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YIELD AND FRUIT QUALITY OF THOMPSON SEEDLESS GRAPE AS AFFECTED BY GEBBERELLIN ACID (GA_3) AND SITOFEX (CPPU)

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ABSTRACT

All treatments used significantly increased the yield per vine than the control during the two seasons of study.

The vines treated with (CPPU) 2.5 or 7.5ppm and GA_3 at 20, 10, 20ppm gave the higher yield compared with the treatments. These increments reached about 92-94 % and 94-96 % respectively than the untreated vines used during the two seasons.

The untreated vines showed higher values in bunch compactness than all treatments used during the each seasons 1997 and 1998. Whereas, the rachis weight gave higher values for the all treatments used compared the control.

All treatments used significantly increased both of berry and juice volume than the control especially, Sitofex at 2.5 or 7.5ppm in combination with GA_3 at 20, 10, 40ppm.

All Sitofex and GA_3 applications used significantly increased berry length and diameter, than the control.

All treatments used significantly reduced T.S.S. than the control but the acidity took the opposite trend to those found with T.S.S.. Whereas, T.S.S/acid ratio took similar trend to those found with T.S.S.

INTRODUCTION

Grape is considered as one of most popular and favorite fruit crops in Egypt; it ranks the second crop after citrus.

The Thompson Seedless is the first verity. Yet, this cultivar is prone to quality defects such as small and uneven berry size and berry abscission, which can cause major loose in production. Sitofex (CPPU) is a new plant growth regulator that enhances and increases berry size of table grapes. However, the form of Sitofex treated berries is very acceptable and does not influence grading, marketability negatively. Furthermore, the best effects are obtained if Sitofex is applied in combination with Gebberellic acid. The applications rate of GA_3 can be reduced in this case (Wolf et al. (1994), Dokoozlian et al. (1994), and Retamales et al. (1995)).

Thus, this work was carried out to study only the effect of Sitofex or combined with Gebberellic acid (GA_3) on yield and berry quality of Thompson Seedless grapes.

MATERIALS AND METHODS

This experiment was carried out in two successive reasons of 1997 and 1998 on 15-year old Thompson Seedless grapevine in private orchard at Pasandila village near Belquas city Dakahlia government. The vines were planted in clay loam soil and spaced 1.5m between vines and 2.5m between

rows. The vines ware pruned as cane pruning system and to 5 fruiting canes each bearing 14 buds. All vines received the common cultural practices used in that district. The experiment was designed according to the randomized system with three replications per treatment, four vines each. Crop load of all vines was adjusted to 15 bunches/vine prior to antheis during the two seasons respectively.

The clusters were sprayed with GA_3 or Sitofex (CPPU) as follows:

1- Control untreated vines and sprayed by water.
2- GA_3 at 20ppm when the flower cluster length reached about 10cm + CPPU at 2.5ppm when berry size reached about 7mm.
3- Vines treated with GA_3 at 20ppm when the flower cluster length reached about 10cm + Sitofex (CPPU) at 7.5ppm when berry size reached about 7mm.
4- Vines treated with GA_3 at 20pmm when the flower cluster length reached about 10cm + GA_3 at 10ppm in full bloom for thinning + Sitofex (CPPU) at 2.5ppm when berry size reached 7mm.
5- Vines treated with GA_3 at 20ppm when the flower cluster length reached about 10cm + GA_3 at 10ppm at full bloom for thinning + Sitofex (CPPU) at 7.5ppm when the berries size reached about 7mm.
6- Vines treated with GA_3 at 20ppm when the flower cluster reached about 10cm + GA_3 at 10ppm at full bloom for thinning + GA_3 at 40ppm when the berries size reached about 5mm + Sitofex (CPPU) 2.5ppm when the berries size reached about 7mm.
7- Vines treated with GA_3 at 20ppm when the flower cluster length reached about 10cm + GA_3 at 10ppm at full bloom fir thinning + GA_3 at 40ppm. When the berries size reached about 5mm + Sitofex (CPPU) at 7.5ppm when the berries size reached about 7mm.
8- Vines treated with GA_3 at 20ppm when the flower cluster length reached about 10cm + GA_3 at 10ppm at full bloom for thinning + GA_3 at 40ppm when berries size reached about 5mm.

T.S.S. of untreated fruits reached about 15-16% (El-Bana et al. (1968)). At harvest time, total yield per vine, cluster weight, dimension, and rachis weight were determined. Bunch compactness factor was calculated by determining the number of berries cm lateral (second and third basal laterals) according to Turky et al. (1995). From each treatment, four sample determinations such as berry weight, dimension, juice volume, percentage of total soluble solids (by using refractometer), total acidity and T.S.S. acid ratio. The obtained data was statistically analyzed by new L.S.D. according to Sendecor, and Cochran (1967).

