3 ^{d}	971.7 ^{c}	1200.0 ^{a}	958.8 $^{A-}$
Mean	707.8 ^{D}	820.0 ^{C}	943.9 ^{B}	981.8 ^{A}		710.0 ^{D}	810.8 ^{C}	908.2 ^{B}	788.4 ^{A}	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

5- Yield per vine:

The results of yield/vine (Table 8) were similar to those of bunch weight in the preceding table (7). Yield/vine was significantly increased by CPPU and/or GA_3 applications.

Table (8): Effect of CPPU and/or GA_3 on yield/vine (kg) of Ruby Seedless grapes.

GA_3 ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	12.8 ^{hi}	13.7 ^{h}	15.3 ^{f}	15.7 ^{f}	14.4 $^{D-}$	12.7 ^{j}	13.6 ^{i}	14.4 ^{gi}	15.0 ^{gh}	13.9 $^{D-}$
5	13.5 ^{h}	17.0 ^{e}	18.1 ^{d}	19.4 ^{c}	17.0 $^{C-}$	13.8 ^{i}	16.7 ^{f}	17.4 ^{ef}	18.9 ^{cd}	16.7 $^{C-}$
10	14.4 ^{g}	17.0 ^{e}	20.4 ^{b}	21.0 ^{b}	18.2 $^{B-}$	14.7 ^{gh}	16.9 ^{f}	21.5 ^{b}	21.5 ^{b}	18.1 $^{B-}$
20	15.8 ^{f}	17.9 ^{d}	20.9 ^{b}	23.0 ^{a}	19.4 $^{A-}$	15.6 ^{g}	17.7 ^{e}	21.2 ^{b}	24.0 ^{a}	19.6 $^{A-}$
Mean	14.1 ^{D}	16.4 ^{C}	18.7 ^{B}	19.8 ^{A}		14.2 ^{D}	16.2 ^{C}	18.6 ^{B}	19.3 ^{A}	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

The highest yield was achieved by CPPU 7 ppm and/or GA_3 at 20 ppm and the increments percentages than control were:

	First season	Second season
CPPU at 7 ppm	40	36
GA_3 at 20 ppm	35	41
CPPU at 7 ppm x GA_3 at 20 ppm	80	89

The combined application of CPPU and GA_3 produced a pronounced response, that the increments induced by the combined application were twice or more than the individual application of CPPU or GA_3.
The increase in yield/vine is related to the increase in bunch weight. The obtained data are confirmed by the results of (Abdel-Kawi, 1984; Nickell, 1985 and Rizk, 1994).

6- Colouration :

The aim of this investigation was to delay the ripening of Ruby Seedless table grape. So, delaying colouration is one of the tools to achieve

the aim. The results of (PCBP) are illustrated in (Fig.1 and 2). It is clear that CPPU and/or GA_3 induced an increase in PCBP. The more increase in the concentration of CPPU and/or GA_3, the more increase of PCBP. The highest PCBP value was recorded at the application of 7 ppm CPPU or 20 ppm GA_3 and their combination. As time advanced, PCBP started to decrease but the highest PCBP values still noticeable at the application of 7 ppm CPPU in combination with all GA_3 concentrations. At TSS 18, it is clear that all PCBP were decreased and the values were similar to the control. The highest values were recorded for 7 ppm CPPU and all GA_3 concentrations (Fig 1 and 2) It is logic that the results of PCBP took a reverse trend compared to those of anthocyanin (Table 13).

The highest yield/vine was achieved by the application of 7 ppm CPPU x 20 ppm GA_3 (Table 8) accompanied by low values of anthocyanin (Table 13) and higher PCBP (Fig.1and 2). At the same time, the application of 5 ppm CPPU x 10 ppm GA_3 produced yield/vine less about 21% and 20% in the first and second seasons, respectively than 7 ppm CPPU x 20 ppm GA_3 and accompanied by higher anthocyanin concentration and lower PCBP. So, the increment in yield/vine induced by 7 ppm CPPU x 20 ppm GA_3 could not be neglected, but more work is needed to improve the level of anthocyanin and decrease PCBP.

The delay in ripening produced by CPPU x GA_3 is desired for Ruby Seedless grapes in regard to marketing especially in the desert areas. The results indicated that CPPU x GA_3 delayed the harvest of Ruby Seedless table grape to the second half of August which raise its price from 70 piasters at the fourth week of July to 115 piasters/kg at the second week of August then to 135 paisters per kg at the third week of the same month. (Personal communication with the owner of the farm).

The appearance of Romi Ahmer table grape variety in August made no problem for its poor colour in that period and loose bunches.

