Assiut J. Agric. Sci., (47) No. (6-1) 2016 (173-180) *ISSN: 1110-0486*
Website: http://www.aun.edu.eg/faculty_agriculture *E-mail: ajas@aun.edu.eg*

Effect of GA_3 and Lemongrass Oil Spraying on Fruiting of Ruby Seedless Grapevines

Fatma El-Zahraa M. Gouda
Pomology Department, Fac. Agric, Assiut University

Received on: 13/12/2016 **Accepted for publication on:** 31/12/2016

Abstract

This investigation was conducted during the two successive seasons of 2015 and 2016 at the Experimental Orchard Faculty of Agriculture, Assiut University, Egypt, to compare the effects of GA_3 and lemongrass oil spraying on fruiting of Ruby Seedless grapevines.

GA_3 spraying was applied twice, once at 5 or 7.5 ppm at full bloom and the second, 30 ppm when the berry size about 5-6 mm, whereas, lemongrass oil spraying was applied at 0.5, 1 or 1.5% at the same previous dates.

The results obtained could be summarized under the following main points: lemongrass oil twice spraying significantly decreased the berry set percentage, cluster weight and yield/vine and consequently significantly decreased the cluster compactness coefficient compared to the unsprayed ones. On other hand, GA_3 twice spraying significantly decreased the berry set percentage and insignificantly decreased the cluster weight and yield/vine, as well as significantly decreased the cluster compactness compared to unsprayed ones. No significant differences in these traits due to lemongrass oil spray at 1 or 1.5% as well as GA_3 at 5 or 7.5 ppm.

Lemongrass oil significantly improved the berry quality in terms of berry weight, total soluble solids and anthocyanin contents, whereas GA_3 significantly increased the berry weight and significantly decreased anthocyanin content.

From this study, it is clear that lemongrass oil twice spray at 1% improve the grapevines production and overcome the adverse effects of GA_3 used at high concentration.

Keywords: *GA_3, lemongrass oil, fruit quality, Ruby Seedless, Grapevine.*

Introduction

The grape is considered as one of the most important fruit crops in the world. It is grown extensively in Europe or in other regions all over the world. It occupies the second position after citrus regarding the cultivated area and the magnitude of fruit production. Due to its high return, the cultivated area has grown rapidly in the last two decades reaching 192873 fed. and yielded 1596169 ton of fruits (M.A.L.R., 2014).

Seedless grape is prone to quality defects like small and uneven berry size which can cause a major loss in production comparing to seeded grape. There is a potential to solve this problem by using plant growth substances and berry thinning (Dokoozlian and Peacock, 2001).

Berry thinning has been used to obtain the needed loosened, large berries, highest berry weight and fasted ripening. Plant growth substances play a major in plant growth and development. Therefore, spraying GA_3 at different concentrations on seedless grape cultivars once or twice at full bloom or berry set increased clus-

ter weight and the yield per vine. GA_3 at high concentration had adverse effects i.e. it can delay the berry ripening and reduce full coloration (Maximos *et al*., 1975; Saad *et al*., 1981; Wassel, 1984; Dokoozlian and Peacock, 2001 and El-Salhy *et al*., 2009).

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; El-Salhy *et al*., 2009 and Abd-Allah *et al*., 2013).

GA_3 at 1.5 or 3.0 ppm spraying, brushing flowers cluster or 1% urea vine foliage spraying at full bloom significantly improved cluster and berry traits of Ruby Seedless grapes (El-Salhy *et al*., 2009).

Lemongrass (*Cymbopogan citrates* L.) is an aromatic herb and mainly grown as an ornamental plant. It has many uses as: (1) its use as a herbal tea because of its sharp lemon flavor. (2) also, its use in the performing soap industries. (3) Moreover, it can be used in the manufacture of synthetic vitamin A and in the medicine to treat various health oilments, including acne, athlete's foot, flatulence, muscle aches and scabies (Masamba *et al*., 2003; Abbas and El-Saeid, 2012).It is known that oil of lemongrass in one of the most important essential oil-bearing herbaceous species of the gramineae because of its high citral content, furthermore, lemongrass contains terpenes, alcohols, ketones, aldehyde, esters and flavonoids (Luteolin, isoarienlin 2'-O-rhamnoside, quercetin, Kaempfero and apiginin) (Shab *et al*., 2011).

Spraying lemongrass extract at 0.25 or 0.50% at full bloom reduce the number of berries per cluster and cluster compactness which improve berry weight that reflected on increasing the cluster weight and improved the berry quality (Abd-Allah *et al*., 2013).

