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Effect of some Compounds Spraying on Fruiting of Superior Seedless Grapevines under Assiut Conditions

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ABSTRACT

This investigation was carried out during two seasons i.e. 2016 and 2017 on Superior Seedless grapes cultivar grown at the Experimental Orchard, Faculty of Agriculture, Assiut University, Egypt. Ten combined treatments of GA_3, urea, roselle and active dry yeast spraying at various stage of berry development were evaluated. The experimental vines were arranged in a complete randomized design. From the results of this investigation, it could be concluded that spraying with GA_3 seven times, once at pre-bloom (5 ppm), thrice at full-bloom (5 and 10 ppm) and other thrice when the berry at (6 mm) pea stage (30ppm). In addition , combined spraying GA_3 four times once at pre-bloom and thrice at full-bloom plus 1.5% active dry yeast when the berry at pea stage, as well as roselle at0.2% three times to obtain heavy and less compact cluster and hasten the ripening with fairly good Superior Seedless berries quality. In addition, it could be used urea and yeast as well as roselle extract instead of GA_3 in grape production to overcome the adverse GA_3 effects.
Keywords: Growth regulators, GA_3, urea, yeast, roselle and grapes.

INTRODUCTION

Grapes (*Vitis vinifera L.*) are considered the first major fruit crop in its production all over the world, for being of an excellent flavor, nice taste and high nutritional value. In Egypt grapes rank second among fruit crops while citrus being the first. The total planted area attained about 188543 Fed with an average of 1378815 tons M.A.L.R., (2015).

The improving early grapes are very important either for local consumption markets or exportation to external markets. Berry thinning has been used to obtain a good cluster with highest berry weight and fastest ripening. Bunch thinning is done as a regular cultural treatment or spray of chemicals at pre-bloom, peak bloom and fruit set stages. The practice is done to reduce cluster compactness and to improve the productivity and berry quality. The thinning necessary depended on the cultivar as well as sunshine, temperature and nutrient supply Dhillon *et al*., (1992); Poni, (2003); Ahmed *et al*., (2004) and El-Salhy *et al* (2009).

Plant growth substances play a major role in plant growth and development GA_3 still used to increase cluster length, thinning bunch berries as well as berry size in Seedless grape cultivars Orth, (1990); Colapietra *et al*., (1995); El-Hammady *et al*., (1998); Williams and Ayars, (2005); Selim, (2007); Zoffoli *et al*., (2009) and El-Halaby *et al* (2015).

Recently urea spraying at pre-bloom or full blood has been used to reduce the berry set percentage and consequently to induce berry thinning Ahmed *et al.,* (2004); El-Salhy *et al*., (2009); Fawzi *et al*., (2014) and El-Halaby *et al* (2015). The bio-fertilizer active dry yeast was enhanced grape yield and berry quality where, yeast contains some natural growth regulators, some important nutrients and some common amino acids Moor, (1979); Idso *et al*., (1995); El-Salhy *et al*., (2011) and Fawzi *et al*., (2014).

Plant extracts as a natural products were used in many ways. The natural products were used in improving growth, nutritional status, production and as pesticides for public health and environmental safety. The higher content of plant extracts from phenolic and another chemical constituent seem to have synergistic effects on growth and fruiting of fruit trees Paik and Chung, (1997) and Srivastava and Lal, (1997).

Roselle (*Hibiscus sabdariffa*), extract contains higher amount of anthocyanin, organic acids, ascorbic acid, calcium oxalate and herbicide hydrochloride Raffauf, (1970). The own higher content of plant extracts from antioxidants especially phenolic compounds, nutrients and plant pigments which in turn stimulating the growth and fruiting of fruit trees Srimal, (1997) and Pons, (2003).

The beneficial effects of using plant extracts on growth and fruiting of grapevines were emphasized by Vargas *et al* (2008), Gad El. Kareem and Abdel. Rahman (2013), Abada (2014), Gouda. Fatma El-zahraa (2016) and El-salhy *et al* (2017).

This study aimed to recognize the benefit of spraying GA3 and urea as well as active dry yeast and roselle in fruiting Superior Seedless grapes cultivar.

