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ORIGINAL ARTICLES

Effect of spraying Lemongrass extract at full bloom on yield and fruit quality of 'Flame seedless' grape.

[1]A.S.E. Abd-Allah, [2]E. Abd El-Razek, [3]Mona A. Abdalla and [2]M.M.S. Saleh

[1]Horticulture Crops & Technology Department and [2]Pomology Department, National Research Center, El-Tahrir St., Dokki, Cairo, Egypt.
[3]Medical & Aromatic Plants Department, Horticulture Research Institute, Agricultural Research Centre, Giza, Egypt.

ABSTRACT

Lemongrass extract was examined for reducing the excessive fruit set and to improve yield and fruit quality of 'Flame seedless' grapevines (*Vitis vinifera* L.) by spraying the extract at 0.25 or 0.50 % comparing with GA_3 at 5 ppm at full bloom. A relation could be noticed between reducing number of berries per cluster as well as cluster compactness and increasing berry diameter and berry weight, since spraying lemongrass extract at both concentrations at full bloom had the same effect of GA_3 on reducing the number of berries per cluster and cluster compactness which enhanced berry diameter and weight that reflected on increasing the cluster weight and improved the berry red color than the control, while these treatments didn't influence cluster dimensions (length and width), T.S.S. and acidity in the berries. However, the spraying lemongrass extract at 0.50 % had a clear trend on increasing cluster weight than the control. The obtained results proved a good chance to replace lemongrass extract instead of the synthetic chemical products of GA_3 at full bloom to reduce the excessive fruit set for improving yield and fruit quality of 'Flame seedless' grapes. In this respect, the application of lemongrass extract at 0.50% is recommended.

***Key words*:** Lemongrass extract – Flame seedless grapes - Yield - Fruit quality.

Introduction

Grapes are considered as one of the most important fruits in worldwide. In 2011, the harvested area in Egypt reached approximately 64835 ha which produced about 1320800 tons (FAO-STAT). 'Flame seedless' is a popular table grape cultivar that recently introduced in Egypt and consider as a promising variety because its qualities for local market and export (Hegazi and Sallam, 2003). However, excessive fruit set can reduce the quality of 'Flame seedless' table grapes, resulting in compact, tightly filled clusters with small berries that are prone to bunch rot at harvest. Bloom sprays for 'Flame seedless' grapes increase berry weight but have little effect on berry shape. Therefore, spraying GA_3 at different concentrations on seedless grape cultivars once or twice at full bloom or berry set increased cluster weight, berry weight and the yield per vine (Maximos *et al.*, 1975, Saad *et al.*, 1981, Wassel, 1984, Dokoozlian and Peacock, 2001).

However, the use of natural products in horticultural practices instead of other synthetic chemical products is becoming a main target for many fruit crop producers, where, the world market has been growing rapidly in recent years for organic fruit production (Dimitri and Oberholtzer, 2006). In this study, lemongrass extract was suggested for using instead of the synthetic chemical products of GA_3 at full bloom to reduce excessive fruit set which affect productivity and fruit quality of 'Flame seedless' grapes.

Lemongrass (*Cymbopogon citratus* L.) is an aromatic herb and mainly grown as an ornamental plant. Its leaves and stem are used to extract oil by the hydro-distillation method that produces a yellow color oil contains the following compounds: (1) Geranial (41.67 %) 'Citral A'. (2) Neral (40.33%) 'Citral B'. (3) Myrcene (9.99%). (4) Borneol (1.62%). (5) Methyl-2, 4-decadienoate (1.28%). (6) Geranyl acetate (0.95%) (Masamba *et al.*, 2003). It is known that oil of lemongrass is one of the most important essential oil-bearing herbaceous species of the *Gramineae* because of its high citral content (up to at least 75% of the oil) (Jayasinha, 1999). Furthermore, lemongrass contains terpenes, alcohols, ketones, aldehyde, esters and flavonoids (luteolin, isoorientin 2'-O-rhamnoside, quercetin, kaempferol and apiginin) (Shah *et al.*, 2011).