So, this study aimed to study the effect of spraying lemongrass oil instead of the synthetic chemical products like GA_3 on fruiting of Ruby Seedless grapevines.

Materials and Methods

This study was carried out during two consecutive seasons of 2015 and 2016 on Ruby Seedless grapevines. The vines were 23-years old spaced at 2x2.5 m 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 by leaving total bud load of 42 buds (12x3 fruiting spurs plus 3 replacement spurs x 2 buds)/vine. Crop load all vines was adjusted to 30 clusters/vine after berry set. The chosen vines were divided into six different thinning treatments including the control.

Thus, the treatments were as follow:

- GA_3 twice spraying, once is 5 ppm at full bloom (70% of the flower cups dropped) and the second is 30

ppm when berry size reached about 5-6 mm.

- GA_3 twice spraying, once is 7.5 ppm at full bloom and the second is 30 ppm when berry size reached about 5-6 mm.
- Lemongrass oil at 0.5% twice spraying, once at full bloom and the second when berry size reached about 5-6 mm.
- Lemongrass oil at 1% twice spraying, once at full bloom and the second when berry size reached about 5-6 mm.
- Lemongrass oil at 1.5% twice spraying, once at full bloom and the second when berry size reached 5-6 mm.
- Control spray with water.

The experiment was arranged in complete randomized block design with three replicates per treatment, two vines each.

Spraying GA_3 and lemongrass oil solutions were prepared by dissolving the assigned amount in the required water. The flower clusters received spraying solution with triton B as a wetting agent at a concentration of 0.1% till run off using a hand held spray wand.

Berry set percentage was estimated by caging two flower cluster on each vine in perforated white cheese bags after spraying and after berry set, the percentage was calculated as follows:

Berry set % = No. of berries per cluster / Total No. of flowers per cluster x 100

At harvest time, when color development accumulated in 80%. Three clusters were taken at random from each replicate to determine the following characters:

Average weight of cluster (g), as well as cluster length (cm) and number of berries per cluster, then 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 analysed 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 GA_3 and lemongrass oil on yield components:

Data in Table (1) show the effect of GA_3 and lemongrass oil spraying on fruit set percentage, cluster weight and yield grapevines during 2015 & 2016 seasons. It is obvious from the data that the results took similar trend during the two studied seasons.

It is clear from such data that lemongrass oil twice spraying significantly decreased the berry set percentage and consequently significantly decreased the cluster weight and yield/vine compared to the unsprayed ones.

On other hand, GA_3 twice spraying significantly decreased the berry set percentage and consequently insignificantly decreased the cluster weight and yield/vine compared to the unsprayed ones. In this respect, lemongrass oil at 1 or 1.5% gave lowest fruit set percentage (11.01 & 10.53%), cluster weight

(300.59 & 292.98 g) and yield/vine (9.03 & 8.81 kg/vine) compared to the unsprayed ones that gave the highest (15.67%, 356.05 g and 10.70 kg/vine av. the two studied seasons), respectively. Then, the reduction percentage of fruit set, cluster weight and yield/vine were attained (29.74 & 32.80%), (15.58 & 17.71%) and (15.61 & 17.66% av. the two studied seasons) compared to the unsprayed ones, respectively. No significant differences in fruit set percentage due to either lemongrass oil at 1 & 1.5% or GA_3 at 5 & 7.5 plus 30 ppm spraying. Raising both GA_3 from 5 to 7.5 ppm and lemongrass oil from 1 to 1.5% failed to show any measurable effects on fruit set percentage, cluster weight and yield/vine. Thus the harmful effect of using GA_3 can be avoided by using lemongrass oil.

2- Effect of GA_3 and lemongrass oil on cluster traits:

It is clear from data in Table (2) that GA_3 and lemongrass oil twice spraying significantly decreased the berries number per cluster compared to the unsprayed ones. On other hand, such treatments significantly increased the cluster length and consequently significantly decreased the cluster compactness coefficient compared to unsprayed ones (control). Lemongrass oil spraying suppressed the effect of GA_3 spraying in reduction the berries number per cluster and cluster compactness coefficient. The berries number per cluster in this study were 108.85, 103.15, 113.10 & 109.50 berry, cluster length were 22.95, 23.03, 23.36 & 23.54 cm and cluster compactness coefficient were 4.74, 4.48, 4.85 & 4.67 as an av. of the two studied seasons due to the spray with lemongrass oil at 1%, 1.5%, GA_3 at 5 and 7.5 ppm plus 30 ppm, respectively. Then, the corresponding decrement percentage of berries number per cluster was attained (27.6, 31.39, 24.78 & 27.17%), cluster length (6.25, 6.62, 8.15 & 8.98%) as well as cluster compactness coefficient (31.99, 35.72 & 30.42 & 32.99%), respectively. No significant differences in these cluster traits due to lemongrass oil spray at 1 or 1.5% as well as GA_3 at 5 or 7.5 plus 30 ppm.