MATERIALS AND METHODS

The present work was conducted through two successive seasons of 2016 and 2017 on 60 uniform vigour seven years-old superior Seedless grapevines. The vines were grown the Experimental Orchard, Faculty of Agriculture, Assiut University, Egypt. They had grown in clay soil at 2x2.5 meters. All vines received the standard agricultural practices that are used in the vineyard including soil fertilization, irrigation and pest control. The vines were cane pruned (68 eyes/vine were left, 10 canes x 6 buds/cane plus 4 renewal spurs with 2 buds). The pruning was done during the second week of January each season. Crop load at all vines was adjusted to 25 clusters/vine after berry set. The chosen vines were divided into ten different treatments including the control. The experimental vines were arranged in a complete randomized block design with three replications per treatment two vines in each. Thus, the treatments were as follow:

1- Control (sprayed with water only).
2- GA_3 at 5 ppm sprayed when cluster length was about (10-12 cm) for elongation.
3- Urea at 1.5 % sprayed when cluster length was about (10-12 cm) for elongation.

4- GA_3 at 5 ppm plus 10 ppm sprayed during full bloom, the successive three days, respectively for berry thinning.
5- Urea at 1.5 two times spraying for elongation berry thinning.
6- GA_3 seven times spraying, once at 5 ppm for elongation, followed by thrice GA_3 at 10 ppm for thinning and other thrice 30ppm of GA_3 when berry diameter reached about 6 mm (pea stage) for sizing.
7- GA_3 four times spraying, once at 5 ppm for elongation, followed by thrice GA_3 at 10 ppm for thinning and spraying once of 0.2% yeast when berry diameter reached about 6 mm (pea stage) for sizing.
8- Urea twice sprays once at 1.5% for elongation, followed by other at 1.5% for thinning and then of 0.2% yeast spraying when berry diameter reached about 6 mm (pea stage) for sizing.
9- GA_3 once spraying at 5 ppm for elongation, followed by once urea at 1.5% for thinning and then of 0.2% yeast was spraying at pea stage for sizing.
10- Roselle at 0.2% three times spraying, once for elongation followed by once for berry thinning and once for sizing.

GA_3 (Gibberellic acid), and low biuret urea (46%) and roselle extract were prepared before spraying by dissolved the define amount in water based. Active dry yeast was prepared by dissolved the define amount in warm water (38°C) followed by addition of 0.3% Egyptian treacle (as source of sugar) and left for two hours for activating before spraying. All chemicals were sprayed at same date by using a hand sprayer to the run off.

The percentage of berry set was estimated by caging two clusters per vine in perforated white cheese bags after the first spraying. Such bags were removed for chemical spraying at blooming; the percentage of berry set was calculated as follow:

$$Berry\,set\,\% = \frac{No.\ of\ berries/cluster}{No.\ of\ total\ flowers/cluster} x\,100$$

At harvest time (when TSS of berry juice in the check treatment reached 13-14% brix), the clusters were harvested, weighed and yield/vine (kg) was recorded. Two clusters were taken at random from yield of each vine and the following characteristics were determined.

Cluster weight (g), cluster length (cm) and number of berries per each cluster, then cluster compactness coefficient according to Winkler *et al*. (1974), as well as shot berries percentage were recorded.

In addition berry quality in terms of berry weight, TSS, total titratable acidity and reducing sugars % according to A.O.A.C. (1985).

All obtained data were tabulated and statistically analyzed according to Gomez and Gomez (1984) and Snedecor and Cochran (1990) using the New L.S.D. test for distinguishing the significance differences between various treatment means.

RESULTS

1- Berry set percentage and yield:

Data presented in Table (1) shows the effect of spraying with GA_3, low biuret urea, active dry yeast and roselle on berry set percentage, shot berries percentage, yield/vine and cluster weight of Superior Seedless grapevines in 2016 and 2017 seasons. It is obvious from the obtained data that the results took similar trend during the two studied seasons. Spraying of GA_3 or urea as well as roselle at full bloom decreased the berry set and shot berries percentages compared to untreated vine. The lowest values of berry set percentage was recorded due to spray GA_3 or urea ,whereas, shot berries percentage was recorded due to spray GA_3 or urea combined with yeast as well as roselle compared to unsprayed ones.

