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Effect of berry Thinning, CPPU spraying and pinching on cluster and berry quality of two grapevine cultivars

Abdel-Fattah M.E. , K.A. Amen , Alaa.A.B. and Eman .A.A. Abo zeed
Hort. Dept. Fac. Agric, Assiut Univ., Egypt

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Abstract: This investigation was carried out at the Experimental orchard, Faculty of Agriculture, Assiut University, Egypt, to study the effect of CPPU spraying and pinching on cluster and berry traits of Roomy Red, as well as, effect of berry thinning and GA_3 application on cluster and berry traits of Ruby Seedless grapes during 2007 and 2008 seasons. The experiment was set up as complete randomized block (CRB) with four replicates, one vine per each. Pinching of both shoots and flower clusters as well as brushing and spraying solutions were performed at full bloom. The obtained results could be summarized as follow.

GA_3 at 1.5 or 3.0 ppm spraying, brushing flowers cluster or 1% Urea vine foliage spraying at full bloom significantly decreased the berries number, weight and compactness coefficient of clusters compared to untreated one.

All berry thinning reduced the berries number and increased the length of clusters, hence induce a pronounced decrease in compactness coefficient and produced losse clusters.

GA_3 at 1.5 to 3.0 ppm and Urea at 1% spraying and brushing the flowers cluster at full bloom significantly increased the berry weight, total soluble solids, reducing Sugars and anthocyanin in berry skin compared to untreated ones

On the other hand, CPPU spraying of shoots and flower clusters at full bloom significantly increased the berries number, weight and compactness coefficient of clusters compared to untreated ones. CPPU spraying at full bloom gave the highest there cluster traits compared to pinching ones.

CPPU spraying and pinching either shoots or flower clusters at full bloom significantly increased the berry weight and improved the chemical constituents of juice and skin anthocyanin of berries compared to untreated ones.

It could be concluded that, the best methods for berries thinning of Ruby Seedless grapevines that whether GA_3 at low concentration, 1.5-3 ppm or brushing the flower cluster at full

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bloom to overcome the adverse effects of GA_3 at high concentration. Furthermore, to overcome the unfavorable phenomenon's of Roomy Red grapevine clusters, must using either CPPU 2.5 to 5.0 ppm spraying or pinching the shoot tips alone or along with flower cluster tipping at full bloom

Introduction

The grape is considered as one of the most important fruit crops in the world. It grown extensively in Europe or in other regions all over the world, for being of an excellent flavor, nice taste and high nutritional value. In Egypt, it occupies the second position after citrus regarding the cultivated area and the magnitude of fruit production. The total cultivated area attained 153954 feddans with annual production of 1531368 tons. (According to the annual statistical of the Ministry of agriculture in 2008).Berry thinning has been used to obtain the needed loosened, large berries, highest berry weight and fastest ripening. Hand thinning plays an important role with some grape varieties since its control crop and improves its quality and hastens the ripening (Dhillon *et al.*, 1992, Fitzgerald, J. and W.K. Patterson, 1994 and Palliotti and Cartechini, 1998). Plant growth substances play a major role in plant growth and development. GA_3 still used to increase berry size and for thinning bunch berries in seedless cultivars (Orth, 1990, Colapietra *et al.*, 1995 and Selim, 2007). The thinning necessary depended on the cultivar as well as sunshine, temperature and nutrient supply (Poni, 2003).Using the brushing of the flower at full bloom was the optimal tool for reducing the berry set (Omran et. al.,2005).

The reduction of berry set in Roomy Red cv., produced loose clusters accompanied by a reduction in berry number and shot berries is the main important problem, whereas, the clusters become unfavorable from consumer point of view. One of the main reasons for these problems is excessive vegetative growth resultant from the un-balance existed between various nutrients that resulted from heavy application of some of them. Vine vigor may be accommodating canopy modification or can be controlled through summer hedging (Reynolds, 1988). Using shoot tipping at pre-bloom on Roomy Red grapevines caused significant increases in fruit set and cluster weight (Mohamed, 1999, Seleem, Bassma, 2001 and Omran *et al.*, 2004).