Therefore, it can be concluded that the lemongrass oil that sprayed at 1% reduced the berries number and increased the length of cluster. These effects induced a pronounced decrease in compactness coefficient and produced loose clusters as well as had the same effect of GA_3 on cluster traits.

Table 1. Effect of GA_3 and lemongrass oil spay on fruit set, cluster weight and yield/vine of Ruby Seedless grapevines in 2015 and 2016 seasons.

Charact.→ / Treat.↓ Seasons	Fruit set %			Cluster weight (g)			Yield vine (kg)		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
Lemongrass 0.5%	12.52	11.53	12.05	298.80	347.80	323.30	8.96	10.45	9.71
Lemongrass 1%	11.65	10.37	11.01	285.68	315.50	300.59	8.58	9.48	9.03
Lemongrass 1.5%	11.10	9.96	10.53	277.20	308.75	292.98	8.33	9.28	8.81
GA3 5 ppm + 30 ppm	12.28	10.95	11.62	316.40	379.9	348.15	9.51	11.40	10.46
GA3 7.5 ppm + 30 ppm	11.88	10.67	11.28	315.80	376.30	346.05	9.48	11.30	10.39
Control	16.61	14.72	15.67	322.50	389.60	356.05	9.70	11.70	10.70
LSD	**1.28**	**1.16**		**20.38**	**26.81**		**0.48**	**0.54**	

Table 2. Effect of GA_3 and lemongrass oil spay on cluster traits of Ruby Seedless grapevines in 2015 and 2016 seasons.

Charact.→ / Treat.↓ Seasons	Number of berries/cluster			Cluster length (cm)			Compactness coefficient		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
Lemongrass 0.5%	108.30	122.30	115.30	22.46	23.11	22.79	4.82	5.29	5.06
Lemongrass 1%	102.80	114.90	108.85	22.65	23.25	22.95	4.54	4.94	4.74
Lemongrass 1.5%	97.60	108.20	103.15	22.74	23.31	23.03	4.29	4.66	4.48
GA3 5 ppm + 30 ppm	108.20	118.00	113.10	23.11	23.61	23.36	4.68	5.02	4.85
GA3 7.5 ppm + 30 ppm	103.40	115.60	109.50	23.21	23.86	23.54	4.48	4.85	4.67
Control	142.50	158.20	150.35	21.20	22.00	21.60	6.75	7.18	6.97
LSD	**10.16**	**10.48**		**0.68**	**0.73**		**0.49**	**0.53**	

Table 3. Effect of GA_3 and lemongrass oil spay on berry quality of Ruby Seedless grapevines in 2015 and 2016 seasons.

Charact. → / Treat.↓ Seasons	25 berries weight (g)			TSS %			Acidity %			Reducing sugars %			Anthocyanin mg/g		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
Lemongrass 0.5%	62.36	64.80	63.58	18.00	18.20	18.10	0.41	0.36	0.39	14.12	14.35	14.24	1.63	1.59	1.61
Lemongrass 1%	64.91	67.25	66.08	18.30	18.60	18.45	0.40	0.35	0.38	14.16	14.48	14.32	1.68	1.63	1.16
Lemongrass 1.5%	66.16	68.93	67.55	18.80	18.80	18.80	0.36	0.33	0.35	14.62	14.70	14.66	1.74	1.68	1.71
GA3 5 ppm + 30 ppm	73.80	77.85	75.83	16.35	16.50	16.43	0.51	0.48	0.50	12.98	13.11	13.05	1.25	1.21	1.24
GA3 7.5 ppm + 30 ppm	75.50	80.21	77.86	16.10	16.36	16.23	0.53	0.49	0.51	12.70	12.86	12.78	1.20	1.16	1.18
Control	53.10	55.30	54.20	16.60	17.00	16.80	0.45	0.42	0.44	13.16	13.32	13.24	1.48	1.44	1.46
LSD	**2.11**	**2.49**		**0.58**	**0.68**		**0.02**	**0.03**		**0.48**	**0.54**		**0.04**	**0.05**	

3- Effect of GA_3 and lemongrass oil spray on berry quality:

Data in Table (3) showed that lemongrass oil spray at any concentrations significantly improved the berry quality in terms of berry weight, total soluble solids, reducing sugars and anthocyanin in berry skin and decreasing titratable acidity.