On other hand most treatments unsignificantly effected on cluster weight and yield/vine compared to unsprayed ones. Spraying roselle significantly increased the cluster weight and yield/vine compared to unsprayed ones (control).The increment of the cluster weight and yield/vine due to roselle over unsprayed ones (control) attained 9.56 and 5.89% as an av. the two studied seasons respectively. Contrarily, GA_3 or urea spraying for thinning significantly decreased the cluster weight and yield/vine compared to control. The decrement percentage of yield/vine attained 11.56 and 9.27 % as an av. of the two studied seasons due to GA_3 or urea spraying compared to unsprayed ones, respectively.

Table 1. Effect of GA_3, urea, yeast and roselle spraying on berry set %, shot berries %, yield and cluster weight of Superior Seedless grapevines during 2016 and 2017 seasons.

No	Berry set (%)			Shot berries (%)			Yield/vine (kg)			Cluster weight (g)		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
T_1	15.60	15.11	15.35	12.68	14.56	13.62	9.15	9.19	9.17	363.6	370.5	367.1
T_2	15.23	14.89	15.06	5.64	6.28	5.96	9.41	9.71	9.56	376.5	388.6	382.5
T_3	15.86	15.13	15.50	5.58	6.34	5.96	9.57	9.81	9.69	383.8	393.6	388.7
T_4	11.18	11.33	11.25	3.28	3.61	3.44	8.01	8.21	8.11	320.6	328.3	324.5
T_5	12.05	11.53	11.79	3.61	4.15	3.88	8.21	8.43	8.32	328.3	337.4	332.8
T_6	11.72	11.57	11.65	2.26	2.68	2.47	9.42	9.72	9.57	378.7	390.9	384.8
T_7	11.24	10.98	11.11	2.49	3.05	2.77	9.24	9.48	9.36	369.5	379.3	374.4
T_8	11.75	11.32	11.53	2.35	2.56	2.45	9.47	9.76	9.51	378.8	390.4	384.6
T_9	11.54	11.21	11.37	2.34	3.46	2.90	9.35	9.60	9.47	374.1	384.1	379.1
T_{10}	13.18	13.09	13.13	3.88	4.96	4.42	9.63	9.80	9.71	396.2	408.2	402.2
N.LSD	1.28	1.43		0.68	0.54		0.56	0.63		22.62	20.48	

1-control **T2=GA_3 5 ppm** **T3=Urea 1.5%**
T4= GA_3 (5+ 10 ppm) **T5= Urea (1.5 + 1.5 %)** **T6= GA_3 (5 + 10+ 30 ppm)**
T7= (GA_3 5 + 10 ppm) + (Yeast 0.2 %) **T8= (Urea 1.5 + 1.5 %) + (Yeast 0.2 %)**
T9= (GA_3 5 ppm) + (Urea 1.5) + (Yeast 0.2 %) **T10=Roselle (0.2 +0.2 +0.2 %)**

Therefore, it can be concluded that thrice spraying of roselle (T10) as well as combined GA_3 plus urea and yeast (T9) or urea twice plus yeast (T8) at pre- bloom, full bloom and when berry at pea stage were the best tool to produce heavy weight of clusters and yield/vine.

2- Cluster characteristics:

The effects of tested treatments on cluster characteristics during the two studied seasons are presented in Table (2). It is evident that all treatments improved the cluster traits. Using GA_3 or urea as well as roselle at pre-bloom significantly increased the cluster length, whereas, using them at full-bloom significantly decreased the berries number per cluster compared to untreated one (control). Hence, all spraying significantly decreased compactness coefficient of cluster and produced loose clusters. No significantly differences were detected due to use either GA_3, urea or roselle extracts. The decrement of cluster compactness coefficient was attained (35.87, 35.87 and 30.00 % as av. of the two studied seasons) due to GA_3 (T4), urea (T5) and roselle(T10) spraying compared to unsprayed ones, (control) respectively. Also, these treatments significantly increased the berry weight compared to untreated one (control). The increment of berry weight was attained 38.31 , 35.13 and 36.07% as an av. of the two studied seasons due to spray seven times GA_3 (T6),urea twice and yeast (T8) and roselle extracts three times(T10),compared to untreated one respectively.