CPPU exhibits cytokinin-like properties when applied to plants has significant physiological activity on many fruits, including grapes. The primary physiological effects of CPPU on grapevines involve the regulation of fruit set, berry growth and development. CPPU can be used

without any health or environmental hazards (Nickell,1985 and Dokoozlian *et al.*, 1994, Abdul et al.,1998 and Sourial et al.,2004).

So, this study aimed to recognize the benefit of using CPPU and pinching as a tool to overcome the production problem in Roomy Red grapevine cultivar, as well as, study the effect of berry thinning on yield and berry quality of Ruby Seedless cultivar.

Materials and Methods

This study was carried out during two successive seasons of 2007 and 2008 on two cultivars of *Vitis vinifera* L., i.e. Ruby Seedless and Roomy Red. Ruby Seedless grapevines were 16-year old spaced at 2x2.5 m, while, Roomy Red were 7-years-old, spaced at 2x2.5 m. All vines grown in experimental vineyard of the Faculty of Agriculture, Assiut University, where the soil is clay and well drained.

The chosen vines were received the usual agriculture practices that are used in the vineyard including soil fertilization, irrigation and pest control, The vines were trained according to the head training system and pruned during the second week of January. Head pruning system was applied by leaving total bud load of 39 and 30 buds per Ruby Seedless and Roomy Red grapevines (13 & 10 fruiting spurs x 3 buds plus 5 replacement spurs x 2 buds/vine), respectively.

The chosen vines of Ruby Seedless and Roomy Red cultivars were divided into five different thinning treatments and six sitofex (CPPU) and pinching treatments including the control for each cultivar, respectively. The experiment was arranged in complete randomized block design with four replications per treatment, one vine each. Thus the thinning treatments on Ruby Seedless grapevines were as follow:

1- GA_3 1.5 ppm sprayed at full bloom (70% of the flower caps dropped).
2- GA_3 3.0 ppm sprayed at full bloom.
3- Vine foliage spraying with 1% urea (V/V) at full bloom.
4- Burshing the clusters at full bloom with bursh.
5- Control (untreated vines).

As well as the different treatments on Roomy Red grapevines were as follow:

1- Spraying CPPU at 2.5 ppm.
2- Spraying CPPU at 5.0 ppm.
3- Removing about 25% of shoot length (pinching 25% of shoot top).
4- Removing about 25% of the apical portion clusters.
5- Pinching 20% of shoot top plus removing 20% of the apical portion cluster.
6- Control (untreated vines).

Spraying GA_3 and CPPU as well as urea solutions were prepared by dissolving the assigned amount in the required water. The flower clusters received spraying solution with triton B as wetting agent at concentration of 0.1% till runoff using a hand held spray wand. Pinching of shoot and flower cluster as well as bursbing and spraying solutions were performed at full blooming. All vines including the check ones received the ordinary management practices usually applied in the vineyard.

At harvest time, when color development accumulated in 80% Ruby seedless and Roomy Red cvs. Three clusters were taken at random from each replicate to determine the following characters.

Average weight of cluster (g), cluster length (cm), and number of berries per cluster ,as well as, cluster compactness coefficient according to Winkler *et al.* (1974).

In addition, berry quality in terms of berry weight TSS, total acidity and reducing sugars % according to A.O.A.C. (1985) as well as total anthocyanin according to Marrkham (1982).