Recently, bioactive studies have shown that the various components of this essential oil contain antimicrobial, antifungal, antibacterial and mosquito repellent properties (Schaneberg and Khan, 2002). However, lemongrass has many other uses as: (1) It's used in herbal tea because of its sharp lemon flavor. (2) Also, it's used in the perfumery and soap industries. (3) Moreover, it's used in the manufacture of synthetic

Corresponding Author: E. Abd El-Razek, Horticulture Crops & Technology Department.
E-mail :emad71_9@yahoo.com

vitamin A and in the medicine to treat various health ailments, including acne, athlete's foot, flatulence, muscle aches and scabies (Masamba *et al.*, 2003, Abbas and El-Saeid, 2012).

Oil was used as photosynthetic inhibition as a mode of action either alone or in combination with other thinners to induce flower and fruit abscission (Byers *et al.*, 1990). Generally, lemongrass extract contains up to 75% oil. In this respect, this investigation aims to study the effect of lemongrass extract instead of the synthetic chemical products of GA_3 at full bloom for reducing excessive fruit set which can improve yield and fruit quality of 'Flame seedless' grapes.

Materials and Methods

Plant materials and vineyard site:

The present study was conducted in 2010 & 2011 seasons on ten years old own-rooted 'Flame seedless' grapevines (*Vitis vinifera* L.) grown in a commercial vineyard located at Cairo-Alexandria desert road, Egypt. The vines were planted in a sandy soil under drip irrigation system, spaced at 1.5 x 3 m, trained to quadrilateral cordon, spur pruned, supported by Gable trellis.

Treatments and experimental design:

The vines were treated at full bloom with four treatments: (1) Spraying lemongrass extract at 0.25 %. (2) Spraying lemongrass extract at 0.50 %. (3) Spraying GA_3 at 5 ppm. (4) Vines without spray (control).

The essential oil of lemongrass (*Cymbopogon citratus* L.) extract extracted by steam distillation and emulated in water at 0.25 or 0.50 % as described by Abd El-Kader *et al.*, 2006. All experimental vines sprayed with GA_3 at 15 ppm when clusters length reach about 8 to 10 cm for cluster lengthening and sprayed also with GA_3 at 30 ppm when berry size reached about 6-8 mm and after one weeks later for berry sizing. The vines of this experiment were arranged in randomized complete block design (RCBD) and the treatments were done with three replicates (1 replicate = 3 vines).

Fruit Physical and chemical properties:

Four clusters were taken at random from each vine. The harvested clusters were weighed and average cluster weight was recorded. Cluster length and width as well as total berry numbers per cluster and average weight of 100 berries were recorded. Also, cluster compactness (No. of berries per cluster / cluster length) was calculated. Fifty berries were randomly sampled and berry quality attributes, including total soluble solids percentage (TSS %) was determined with a hand-held refractometer and titratable acidity as tartaric acid equivalent was determined by titration with 0.1 N Na OH (A. O. A. C., 1990). The red berry color was estimated according to the degree among 1 to 5.

Statistical analysis:

Data were analyzed by analysis of variance (ANOVA), and means were compared using Duncan's test at $p < 0.05$ to determine the significance of differences between the conducted treatments (Duncan, 1955).

Results and Discussion

Table (1) shows the effect of spraying lemongrass extract at 0.25 or 0.50 and GA_3 at full bloom on berry dimensions, weight and number of berries per cluster of 'Flame seedless' grape during the two studied seasons. It's clear from the obtained results that all treatments didn't affect the berry length, while, they affected berry diameter in the second season only and weight which were higher with lemongrass extract application at especially 0.50 % than the other treatments including the control.

On the other hand, all spraying materials had a positive effect on reducing number of berries per cluster than the control (T4) especially in the second season. Generally, application of lemongrass extract at 0.25 & 0.50 % had the same effect of GA_3 on reducing the number of berries per cluster which improved berry diameter and weight.