Table 2. Effect of GA_3, urea, yeast and roselle spraying on No. of berries/cluster, cluster length, compactness coefficient, and 25 berries weight of Superior Seedless grapevines during 2016 and 2017 seasons.

No	No. berries/cluster			Cluster length (cm)			Compactness coefficient%			25 berries weight (g)		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
T1	138.1	143.8	140.9	18.66	18.92	18.79	7.40	7.60	7.50	58.80	60.30	59.50
T2	136.1	141.3	138.7	21.76	22.18	21.97	6.25	6.37	6.31	63.50	65.10	64.30
T3	138.3	140.8	139.5	21.35	21.96	21.65	6.47	6.41	6.44	64.80	66.30	65.50
T4	102.2	107.1	104.7	21.58	21.87	21.72	4.73	4.89	4.81	67.60	69.30	68.50
T5	101.6	104.3	102.9	21.11	21.60	21.35	4.81	4.82	4.81	68.30	69.80	69.10
T6	100.8	107.2	104.0	20.92	21.48	21.20	4.81	4.99	4.90	81.10	83.60	82.30
T7	101.8	105.8	103.8	21.38	21.86	21.62	4. 76	4.84	4.80	79.40	81.80	80.60
T8	103.6	106.2	104.9	21.60	21.53	21.56	4.79	4.93	4.86	79.50	81.40	80.40
T9	103.8	105.3	104.5	21.18	21.72	21.45	4.90	4.85	4.87	78.50	80.60	79.60
T10	109.4	111.9	110.6	20.64	21.45	21. 05	5.21	5.28	5. 25	79.96	82.06	80.96
N.LSD	8.22	8.67		0.93	1.06		0.42	0.54		3.58	4.17	

1-control **T2=GA_3 5 ppm** **T3=Urea 1.5%**
T4 = GA_3 (5+ 10 ppm) **T5= Urea (1.5 + 1.5 %)** **T6= GA_3 (5 + 10+ 30ppm)**
T7= (GA_3 5 + 10 ppm) + (Yeast 0.2 %) **T8= (Urea 1.5 + 1.5 %) + (Yeast 0.2 %)**
T9= (GA_3 5 ppm) + (Urea 1.5) + (Yeast 0.2 %) **T10=Roselle (0.2 +0.2 +0.2 %)**

Using singly GA_3 spraying or GA_3 plus active dry yeast for sizing had the highest berry weight and size with good cluster traits compared to control. No significant differences were observed between used GA_3 or urea for cluster elongation and berry thinning, as well as used GA_3 or yeast after berry set for sizing. In addition, roselle spraying three times gave the same positives effecting of GA_3, urea and yeast on cluster attributes and berry weight.

3- Chemical constituents:

Data of various berry characteristics as affected by different studied treatments during 2016 and 2017 seasons are presented in Tables (3).

Table 3. Effect of GA_3, urea, yeast and Roselle spraying on TSS, reducing sugars and titratable acidity of Superior Seedless grapes during 2016 and 2017 seasons.

No	TSS (%)			Reducing sugars (%)			Titratable acidity (%)		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
T_1	13.29	13.52	13.40	9.38	9.54	9.46	0.426	0.445	0.435
T_2	14.53	14.68	14.60	10.59	10.77	10.68	0.331	0.348	0.339
T_3	14.86	1500	14.93	11.18	11.14	11.16	0.341	0.352	0.346
T_4	13.18	15.10	15.14	11.36	12.28	12.17	0.325	0.343	0.334
T_5	15.60	15.73	15.66	11.06	11.82	11.79	0.287	0.333	0.310
T_6	15.18	15.40	15.29	10.94	11.88	11.76	0.296	0.316	0.306
T_7	15. 80	15.75	15.77	12.15	12.05	12.10	0.293	0.308	0.301
T_8	15.70	16.06	15.79	11.53	11.59	11.56	0.296	0.310	0.303
T_9	16.16	15.90	16.03	11.96	12.13	12.05	0.290	0.308	0.299
T_{10}	15.80	15.68	15.74	11.44	11.72	11.58	0.304	0.320	0.312
N.LSD	0.57	0.66		0.46	0.58		0.015	0.018	