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

Results

1- Effect of fruit thinning, CPPU and topping of shoots and flower clusters on cluster traits:

It is clear from data in Table (1) that Using whether 1.5-3.0 ppm GA_3 spraying, brushing flowers cluster or 1% urea vine foliage spraying at full bloom significantly decreased the berries number per Ruby Seedless cluster and consequently significantly decreased the cluster weight compared to untreated ones. GA_3 spraying suppressed either the urea spraying or flowers cluster brushing in reduction the berries number per cluster. The decrement percentage of berries number per cluster was attained (29.56, 28.99, 26.82 and 27.56% av. two seasons), due to1.5 and 3.0 GA_3 ppm,, 1% urea and brushing respectively. GA_3 and urea spraying significantly increased the length of clusters, whereas, brushing had insignificant effect on such traits compared to untreated ones. Using either GA_3, urea spraying or flowers cluster brushing significantly decreased the cluster compactness coefficient. The corresponding decreasing percentage of cluster compactness coefficient was (35.16, 36.72, 33.07 and 28.78% av. the two seasons), respectively.

GA_3 spraying was most effective in decreasing the berries number and increasing the length of cluster, hence induce a decreasing in cluster compactness coefficient compared to either other berry thinning treatments or unthinning ones. Therefore, it can be concluded that all berry thinning treatments reduced the berries number and increased the length of clusters. These effects induce a pronounced decrease in compactness coefficient and produced losse clusters.

Data in Table (2) showed that CPPU spraying and pinching of shoots and flower clusters at full bloom of Roomy Red grapevines significantly increased the berries number and cluster weight. CPPU spraying at full bloom characterized by giving the highest berries number compared to pinching ones. The increment percentage of berries number per cluster was (28.05, 26.82, 23.79, 18.07 and 19.29% av. the two seasons) due to CPPU spraying at 2.5 ppm or 5.0 ppm , shoot pinching, flower cluster pinching and pinching shoot plus flower cluster compared to control, respectively. In addition, pinching of flower cluster significantly decreased the cluster length, hence, all treatments significantly increased the clusters compactness coefficient compared to untreated ones. The corresponding increment percentage of cluster compactness coefficient attained (12.63, 8.59, 24.74, 55.05 and 46.96% av. the two seasons), respectively. Therefore, CPPU at 2.5 ppm or 5.0 ppm spraying as well as either shoots or flower clusters pinching at full bloom gave optimum cluster characteristics of Roomy Red cultivar.

Table (1): Effect of thinning treatments on cluster traits of "Ruby Seedless" grapes during 2007 and 2008 seasons .

Treatment	Cluster weight (g)		Number of berries/cluster		Cluster length (cm)		Compactness Coefficient	
	2007	2008	2007	2008	2007	2008	2007	2008
Control	372.80	338.00	190.20	178.56	24.67	23.80	7.89	7.46
GA_3 1.5 ppm	314.33	290.10	133.50	126.20	26.30	25.80	5.08	4.88
GA_3 3 ppm	330.40	286.80	138.00	123.80	27.30	26.50	5.05	4.67
Urea (1%)	293.50	278.50	140.30	129.50	26.50	26.00	5.29	4.98
Brushing	308.50	290.40	138.50	128.60	24.50	24.30	5.65	5.29
L.S.D 5%	**18.32**	**15.44**	**15.65**	**13.10**	**1.45**	**1.81**	**0.68**	**0.46**

Table (2): Effect of CPPU and pinching on cluster traits of "Roomy Red" grapes during 2007 and 2008 seasons.

Treatment	Cluster weight (g)		Number of berries/cluster		Cluster Length (cm)		Compactness coefficient	
	2007	2008	2007	2008	2007	2008	2007	2008
Control	335.80	324.80	59.11	61.10	31.20	30.30	1.92	2.04
CPPU2.5 ppm	414.00	408.50	76.80	79.70	32.33	33.33	2.22	2.24
CPPU 5 ppm	420.30	435.00	74.70	80.30	33.33	34.00	2.09	2.21
Pinshing 25 %	400.00	416.90	72.30	73.00	28.50	30.35	2.53	2.40
Remove 25 %	389.00	398.60	70.30	71.00	23.50	22.50	2.99	3.15
Rem. 20% of shoot and cluster	398.50	412.40	70.50	72.30	24.80	24.33	2.84	2.97
L.S.D 5%	21.55	18.27	5.50	6.54	1.53	1.27	0.15	0.11