RESULTS AND DISCUSSIONS

1-Yield and bunch weight:

From Table (1) the data indicated that all treatments used significantly increased the yield per vine than the control during the two seasons of the study. Moreover, the vines treated with (CPPU) 2.5 or 7.5ppm and GA_3 at 20, 10, and 40ppm produced the higher yield compared with the other treatments

used. These increments reached about (92-94 and 94-96)% respectively than the untreated vines used during the two seasons.

Concerning the bunch weight, data in the same table took the same trend found with the yield.

These results were in agreement with those reported by Diaz, and Mandoado (1992), Dokoozlian et al. (1994), Retamales at el. (1995), Intrieri et al. (1995), and Rizk (1998). They found that Sitofex (CPPU) alone or in combination with GA_3 increased both of yield and bunch weight of Thompson Seedless.

Table (1): Effect of Sitofex (CPPU) and GA_3 on yield and cluster weight of Thompson Seedless grapes during 1997 and 1998 seasons.

Treatments	Yield/Vine (kg)			Cluster Weight (gm)		
	1997	1998	Mean	1997	1998	Mean
Control	5.77 f	5.63 e	5.7	384.5 f	375.0 f	379.75
GA_3 at 20ppm + CPPU at 2.5ppm	7.77 e	7.73 cd	7.75	517.8 de	515.0 e	516.4
GA_3 at 20ppm + CPPU at 7.5ppm	10.09 b	9.96 ab	10.03	672.4 b	664.0 b	668.2
GA_3 at 20ppm + GA3 at 10ppm + CPPU at 2.5ppm	7.66 e	7.59 d	7.63	510.7 e	506.0 e	508.35
GA_3 at 20ppm + GA_3 at 10ppm + CPPU at 7.5ppm	9.08 c	9.03 bc	9.05	605.6 c	602.0 c	603.8
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 2.5ppm	11.08 a	10.94 a	11.01	739.0 a	729.0 a	734.0
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 7.5ppm	11.18 a	11.03 a	11.11	745.0 a	735.0 a	740.0
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm	8.38 d	8.25 cd	8.32	556.8 d	550.0 d	553.4
New L. S. D.	0.57	1.37		43.5	26.0	

2-Cluster dimension, compactness and rachis weight:

Data presented in Table (2) shows that all treatments increased cluster dimension compared with the control. However, the differences between the treatments were not significant during the season 1998.

Table (2): Effect of Sitofex (CPPU) and AG_3 on cluster dimension, compactness, and rachis weight of Thompson Seedless grapes during 1997 and 1998 seasons.

Treatments	Cluster dimension ratio L/D			Cluster compactness			Rachis weight (gm)		
	1997	1998	Mean	1997	1998	Mean	1997	1998	Mean
Control	1.20 e	1.3	1.25	5.35	5.40 a	5.38	12.3 d	13.0 c	12.65
GA_3 at 20ppm + CPPU at 2.5ppm	1.42 d	1.4	1.41	4.28	4.50 b	4.39	17.3 bc	18.0abc	17.65
GA_3 at 20ppm + CPPU at 7.5ppm	1.47 cd	1.6	1.54	4.27	4.30 bc	4.29	19.0 bc	20.0 ab	19.5
GA_3 at 20ppm + GA3 at 10ppm + CPPU at 2.5ppm	1.49bcd	1.6	1.55	3.38	3.80 cd	3.59	18.3 bc	19.0 ab	18.65
GA_3 at 20ppm + GA_3 at 10ppm + CPPU at 7.5ppm	1.50bc	1.6	1.55	3.89	4.00 bcd	3.95	20.0 ab	21.0 ab	20.5
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 2.5ppm	1.56ab	1.7	1.63	3.69	3.90 bcd	3.80	17.3 bc	18.0 abc	17.65
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 7.5ppm	1.47cd	1.6	1.54	3.32	3.50 d	3.41	22.0 a	28.0 a	25.00
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm	1.59 a	1.6	1.60	3.87	4.10 bcd	3.99	16.3 c	17.0 bc	16.65
New L. S. D.	0.07	N. S.		N. S.	0.6		2.7	5.0	

In regard to the effect of the treatments used on the cluster compactness, data in Table (2) indicated that untreated vines showed higher

values in bunch compactness than the all treatments used during the 1997 and 1998 seasons. This increment may be due to the increasing number of berries because this vines was not thinning with GA_3 1t 10ppm. Whereas, all practices used decreased the cluster compactness compared with the control. This is not astonishing since these treatments were thinning by spraying with GA_3 at 10ppm in full bloom.

Data in Table (2) also reveal that the rachis weight gave higher values for the all treatments used compared the control during the two seasons. Furthermore, the application of (CPPU) at 7.5ppm with GA_3 at 20, 10, and 40ppm gave the highest values in this respect than all treatments. These results were in lie with those obtained by Dokoozlian et al. (1994).