On the other hand, GA_3 significantly increased the berry weight and titratable acidity and significantly decreased anhtocyanin in berry skin, whereas total soluble solids and reducing sugars content had insignificant differences compared to the unsprayed ones (control). The increment percentage of berry weight were 21.19 & 24.63%, TSS were 9.82 &

11.96% and anthocyanin were 13.70 % 17.12% and decrement percentage of titratable acidity were 13.64 & 20.45%, respectively as an av. the two studied seasons due to lemongrass oil twice spraying at 1% and 1.5% compared to the unsprayed ones (control), respectively. On the other side, the increment percentage of berry weight were 39.91 & 43.65% and titratable acidity were 13.64 & 15.91% and the decrement percentage of anthocyanin in berry skin were 15.07 & 19.18%, respectively as an av. the two studied seasons due to GA_3 spray at 5 and 7.5 plus 50 ppm compared to the unsprayed ones (control), respectively.

So, it could be concluded that lemongrass oil twice spraying at 1% could improve the berry quality in terms of berry weight, total soluble solids, reducing sugars and anthocyanin in berry skin as well as overcome the adverse effects of GA_3 at high concentration.

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 and reduce the compactness coefficient of cluster.

The positive action of GA_3 on stimulating cell elongation process, enhance the water absorption and stimulate the biosynthesis of proteins which will lead to increase berry weight and improve the cluster traits.

To explain the mode of action for using lemongrass oil at full bloom, Byers *et al*. (1990) confirmed that this oil was used as a photosynthetic inhibitor alone or in combination with the other thinners to induce flower and fruit abscission.

This could be reflected on advancing the berry ripening and improving its quality in terms of increasing sugars and anthocyanin contents in ruby seedless grapes.

The above mentioned results showed a good chance to replace lemongrass oil 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 Ruby Seedless grapes. These result are in parallel with that of Dimitri and Oberholtzer (2006), El-Salhy *et al*. (2009) and Abd-Allah *et al*. (2013), who confirmed that using natural products in horticultural practices instead of chemical products is recommended and 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.

Conclusion

It could be concluded that lemongrass oil twice spraying at 1% at full bloom and then when berry size reached about 5-6 mm are the best methods for improving the grapevine production, as well as avoiding the harmful effects of GA_3 used.

References

Association of Official Agricultural Chemists (1985). Official Methods of Analysis A.O.A.C. Benjamin Franklin Station, Washington, D.C., M.S.A. pp. 440-512.

Abbas, S.M. and H.M. El-Saeid (2012). Effects of some growth regulators on oil yield, growth and hormonal content of lemon grass (*Cymbopogon citrates*). Botanica Serbica, 36: 97-101.

Abd-Allah, A.S.E.; E. Abdel-Razek; M.A. Abdalla and M.M.S. Saleh (2013). Effect of spraying lemongrass extract at full bloom on yield and fruit quality of Flame Seedless grape. J. of Applied Sci. Research, 9 (2): 1244-1248.

Byers, R.E.; J.A. Barden; R.F. Polomski; R.W. Young and D.H. Carbaugh (1990). Apple thinning by photosynthetic inhibition. J. Amer. Soc. Hort. Sci., 115: 14-19.

Dimitri, C. and L. Oberholtzer (2006). EU and U.S. organic markets face strong demand under different policies. Amber Waves. Economic Research Service USDA, 4: 12-19.

Dokoozlian, N.K. and W.L. Peacock (2001). Gibberellic acid applied at bloom reduces fruit set and improves size of 'Crimson Seedless' table grapes. HortScience, 36: 706-709.

El-Salhy, A.M.; K.A. Amen; A.B. Alaa and Eman A.A. Abo Zeed (2009). Effect of berry thinning, CPPU spraying and pinching on cluster and berry quality of two grapevine cultivars. Assiut J. Agric. Sci., 40 (4): 92-107.

Gomez, K.A. and A.A. Gomez (1984) Statistical Procedure for Agriculture Research, 2nd Ed. Wiley, New York.

Marrkham, K.P. (1982). Techniques of flavonoids identification Academic Press, London.

Masamba, W.R.L.; J.F.M., Kamanula; Elizabeth M.T. Henry and G.K.C., Nyirenda (2003). Extraction and analysis of lemongrass (*Cymbopogon citrates*) oil: an essential oil with potential to control the Larger Grain Borer (*Prostephanus truncates*) in stored products in Malawi. Malawi J. Agric. Sci., 2: 56-64.