2- Effect on berry quality:

According to Table (3) GA_3 and urea spraying as well as brushing the flowers cluster at full bloom significantly improved the Ruby Seedless grapes quality in terms of the berry weight, total soluble solids, reducing sugars, and anthocyanin in berry skin compared to untreated ones. The increment percentage of anthocyanin in Ruby Seedless berry skin was (53.64, 53.64, 67.19 and 88.54% av. the two seasons), due to either GA_3 at 1.5 ppm, 3.0 ppm, 1% urea or brushing flowers cluster at full bloom, respectively compered to control. Brushing flowers cluster at full bloom gave the best chemical juice quality compared to GA_3 or urea spraying. GA_3 at 1.5 to 3,0 ppm was the beneficial concentration to berry thinning in Ruby Seedless grapes. In addition, using either 1% urea vine foliage or flowers cluster brushing at full bloom as berry thinning could be used as tool instead of GA_3 to overcome the adverse effects due to GA_3 in grape production i.e., delaying the berry ripening and reducing full coloration, especially with color cultivars.

Moreover, Table (4) cleared that CPPU spraying either 2.5 or 5.0 ppm, pinching 25% of shoots or 25% of flower clusters only, or pinching both of 20% shoots and 20% of flower clusters at full bloom were significantly effective in increasing weight of the berry as compared two untreated ones. The increases in berry weight are targeted by grape producers to increase the packable yield, furthermore improving the cluster phenomenons of Roomy Red cultivar.

Furthermore, CPPU spraying and pinching either shoots or flower clusters at full bloom were significantly improved the berry chemical quality in terms of improving the chemical constituents of berry juice and anthocyanin in berry skin compared to untreated ones. The increment percentage of anthocyanin in Roomy Red berry skin attained (82.54, 87.83, 120.63, 131.75 and 149.21% av. the two seasons), due to CPPU spraying 2.5 or 5.0 ppm , shoot pinching, flower cluster pinching and pinching shoot plus flower cluster, respectively

Table (3): Effect of thinning treatments on 10 berries weight (g) and some chemical constituents of "Ruby Seedless" grapes berries during 2007 and 2008 seasons.

Treatment	10 berries weight (g)		TSS%		Acidity %		Reducing sugars %		Anthocyanin mg/g	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Control	18.00	18.15	16.20	16.60	0.33	0.38	12.80	12.60	1.96	1.88
GA_3 1.5 ppm	22.80	22.35	18.00	18.50	0.33	0.35	13.78	13.50	2.85	2.05
GA_3 3 ppm	23.10	22.60	17.70	18.10	0.28	0.28	13.52	13.72	2.93	2.96
Urea (1%)	20.53	21.31	17.50	17.80	0.28	0.30	13.68	14.06	3.25	3.16
Brushing	21.65	22.45	17.30	18.00	0.25	0.29	14.25	13.80	3.56	3.68
L.S.D 5%	**2.26**	**2.58**	**0.93**	**1.13**	**0.07**	**0.06**	**0.72**	**0.91**	**0.17**	**0.13**

Table (4): Effect of CPPU and pinching on 10 berries weight (g) and some chemical constituents of "Roomy Red" grapes berries during 2007 and 2008 seasons.