1- Berry weight and juice volume:

Data presented in Table (3) show that all treatments used significantly increased both of berry weight and juice volume more than the control in the two seasons. Moreover, Sitofex (CPPU) at 2.5 or 7.5ppm in combination with GA_3 at 20, 10, and 40ppm gave the highest values in this respect. The results of this study are also in agreement with previous studies, which reported that combined application of Sitofex (CPPU) and GA_3 had synergistic effect on berry growth of Thompson Seedless grapes (Neckell (1985), Dokoozlain (1994), Oswald (1994), and Retamales (1995)).

The increments in juice volume and berry weight which obtained in the treatments used in this study may be due to GA_3 might stimulate cell elongation through the hydrolysis of starch resulting from the production of GA_3 induced alpha amylase that might increase the concentration of sugar, thus raising the osmotic pressure in cell sap so that water enters the cell and lends to stretch it (Kogl and Elema (1960)).

Table (3): Effect of Sitofex (CPPU) and GA_3 on berry weight and juice volume of Thompson Seedless grapes during 1997 and 1998 seasons.

Treatments	Berry weight (gm)			Juice volume at 100 berries		
	1997	1998	Mean	1997	1998	Mean
Control	16.2 d	1.5 c	1.56	72.0 a	71.5 c	71.75
GA_3 at 20ppm + CPPU at 2.5ppm	2.24 c	2.0 bc	2.12	75.0 c	74.0 bc	74.50
GA_3 at 20ppm + CPPU at 7.5ppm	2.44 c	2.2 bc	2.32	75.0 c	74.5 bc	74.75
GA_3 at 20ppm + GA3 at 10ppm + CPPU at 2.5ppm	2.33 c	2.1 bc	2.22	76.1 c	75.5 bc	75.80
GA_3 at 20ppm + GA_3 at 10ppm + CPPU at 7.5ppm	2.83 b	2.7 ab	2.77	76.0 c	75.0 bc	75.5
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 2.5ppm	3.15 a	3.0 a	3.08	78.1 b	77.0 ab	77.55
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 7.5ppm	3.32 a	3.2 a	3.26	82.0 a	81.0 a	81.5
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm	2.81 b	2.5 ab	2.66	78.0 b	77.5 ab	77.75
New L. S. D.	0.22	0.7		1.5	4.0	

2- Berry length and diameter:

Data in Table (4) indicated that all Sitofex and GA_3 applications used significantly increased berry length and diameter than the untreated vines during the two seasons. Furthermore, Sitofex at 7.5ppm combined with GA_3 at 20, 10, and 40ppm produced the highest values for berry length and diameter compared with the other treatments.

The dimensions of berries treated with GA_3 alone gave the highest values compared with Sitofex at 2.5 or 7.5ppm + GA_3 at 20, 10, and 40ppm in the two seasons.

Our data are in harmony with those reported by Dokoozlian et al. (1994), Wolf et al. (1994), Retamales et al. (1995), and Rizk (1998). Also, our results are not astonishing since Sitofex stimulates preclinal berry growth resulting in proportionately greater increases in berry diameter than berry length. In contrast, GA_3 treatments stimulate anticline growth resulting I elongated berries.

Table (4): Effect of Sitofex (CPPU) and GA_3 on berry dimension of Thompson Seedless grapes during 1997 and 1998 seasons.

Treatments	Berry length (cm)			Berry diameter (cm)			Berry dimension		
	1997	1998	Mean	1997	1998	Mean	1997	1998	Mean
Control	1.13f	1.25b	1.19	1.00e	1.07 b	1.04	1.13	1.15b	1.14
GA_3 at 20ppm + CPPU at 2.5ppm	1.52e	1.50ab	1.51	1.18d	1.15ab	1.17	1.29	1.30ab	1.30
GA_3 at 20ppm + CPPU at 7.5ppm	1.68d	1.57ab	1.63	1.35bc	1.30ab	1.33	1.25	1.25ab	1.25
GA_3 at 20ppm + GA3 at 10ppm + CPPU at 2.5ppm	1.70d	1.65ab	1.68	1.28c	1.30ab	1.29	1.33	1.35ab	1.34
GA_3 at 20ppm + GA_3 at 10ppm + CPPU at 7.5ppm	1.83c	1.70ab	1.77	1.38ab	1.40ab	1.39	1.33	1.35ab	1.34
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 2.5ppm	1.88c	1.85a	1.87	1.30bc	1.35ab	1.33	1.45	1.50a	1.48
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 7.5ppm	2.12a	2.00a	2.06	1.47a	1.50a	1.49	1.44	1.45a	1.45
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm	1.98b	1.90a	1.94	1.35bc	1.40ab	1.38	1.47	1.52a	1.5
New L. S. D.	0.13	0.51		0.26	0.41		N. S.	0.29	

3- Total soluble solids, acidity, and T.S.S. acid ratio:

Concerning the effect on T.S.S., the data in Table (5) reveals that all treatments used significantly reduced T.S.S. imputed to Sitofex + GA_3 was more pronounced since this reduction reached about 16.8 and 15% compared with the control during the two seasons respectively.