1-control **T2=GA_3 5 ppm** **T3=Urea 1.5%**
T4= GA_3 (5+ 10 ppm) **T5= Urea (1.5 + 1.5 %)** **T6= GA_3 (5 + 10+ 30 ppm)**
T7= (GA_3 5 + 10 ppm) + (Yeast 0.2 %) **T8= (Urea 1.5 + 1.5 %) + (Yeast 0.2 %)**
T9= (GA_3 5 ppm) + (Urea 1.5) + (Yeast 0.2 %) **T10=Roselle (0.2 +0.2 +0.2 %)**

The data indicated that GA_3 and urea plus active dry yeast spraying at pre-bloom and full bloom, and followed by GA_3 or urea plus active dry yeast as well as roselle three times significantly improved the Superior Seedless grapes quality in terms of increasing total soluble solids and reducing sugars and decreasing total acidity com-

pared to untreated ones. No significant differences were found due to use GA_3 or urea plus yeast or roselle extracts The increment percentage of total soluble solids was (17.69, 17.84, 19.63 and 17.46% an av. of the two studied season) due to use GA_3 twice plus yeast (T7), urea twice plus yeast (T8), GA3 and urea plus yeast (T9) or roselle three times (T10) compared to unsprayed ones (control, T1), respectively. Hence, it can be concluded that could be used urea, yeast and roselle instead of GA_3 to overcome the adverse effects due to GA_3 in grape production, i.e. delaying the berry ripening and reduction berry quality.

Discussion and Conclusion:

GA_3 has been routinely used for Seedless grape production to increase berry and cluster weight, and cause thinning of clusters. The effect of GA_3 depends on date of application and concentration applied. GA_3 spraying at full bloom decreased berry set since its role in flower dropping, causing a reduction of berries number of cluster .The positive action of GA_3 on stimulating cell elongation process, enhancing the water absorption and stimulating the biosynthesis of proteins which will lead to increase the cluster length, as well as, berry size and weight., Roper and Williams, (1989); Lu *et al*., (1995);perez *et al* (2000), Dokoozlian and Peacock (2001), Selim (2007), El-Salhy *et al*. (2009) and Abu-Zahra, (2010).

The results are on line with those obtained by the investigators, Ezzahouani *et al*. (1985), Orth (1990), Lu *et al*. (1995), and El-Halaby *et al*., (2015).

In addition, the positive action of urea as nitrogen source and producing new tissues that water and nutrients absorption induce more vegetative growth that shifted the balance of competition between reproductive growth and vegetative organs in favor of the latter. Low buiret urea differed significantly from control in term of fruit set and fruit thinning percentage. The reasons may be the interference with fertilization of the ovary of phytotoxicity in the peduncle region Byers and Lyons, (1985); Guirguis *et al*., (1996) and Ahmed *et al*., (2004). There was a remarkable improving on berry quality expressed on increasing the berry weight, total soluble solids, reducing sugars and anthocyanin contents as berry thinning. The results of urea on improving yield and berry quality of grapevines was supported by many authors such as El-Moursy *et al*. (1993), Abdel-Hady (1995), Ahmed *et al*. (2004), El-Salhy *et al*. (2009),Fawzi *et al*. (2014) and El- Halaby *et al*. (2015).

The improving effect of yeast application was attributed to auxins, hormones, vitamins, chelating agents and enzyme produced which have stimulatory effects on cell division and enlargement, nutrient uptake, protein synthesis and improves net photosynthesis Moor, (1979) and Idso *et al*. (1995). These effects induce advancing of the berry ripening. It known that the earliest productions are the most important target for export and marketing. The results are in harmony with those of Hassan (2002), Omran and Abdel-Latif (2003), El-Akkad (2004), Omran *et al*. (2005), El-Salhy *et al*. (2011) ,Fawzi *et al*. (2014) and El-Halaby (2015).