Data in Table (2) present the effect of spraying lemongrass extract and GA_3 at full bloom on cluster characteristics of 'Flame seedless' grape. The results show that, all treatments didn't influence cluster dimensions (length and width) in both studied seasons. On the other side, cluster weight was increased by the applying lemongrass extract at 0.50% (T1) and GA_3 (T3). This consist trend was observed during the two studied seasons. Regarding cluster compactness, all treatments reduced this parameter than the control. This was noticed in both studied seasons. Results show that the reducing of cluster compactness was due to the effect of

lemongrass in both concentrations as well as GA_3 (T3) on reduction number of berries per cluster. Generally, the application of lemongrass extract at 0.25 & 0.50 % had the same effect of GA_3 on reducing the cluster compactness but lemongrass extract at 0.50% increased cluster weight than the control.

From the above results, a relation could be noticed between reducing the number of berries per cluster as well as cluster compactness and increasing the berry diameter and berry weight (weight of 100 berries). This could be explained the increment of berry diameter and weight as a result for spraying lemongrass at both concentrations and GA_3 treatments which reflected on cluster weight. However, the application of lemongrass at 0.50 % increased cluster weight and gave the highest value comparing with the untreated vines. This trend was significant in the second season only. Therefore, the lemongrass extract application at 0.50 % at full bloom is recommended.

These findings are in agreement with Qadir *et al.* (1989) who mentioned that the cluster weight and berry weight of 'Flame seedless' grapes were significantly increased after the vines sprayed with GA_3 at bloom and fruit setting. Moreover, spraying GA_3 on the other seedless grape cultivars at full bloom increased cluster weight, berry weight and the yield per vine (Maximos *et al.*, 1975 and Saad *et al.*, 1981 on 'Thompson seedless', Wassel, 1984 on 'White Banaty seedless', Dokoozlian and Peacock, 2001 on 'Crimson seedless'), since the application of gibberellic acid (GA_3) during bloom reduces the fruit set of seedless table grape cultivars (Christodoulou *et al.*, 1968, Lynn and Jensen, 1966, Weaver and Pool,1971).

Table (3) clear the effect of full bloom spraying with lemongrass extract and GA_3 on total soluble solids (T.S.S), acidity and degree of berry color of 'Flame seedless' grapes during the two seasons. In this respect, spraying GA_3 (T3) had a significant effect on T.S.S comparing with all other treatments in the first season only. Furthermore, no significant effect was detected in the second season although lemongrass extract at 0.25 % tended to increase TSS than the other treatments.

Regarding the acidity of berries, there was no constant trend for the treatments. In the first season, control (T4) had the highest value followed by lemongrass extract in the both concentration, whereas spraying GA_3 recorded the lowest value. In the second season, spraying lemongrass extract at 0.25 had higher value compared with the control.

Concerning the degree of the berry red color, it was affected by different spraying materials and it had constant significant value in both studied seasons, since, GA_3 (T3) was the highest degree followed by lemongrass extract at both concentrations compared with the control (T4).

This result is in parallel with those of Qadir *et al.* (1989) on 'Flame seedless', Dokoozlian and Peacock (2001) on 'Crimson seedless', Saad *et al.* (1981) on 'Thompson seedless', Wassel *et al.* (2007) on 'White Banaty seedless' who reported that spraying GA_3 at full bloom had no effect on T.S.S. and acidity of berries.

To explain the mode of action for using lemongrass extract at full bloom which contains about 75-82 % oil, Jayasinha (1999) and Masamba *et al.*(2003), Byers *et al.* (1990) confirmed that oil was used as photosynthetic inhibitor as a mode of action alone or in combination with the other thinners to induce flower and fruit abscission.