Delaying colouring as results of applying CPPU and/or GA3 were reported by (Intrieri *et al*., 1993 and Wolf *et al*., 1994).

7-Total soluble solids (TSS):

It is obvious from Table (9) that CPPU and GA_3 in addition to their interactions delayed sugar accumulation in juice of Ruby Seedless grape berries. CPPU caused a significant decrease in TSS. The lowest value was recorded at the application of high concentration of CPPU (7 ppm). The same trend was observed for GA_3. Meanwhile, neither CPPU nor GA_3 applications produced the level of TSS 16%. More significant decreases in TSS were found as a result of the combined application of CPPU and GA_3 with the exception of 0 ppm CPPU x 0 ppm GA_3, 3 ppm CPPU x 0 ppm GA_3 and 0 ppm CPPU x 5 ppm GA_3. The lowest values were recorded when high concentrations of CPPU and GA_3 were applied.

As the time advanced TSS increased and days needed to reach TSS 16 and 18 are found in table 10. It is clear that the rate of sugar accumulation was slower under treatments with high CPPU and/or GA_3 concentration compared to the lower ones.

It is clear that small berries needed few days to accumulate sugars in comparison to large ones. The above results showed evidence that CPPU and/or GA_3 delayed maturation of Ruby Seedless grapes for several days.

This delay is logic since CPPU and/or GA_3 increased berry size (Table 2), delayed sugar accumulation (Table 9) consequently, delayed ripening. These results are in accordance with those of (Intrieri *et al*., 1993; Retamales *et al*., 1993; Dokoozalian, 1994; Wolf *et al*., 1994 and Rizk, 1998).

Table (9): Effect of CPPU and/or GA_3 on TSS of Ruby Seedless grapes.

GA_3 ppm	1997 (26 July)					1998 (24 July)				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	16.0 a	16.0 a	15.1 b	14.5 c	15.4 A-	16.0 a	15.8 a	15.1 b	14.7 b	15.4 A-
5	16.0 a	14.5 c	14.3 d	14.3 d	14.8 B-	15.9 a	14.0 c	14.0 c	14.0 c	14.5 B-
10	15.5 b	14.2 d	14.0 e	14.0 e	14.4 B-C-	15.4 b	13.8 d	13.5 d	13.3 e	14.0 C-
20	15.5 b	13.8 f	13.7 f	13.5 f	14.1 D-	15.2 b	13.5 d	13.5 d	13.2 e	13.9 C-
Mean	15.8 A	14.6 B	14.3 Bc	14.1 C		15.6 A	14.3 B	14.2 B	13.8 C	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

Table (10): Effect of CPPU and/or GA_3 on days needed to TSS to reach 16 and 18 after control, physical and chemical characteristics of Ruby Seedless table grapes.

CPPu Ppm	GA_3 ppm	Days needed to TSS to reach 16 and 18 after control 16		18		Adherance strength at TSS 18		Firmness at TSS 18		Acidity at TSS 18		Anthocyanin at TSS 18	
		1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
0	0	-	-	4	5	335 d	332 d	0.55 c	0.50 c	0.43 a	0.44 a	1.65 a	1.93 a
3	0	-	-	4	5	350 c	348 c	0.75 b	0.71 b	0.43 a	0.44 a	1.55 a	1.85 a
5	0	5	6	5	5	360 b	367 b	0.75 b	0.68 b	0.43 a	0.45 a	1.55 a	1.84 a
7	0	7	8	6	5	365 b	372 b	0.90 a	0.80 a	0.45 a	0.45 a	1.31 b	1.35 b
0	5	-	-	4	5	350 c	359 c	0.78 b	0.61 b	0.43 a	0.46 a	1.59 a	1.84 a
0	10	3	3	4	5	355 bc	365 bc	0.76 b	0.63 b	0.43 a	0.47 a	1.59 a	1.85 a
0	20	5	4	6	7	360 b	371 b	0.77 b	0.64 b	0.44 a	0.46 a	1.56 a	1.86 a
3	5	5	6	5	6	368 b	379 b	0.75 b	0.63 b	0.46 a	0.47 a	1.58 a	1.86 a
3	10	6	8	6	6	365 b	375 b	0.77 ab	0.65 b	0.46 a	0.48 a	1.57 a	1.86 a
3	20	6	8	7	7	367 b	379 b	0.78 b	0.65 b	0.46 a	0.49 a	1.53 a	1.87 a
5	5	6	9	6	8	371 b	382 ab	0.75 b	0.70 b	0.46 a	0.49 a	1.58 a	1.89 a
5	10	7	10	8	8	369 b	377 b	0.81 a	0.72 b	0.49 a	0.50 a	1.55 a	1.83 a
5	20	7	10	6	8	370 ab	378 b	0.82 a	0.74 ab	0.51 a	0.50 a	1.55 a	1.83 a
7	5	9	11	7	9	380 a	384 a	0.91 a	0.78 a	0.52 a	0.52 a	1.25 b	1.30 b
7	10	10	11	8	9	385 a	387 a	0.93 a	0.78 a	0.53 a	0.49 a	1.25 b	1.34 b
7	20	10	12	8	9	389 a	395 a	0.95 a	0.83 a	0.53 a	0.52 a	1.20 b	1.26 b