Treatment	10 berries weight (g)		TSS%		Acidity %		Reducing sugars %		Anthocyanin mg/g	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Control	52.75	50.35	16.20	16.50	0.45	0.48	11.36	11.78	0.61	0.65
CPPU 2.5ppm	55.95	54.00	15.85	16.30	0.43	0.44	11.15	11.80	1.13	1.18
CPPU 5 ppm	56.12	55.20	16.00	16.00	0.41	0.45	11.30	12.06	1.09	0.93
Benching 25 %	55.20	53.40	16.80	17.00	0.38	0.41	12.65	12.88	1.36	1.42
Remove 25 %	55.30	53.82	17.00	17.50	0.36	0.40	12.80	13.15	1.43	1.48
Remove 20 %	56.83	55.30	17.60	17.33	0.37	0.42	13.20	13.28	1.51	1.63
L.S.D 5%	**2.29**	**2.68**	**0.93**	**0.88**	**0.02**	**0.03**	**1.23**	**1.05**	**0.14**	**0.12**

DISCUSSION and Conclusion

GA_3 spraying at full bloom decreased berry set since its role in flower dropping, causing reduction of berries number of clusters. As well as the positive action of urea as nitrogen source and producing new tissues that enhancing the 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. Whereas, the reduction effect of brushing could be due to its role in dropping the flower and shot berries.

In addition, reducing the berries number per cluster without changing the number of leaves, which reduce the competition between the berries on essential materials. As well as, 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 berry weight. So, it can be concluded that the berry thinning treatments were able on carbohydrates accumulation, which activate the process of growth and development, hence increased the berry weight and hastened ripening. These surely reflected on advancing the berry ripening and improving its quality in terms of increasing sugars and anthocyanin contents as well as total soluble solids and decreasing total acidity.

Therefore, one can concluded that berries thinning must be done to improve the clusters and berries attributes of Ruby Seedless grapes. In addition, the best methods that either GA_3 at low concentration i.e. 1.5-3 ppm or brushing the flowers cluster at full bloom (70% of the flower caps dropped) to overcome the adverse effects of GA_3 using at high concentration, in grape production, i.e. delay the berry ripening and reduce the full coloration.

The results are in line with those obtained by number of research workers such as Hifny *et al.* (1980), Kushal *et al.* (1985), Ezzahouani *et al.* (1985), Orth (1990), Dokoozlian and Peacock (2001), El-Akkad (2004), Selim (2007) and Ahmed, Ebtsam (2007). They revealed that GA_3 sprayed at full bloom in different grapevine cultivars gave a good thinning effect, since it decreased the berry set percentage compared to unsparyed ones (control). In addition, Omran *et al.* (2005) stated that using brush at full bloom was the optimal fruit thinning treatment of Perlette Seedless grapes.

On the other hand, CPPU increased berry set and berry weigh due to its role as cytokinin, where CPPU exhibits cytokinin-like properties when applied to plants. In addition,

pinching increased berry set indirectly by suppression shoot growth at time of berry set shifted the balance of competition between vegetative growth and reproductive organs in favor of the latter. In addition, flower clusters pinching reduces the competition between flowers and consequently improved the berry set.

The promotion effect of CPPU on berries number and cluster weight was emphasized by Retamales *et al.* (1993), Lion *et al.* (1999), Omer and El-Morsy (2000), Ranpise *et al.* (2000), El-Hammady *et al.* (2000), El-Morsey (2001), Fawzi and Hafez, Omaima (2004), Abdel-Aal *et al.* (2005) and Hussein, Maha (2008). Moreaver, Sourial *et al.* (2004) found that the greatest cluster weight of Roomy Red grape came from spraying sitofex 5 ppm at fruit set, whereas, the greatest number of berries per cluster came due to spraying sitofex 5 ppm at full bloom. All sitofex spraying increased the berries number per cluster and cluster weight.

The beneficial of pinching on berries number and cluster weight as well as cluster traits was reported by Wolf *et al.* (1990), Abdel-Ghany (1995), Mohamed (1999), Seleem, Bassma (2001) and Omran *et al.* (2004).

Therefore, it could be concluded that berries thinning must be done to improve the cluster and berries attributes of Ruby Seedless grapes. In addition, the best methods that either GA_3 at low concentration, 2-3 ppm or brushing the flowers cluster at full bloom more effective to overcome the adverse effects of using GA_3 at high concentration, i.e. delay the berry ripening and reduce full coloration.