Table (5): Effect of Sitofex (CPPU) and GA3 on T. S. S., acidity and T. S. S./acid ratio of Thompson Seedless grapes during 1997 and 1998 seasons.

Treatments	T. S. S.			Acidity			T. S. S./Acid ratio		
	1997	1998	Mean	1997	1998	Mean	1997	1998	Mean
Control	19.0a	18.0a	18.50	0.523	0.525	0.524	36.4a	34.3a	35.35
GA_3 at 20ppm + CPPU at 2.5ppm	18.7bc	16.7ab	18.15	0.525	0.533	0.529	35.7b	33.0ab	34.35
GA_3 at 20ppm + CPPU at 7.5ppm	18.5c	17.5ab	18.00	0.551	0.560	0.556	33.6c	31.3b	32.45
GA_3 at 20ppm + GA3 at 10ppm + CPPU at 2.5ppm	17.8d	16.7abc	17.25	0.575	0.585	0.580	31.0d	28.6c	29.8
GA_3 at 20ppm + GA_3 at 10ppm + CPPU at 7.5ppm	17.4d	16.5abc	16.95	0.600	0.575	0.588	29.1e	28.7c	28.9
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 2.5ppm	16.5e	15.5bc	16.00	0.713	0.700	0.707	23.2f	22.1d	22.65
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm +CPPU at 7.5ppm	15.8f	15.2c	15.5	0.787	0.777	0.782	20.1g	19.6e	19.85
GA_3 at 20ppm +GA_3 at 10ppm +GA_3 at 40ppm	16.8e	16.4abc	16.6	0.714	0.720	0.717	23.5f	22.8d	23.15
New L. S. D.	0.9	2.2		N. S.	N. S.		2.1	1.8	

Data presented in Table (5) also indicated that the effect of the treatments used on acidity took the opposite trend to those found with T.S.S.

Concerning the effect on T.S.S./acid ratio took similar trend to those noticed in case of T.S.S. these results were in line with those obtained by Nickell (1986), Dokoozlian at al. (1994), Retamale et al. (1995), and Rizk (1998).

From our study we can conclude that spraying Thompson Seedless grapes with Sitofex at 7.5ppm when the berry size reached about 7mm and GA_3 at 20ppm when the flower bunch length reached about 10cm +GA_3 at 10ppm at full bloom + GA_3 at 40ppm when berry size reached about 5mm produced a higher yield with better quality for berries.

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تـأثير السـيتوفكس وحمـض الجبريليـك علـى جـودة الثمـار والمحصـول فـي العنـب طومسون عديم البذور

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أدت جميـع المعـاملات بـالجبريللين والسـيتوفكس إلـى زيـادة ملحوظـة فـي المحصـول خـلال موسـمي الدراسـة. كمـا أدت المعاملـة بالسـيتوفكس سـواء 2.5 – 7.5 جزء/مليـون مـع جبـريللين 20 جزء/مليـون للاسـتطالة و 10 جزء/مليـون للخـف و 40 جزء/مليـون لزيـادة حجـم الحبـات إلـى زيـادة المحصـول عـن المعاملات الأخرى وهذه الزيادة وصلت إلى 92-94 % و 94-96 % بالترتيب عن الكرمات الغير معاملـة (الكنتـرول) خـلال الموسـمين. الكرمـات الغيـر معاملـة أظهـرت معامـل التـزاحم بصـورة واضـحة عـن بقيـة المعـاملات الأخـرى خـلال الموسـمين. بينمـا وصـل وزن Rachis لقيم عاليـة تحـت تـأثير المعـاملات عـن الكنترول. أدت جميع المعاملات إلى زيادة معنوية لكل من وزن الحبة وحجم العصير عن الكنترول وخصوصا المعاملة بالسيتوفكس بتركز 2.5 و 7.5 جزء/مليون مع الجبريللين بتركيزات 20و 10 و 40 جزء/مليون. كما أدت جميع المعاملات إلي زيادة طول الحبة وعرضها عن الكنترول خلال الموسمين. وجميع المعاملات عملت علي انخفاض معنوي في المول و المواد الصلبة الدائبة بالمقارنة بالكنترول خلال الموسمين ولكنها أعطت نتائج معاكسة للحموضة وكانت نسبة المواد الصلبة الذائبة إلي الحموضة تتمشى مع نتيجة المواد الصلبة الذائبة.