From Tables 2 and 10 sound results could be summarized as follows:

Treatments	Days needed to reach TSS 16 and 18 after control				% increase in berry size than control	
	1997		1998		1997	1998
	16	18	16	18		
Control	0	0	0	0	0	0
CPPU at 7 ppm	7	6	8	5	19	20
GA_3 at 20 ppm	5	6	4	7	38	43
CPPU at 5 ppm + GA_3 at 10 ppm	7	8	10	8	61	69
CPPU at 7 ppm + GA_3 at 20 ppm	10	8	12	9	63	74

Acidity:

Juice acidity was significantly increased by the application of CPPU and/or GA_3 (Table 11). It is obvious that all CPPU concentrations significantly

increased berry acidity compared to the control. Meanwhile, the only significant response of GA_3 was obtained when the highest concentration (20 ppm) was applied. Hence, CPPU was more effective in lowering the degradation rate of acidity than GA_3. The same trend was observed as a result of CPPU x GA_3. However, the differences disappeared when TSS reached 18.Similar observations were reported by (Dokoozalian *et al*., 1994; Wolf *et al*., 1994 and Rizk, 1998).

Table (11): Effect of CPPU and/or GA_3 on acidity % of Ruby Seedless grapes.

GA_3 ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	0.44 e	0.78 bc	0.84 ab	0.86 ab	0.73 B-	0.45 d	0.83 b	0.86 ab	0.88 ab	0.80 B-
5	0.64 d	0.84 ab	0.89 ab	0.89 ab	0.81 A-B--	0.70 c	0.86 ab	0.86 ab	0.89 ab	0.83 A-B-
10	0.68 cd	0.86 ab	0.88 ab	0.90 a	0.83 A-B-	0.73 c	0.87 ab	0.88 ab	0.96 a	0.85 A-
20	0.72 cd	0.89 ab	0.90 a	0.93 a	0.85 A-	0.74 c	0.88 ab	0.90 a	0.93 a	0.86 A-
Mean	0.62 B	0.84 A	0.87A	0.90 A		0.70 C	0.86 B	0.88 AB	0.90 A	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

9-TSS/acidity:

Table (12) illustrated TSS/acidity as affected by CPPU and/or GA_3. All CPPU concentrations significantly decreased this ratio compared to the control. These decreases showed an opposite trend to CPPU concentrations. The same notice was found as a result of GA_3 application. CPPU x GA_3 treatments significantly decreased TSS/acidity. The lowest values were recorded when the high concentrations of CPPU x GA_3 were applied.
The lower TSS/acidity values are due to higher acidity values (Table 11). We agree with (Joublan *et al.,* 1995) that CPPU and/or GA_3 delayed grape ripening in terms of TSS and TSS/acidity.

Table (12): Effect of CPPU and/or GA_3 on TSS/acidity of Ruby Seedless grapes.

GA_3 ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	37.7a	21.2 d	19.0 de	18.6 e	23.0 A-	35.5 a	19.3 c	18.6 cd	18.2 c	22.9 A-
5	25.3 b	19.0 de	17.9 ef	17.9 ef	20.0 B-	23.1 b	18.6 cd	18.6 cd	17.9 de	19.6 B-
10	23.5 bc	18.6 e	18.2 e	17.8 ef	19.5B-C-	21.9 b	18.4 cd	18.2 cd	16.7 e	18.8 C-
20	22.2 c	17.9 ef	17.8 ef	17.2 f	18.8 D-	21.6 b	18.2 cd	17.8 de	17.2 de	18.7 C-
Mean	27.1 A	19.0 B	18.2 C	17.9 C		25.5 A	18.6 B	18.3 B	17.5 C	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A- …..for GA_3 a…..for CPPU x GA_3

10-Anthocyanin:

The application of CPPU and/or GA_3 significantly decreased anthocyanin concent. compared to the control (Table 13). It is obvious that increasing the concentration of CPPU or GA_3 significantly decreased anthocyanin. The lowest values were recorded as a result of applying the high concentration of CPPU and/or GA_3. At TSS 18 (Table 10) anthocyanin was significantly increased with all treatments compared to treatments

contained 7 ppm CPPU. It is obvious that there was no significant difference between control and these treatments, which indicate that the delay of ripening of Ruby Seedless grapes increased anthocyanin contents in the skin and consequently improved its colouration. It was found that the change in grape colour from green to purple was delayed as a result of CPPU application (Intrieri *et al*., 1995). Moreover, (Wolf *et al*., 1994) recommended CPPU dosages not more than 5 mg/L due to negative effects on berry colouring. Similar results were observed when (Joublan *et al.,*1995) applied CPPU and/or GA_3 on Moscatel Roseda grapes. (Rong et al., 1998) explained that CPPU and/or GA_3 stimulated cell division during early fruit development and cell enlargement during later stages and increasing the concentration of fruit endogenous growth regulators particularly IAA, which delayed fruit ripening and colouring.

Table (13): Effect of CPPU and/or GA_3 on anthocyanin concentration (O.D. at 530 nm) of Ruby Seedless grapes.

GA_3 ppm	1997					1998				
	CPPU ppm					CPPU ppm				
	0	3	5	7	Mean	0	3	5	7	Mean
0	1.15 ^{a}	1.15 ^{a}	1.11 ^{a}	1.06 ^{b}	1.12 $^{A-}$	1.32 ^{a}	1.25 ^{b}	1.20 ^{b}	1.09 ^{c}	1.22 $^{A-}$
5	1.05 ^{b}	1.03 ^{b}	0.96 ^{c}	0.90 ^{de}	0.99 $^{B-}$	1.14 ^{c}	1.09 ^{c}	1.02 ^{d}	0.89 ^{fg}	1.04 $^{B-}$
10	1.02 ^{b}	0.99 ^{c}	0.93 ^{d}	0.87 ^{ef}	0.95 $^{C-}$	1.06 ^{cd}	1.02 ^{d}	0.96 ^{e}	0.91 ^{f}	0.99 $^{C-}$
20	0.95 ^{d}	0.93 ^{d}	0.90 ^{d}	0.84 ^{f}	0.91 $^{D-}$	0.96 ^{e}	0.94 ^{ef}	0.91 ^{f}	0.88 ^{g}	0.92 $^{D-}$
Mean	1.04 ^{A}	1.03 ^{A}	0.98 ^{B}	0.92 ^{C}		1.12 ^{A}	1.08 ^{B}	1.02 ^{C}	0.94 ^{D}	

Values with the same letter (s) are not differ significantly at 5% level
A….for CPPU A^{-} …..for GA_3 a…..for CPPU x GA_3

From the foregoing discussion, it is clear that CPPU and/or GA_3 Treatments delayed Ruby Seedless table grape ripening and improved its quality. These effects reflected in increasing its price. To achieve good results, it is recommended to spray the bunches when berry diameter reaches 6-8 mm with 5 ppm CPPU + 10 ppm GA_3.

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تحسين الجودة والتسويق لعنب الروبى سيدلس

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رشت عناقيد عنب صنف كنج روبى عمره ٦ سنوات مرباه بالطريقة الكردونية ومدعمه بنظام تكاعيب البارون بمزرعة خاصة فى وادى الفارغ بمحافظة الجيزة بـ CPPU بتركيز صفر ، ٣ ، ٥ ، ٧ جزء فى المليون أو GA_3 بتركيز صفر ،٥ ، ١٠ ، ٢٠ جزء فى المليون أو كلاهما عندما كان قطر الحبات يتراوح بين ٦-٨ مم . أوضحت النتائج أن هناك زيادة معنوية فى وزن وحجم الحبات ، طول وقطر الحبة ، وزن العنقود ومحصول الكرمه ، كما زادت النسبة المئوية للحبات الرديئة التلوين وسجلت المعاملة ٧ جزء فى المليون CPPU مع ٢٠ جزء فى المليون GA_3 أعلى محصول/كرمة وأعلى نسبة مئوية للحبات رديئة التلوين ، أما المواد الصلبة الذائبة الكلية ، المواد الصلبة الذائبة/الحموضة والمحتوى من الأنثوسيانين فقد انخفض معنوياً ، إضافة إلى ما سبق أدت المعاملات السابقة إلى التأخير فى نضج العنب تراوح بين ٥-٢١ يوم مقارنة بالكنترول. أدى هذا التأخير إلى تحسين جودة العناقيد المعاملة وزيادة تلونها وزيادة السعر .