Maximos, S.S.E., S.M. El-Nabawi, N. Antown and G.F. Ghobrial (1975). Effect of GA_3 sprays and girdling on fruiting and vigor of Thompson seedless grapevines. Annals of Agric. Sci. Moshtohor, Cairo, 4: 167-173.

Ministry of Agriculture and Land Reclamation (M.A.L.R., 2014). Bulletin of the Agricultural Statistics. Part (2) Summer & Nili Crops.

Saad, F.A.; A.A. El-Hammady and M.M. Hamouda (1981). Effect of Gibberellic acid and ethephon on berry weight, size and quality of Thompson seedless and Delight. Plant Growth Regulator Abstracts, 7(1): 109.

Shab, G.; R. Shri; V. Panchal; N. Sharma; B. Singh and A.S. Mann (2011). Scientific basis for the therapeutic use of *Cymbopogon citratus*, stapf (Lemongrass). J. Adv. Pharm. Tech. Res., 2: 3-8.

Snedecor, G.W. and W.G. Cochran (1990). Statistical Methods 7th Ed. The Iowa State Univ., Press.

Wassel, A.M. (1984). White Banaty seedless grapes as influenced by gibberellic acid and ethephon. Bull. Fac. Agric. Univ. Cairo., 35: 1071-1082.

Winkler, A.J.; A.J. Cook; W.M. Kliewer and L.A. Linder (1974). General viticulture. Published by University of California Press, Barkley.

تأثير رش حمض الجبريليك وزيت حشيشة الليمون علي إثمار شجيرات العنب الروبي اللابذري

فاطمة الزهراء محمد عبد الله جودة

قسم الفاكهة – كلية الزراعة– جامعة أسيوط

الملخص

أجريت هذه الدراسة بمزرعة كلية الزراعة – جامعة أسيوط خلال موسمي ٢٠١٥ ، ٢٠١٦ علي شجيرات العنب الروبي اللابذري بغرض دراسة تأثير رش حمض الجبريليك وحشيشة الليمون علي المحصول وخواص العناقيد والحبات. حيث تم رش حمض الجبريليك مرتين المرة الأولي بتركيزي ٥ أو ٧,٥ جزء في المليون في مرحلة اكتمال التزهير، والثانية بتركيز ٣٠ جزء في المليون عند وصول حجم الحبات ٥-٦ مم. بينما تم رش حشيشة الليمون مرتين بتركيزات ٠,٥ ، ١ أو ١,٥% في نفس الموعدين السابقين.

وقد أظهرت النتائج ما يلي:

- سبب رش حشيشة الليمون نقصاً معنوياً لكل من نسبة عقد الحبات ووزن العنقود وبالتالي المحصول/شجيرة. بينما سبب رش حمض الجبريليك نقصاً معنوياً في نسبة عقد الحبات. وكان النقص غير معنوي لوزن العنقود ووزن المحصول/شجيرة مقارنة بالشجيرات التي لم ترش.
- لم تسجل فروق معنوية بين استخدام حشيشة الليمون بتركيزي ١ أو ١,٥% وكذلك حمض الجبريليك بتركيزيه.
- أدي رش حشيشة الليمون وحمض الجبريليك إلي نقص معنوي في عدد الحبات للعنقود ومعامل التزاحم – بينما حدثت زيادة معنوية في وزن الحبات مقارنة بعناقيد الشجيرات التي لم ترش.
- سبب رش حشيشة الليمون زيادة معنوية في نسبة المواد الصلبة الذائبة الكلية ومحتوي الأنثوسيانين بينما حدث نقص معنوي في محتوي الحموضة للعصير، بينما سبب رش حمض الجبريليك نقصاً معنوياً في نسبة المواد الصلبة الذائبة والأنثوسيانين مقارنة بثمار الشجيرات التي لم ترش.

من نتائج هذه الدراسة: يمكن التوصية بأهمية استخدام رش حشيشة الليمون مرتين بتركيز ١% الأولي أثناء الأزهار الكامل لتقليل نسبة العقد، والثانية عندما يصل حجم الحبات ٥-٦ مم وذلك لزيادة وزن الحبات وكذلك لإنتاج عنب جيد صالح للتصدير والتغلب عن التأثيرات السلبية لاستخدام تركيزات مرتفعة من حمض الجبريليك مثل تأخر النضج وقلة التلوين.