Furthermore, spraying either CPPU at 2.5 to 5.0 ppm or pinching the shoot tips alone or along with flower cluster tipping at full bloom of Roomy Red grapevines to overcome the unfavorable characteristics of its clusters, where produce compact clusters with best presentation shape, quality and color of berries.

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تأثير خف الحبات ورش السيتوفكس والتطويش على خصائص العناقيد والحبات فى صنفين من أصناف العنب

عبد الفتاح مصطفى الصالحى, كاميليا ابراهيم احمد أمين, علاء عبد الجابر بدوى
مسعود, ايمان عبد الحكيم عبدالله ابوزيد
قسم البساتين- كلية الزراعة – جامعة أسيوط – جمهورية مصر العربية

أجريت هذة الدراسة بمزرعة كلية الزراعة – جامعة اسيوط – مصر. بغرض دراسة تأثير رش السيتوفكس (cppu) والتطويش على خواص العناقيد والحبات للعنب الرومى الاحمر وكذلك تأثير خف الحبات على خواص العناقيد والحبات للعنب الروبى عديم البذور خلال موسمى ٢٠٠٧-٢٠٠٨م حيث تم إجراء معاملات الرش والتطويش وخف الحبات أثناء اكتمال التزهير .

وقد اظهرت النتائج ما يلى :

- سبب رش النورات الزهرية بحمض الجبريليك بتركيز ١,٥ – ٣ جزء فى المليون اوتمشيطها بالفرشاة اورش النمو الخضرى باليوريا بتركيز ١% أثناء إكتمال التزهير نقص جوهرى فى كل من عدد حبات و وزن ومعامل تزاحم عناقيد العنب الروبى عديم البذور مقارنة بعناقيد الشجيرات التى لم تعامل .
- أدت جميع معاملات خف الحبات السابقة الى تقليل عدد الحبات وزيادة طول العناقيد وبالتالى نقص معامل تزاحم الحبات وأعطت عناقيد قليلة التزاحم .
- سببت معاملات رش حمض الجبريليك واليوريا او التمشيط زيادة معنوية فى وزن الحبات وتحسين تلوين الحبات ومحتوى عصيرها من المواد الصلبة الذائبة والسكريات .
- وعلى الجانب الآخر أظهر رش السيتوفكس (cppu) أو تطويش الآفرخ أو النورات الزهرية أثناء إكتمال التزهير(٧٠ % تساقط القلنسوة) زيادة معنوية فى عدد حبات ووزن ومعامل تزاحم عناقيد العنب الرومى الأحمر مقارنة بعناقيد الشجيرات الغير معاملة .
- إعطى رش السيتوفكس أعلى قيم لخواص العناقيد من حيث الوزن وعدد الحبات والطول مقارنة بمعاملة التطويش .
- سبب رش السيتوفكس او تطويش الآفرخ او النورات الزهرية زيادة معنوية فى وزن الحبات وتحسين تلوين الحبات ومحتوى عصيرها من المواد الصلبة الذائبة والسكريات .
- من نتائج هذة الدراسة يتضح أن أفضل وسيلة لخف حبات العنب الروبى عديم البذور هى رش حمض الجبريليك بتركيز ١,٥-٣ جزء فى المليون او تمشيط النورات الزهرية أثناء إكتمال التزهير وذلك للتغلب على التأثيرات السلبية لإستخدام تركيز مرتفع من حمض الجبريليك – كذلك للتغلب على شلشلة عناقيد العنب الرومى الأحمر يجب رش السيتوفكس بتركيز ٢,٥ – ٥ جزء فى المليون او تطويش ٢٥% من الافرخ او النورات الزهرية فردياً او ٢٠% من كليهما اثناء اكتمال التزهير.