The higher own content of roselle extracts from different antioxidant as well as nutrients surely reflected on enhancing cell division, building organic foods and the tolerance of plants to biotic and abiotic stresses could explain the positive effects on growth and fruiting of fruit trees, Paik and Chung (1997); Pons, (2003) and Okigobo and Emoghene,(2003).

These effects surely reflected on enhancing growth, nutritional status and fruiting of vines. These results were reported by Vargas *et al* (2008), Gadel-kareem and Abdel-Rahman (2013), Ahmed *et al* (2014), Gouda. Fatma EL-zahraa (2016) and El-Salhy (2017).

On the light of the previous results, it could be recommended that spraying of GA_3 seven times, once at prebloom, thrice at full-bloom and thrice (5, 10 & 30 ppm) when the berry of pea stage plus 0.2% active dry yeast when the berry diameters about 6 mm (pea stage). In addition, can be used either 1.5% low biuret urea at prebloom and full bloom, Plus 0.2% active dry yeast when the berry at pea stage or roselle three times. Using urea and yeast as well as roselle more effective to overcome the adverse effective of using GA_3 at high concentration i.e. delay the berry ripening .These treatments very necessary to produce heavy and less compact cluster and hasten the ripening as well as improving the weight, size and taste of Superior Seedless berries. These advantages will eventually enable growers to obtain highly marketable surrounding and overseas markets.

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تأثير رش بعض المركبات علي إثمار شجيرات العنب السوبريور اللابذري تحت ظروف اسيوط

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أجريت هذه الدراسة خلال موسمين متتاليين 2016، 2017 علي شجيرات العنب السوبيريور اللابذري بمزرعة كلية الزراعه جامعة اسيوط محافظة اسيوط – جمهورية مصر العربية. بهدف دراسة تأثير رش حمض الجبريليك واليوريا والخميرة الجافة المنشطة والكركديه علي المحصول وخصائص العناقيد والحبات. وقد تم رش حمض الجبريليك قبيل التزهير وأثناء اكتمال التزهير وعندما وصل قطر الحبات 6 مم بينما تم رش اليوريا قبيل التزهير وأثناء اكتمال التزهير وتم رش الخميرة النشطة عندما وصل قطر الحبات 6 مم فى مواعيد رش حمض الجبريليك بينما تم رش مستخلص الكركديه ثلاث مرات فى المواعيد السابقة بهدف الاستطاله وخف وزيادة حجم الحبات. ويمكن تلخيص أهم النتائج فيما يلي: أدي رش حمض الجبريليك واليوريا او الكركدية إلي زيادة معنوية في طول ووزن العنقود والمحصول مع نقص نسبة العقد وعدد الحبات والحبات الصغيرة وبالتالي تحسين صفات العنقود ووزن الحبات. أدي رش الخميرة في المرحلة الثالثة (قطر الحبات 6 مم) عقب رش حمض الجبريليك او اليوريا في مرحلتي (قبل التزهير، اكتمال التزهير) وكذلك رش مستخلص الكركدية ثلاث مرات إلي تحسين خصائص العناقيد وصفات الحبات الطبيعية والكيميائية. من نتائج هذه الدراسة يمكن التوصية برش حمض الجبريليك في المراحل الثلاثة للحصول علي محصول عال وعناقيد وحبات جيدة – كذلك يمكن استبدال رش حمض الجبريليك برش اليوريا وذلك لاستطالة العنقود وخف الحبات وبالمثل استخدام الخميرة بدلاً من حمض الجبريليك في المرحلة الثالثة كذلك يمكن رش مستخلص الكركدية ثلاث مرات بديلا عن حمض الجبريليك للمراحل الثلاثة وذلك لتلافي أضرار رش الجبريليك. وبالتالي الحصول علي محصول عال مبكر ذو عناقيد وحبات ذات خصائص ممتازة تتفق مع سوق التصدير والقدرة التنافسية بالأسواق الخارجية.