The above mentioned results show a good chance to replace lemongrass extract instead of the synthetic chemical products of GA_3 at full bloom to reduce the excessive fruit set, consequently improving yield and fruit quality of 'Flame seedless' grapes. This result in parallel with that of Dimitri and Oberholtzer (2006) who confirmed that using a natural product in horticultural practices instead of chemical products is recommended because it is considered a main target for many fruit crop producers, where, the world market has been growing rapidly in recent years for organic fruit production.

Conclosion:

Spraying lemongrass extract at 0.25 % or 0.50 % at full bloom shows the same effect of GA_3 on reducing the number of berries per cluster and cluster compactness which improve berry diameter and weight that reflected on increasing the cluster weight and improved the berry red color than the control, while these treatments didn't influence cluster dimensions (length and width), T.S.S. and acidity in the berries. A relation could be noticed between reducing number of berries per cluster as well as cluster compactness and increasing berry diameter and berry weight. However, the spraying lemongrass extract at 0.50 % had a clear trend on increasing cluster weight than the control.

The obtained results show a good chance to replace lemongrass extract instead of the synthetic chemical products of GA_3 at full bloom to reduce the excessive fruit set for improving yield and fruit quality of 'Flame seedless' grapes. In this respect, the application of lemongrass extract at 0.50% seems to be the promising treatment under this experiment conditions.

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Table 1: Effect of spraying lemongrass extract at full bloom on berry dimensions, weight and number of berries per cluster of 'Flame seedless' grape during the two studied seasons.

Treatments	Berry length (cm)		Berry diameter (cm)		Weight of 100 berries (g)		No. of berry /cluster	
	First Season	Second season	First Season	Second Season	First Season	Second Season	First season	Second season
T1= LG 0.50 %	2.0 a	2.1 a	2.2 a	2.0 ab	414 a	378 a	193 b	189 b
T2= LG 0.25 %	2.0 a	1.9 a	2.2 a	1.9 b	402 a	389 a	187 b	178 b
T3= GA_3 5 ppm	2.6 a	2.0 a	2.2 a	2.1 a	345 ab	383 a	207 ab	180 b
T4= Control	2.0 a	1.9 a	1.8 a	1.5 c	281 b	294 b	250 a	224 a

Means within a column followed by different letter (s) are statistically differ at 5 % level.
LG = Lemongrass

Table 2: Effect of spraying lemongrass extract at full bloom on cluster characteristics of 'Flame seedless' grape during the two studied seasons.

Treatments	Cluster length (cm)		Cluster width (cm)		Cluster weight (g)		Cluster compactness (No. of berries/ cluster length)	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season
T1= LG 0.50 %	22.6 a	22.3 a	17.6 a	17.6 a	797 a	795 a	8.5 b	8.6 b
T2= LG 0.25 %	22.0 a	21.3 a	18.6 a	18.6 a	706 bc	699 ab	9.0 b	8.2 b
T3= GA_3 5 ppm	23.6 a	21.6 a	17.6 a	17.6 a	769 ab	774 a	8.7 b	8.3 b
T4= Control	19.3 a	20.0 a	17.3 a	18.6 a	695 c	670 b	10.0 a	11.1 a

Means within a column followed by different letter (s) are statistically differ at 5 % level.
LG = Lemongrass

Table 3: Effect of spraying lemongrass extract at full bloom on total soluble solids (T.S.S), acidity and degree of berry color of 'Flame seedless' grape during the two studied seasons.

Treatments	T.S.S (%)		Acidity (%)		Degree of color	
	First season	Second season	First season	Second season	First Season	Second Season
T1= LG 0.50 %	16.2 b	16.6 a	0.77 b	0.77 ab	3.3 b	3.0 b
T2= LG 0.25 %	16.1 b	17.0 a	0.75 b	0.79 a	3.0 b	3.0 b
T3= GA_3 5 ppm	18.2 a	16.4 a	0.68 c	0.78 ab	4.0 a	4.0 a
T4= Control	15.4 b	16.5 a	0.84 a	0.73 b	1.0 c	1.0 c

Means within a column followed by different letter (s) are statistically differ at 5 % level.
LG = Lemongrass

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