

Effect of some Plant Extracts Spraying on Growth and Fruiting of Flame Seedless Grapevines

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Abstract

The present investigation was carried out during 2013, 2014 and 2015 seasons to study the effect of plant extracts on growth and fruiting of Flame Seedless grapevines. The experiment was arranged in a randomized complete block design in which the study involved seven treatments with three replications, two vines each.

Pruning wood weight, leaf area and leaf chlorophyll were significantly increased by spraying either garlic, turmeric or roselle extracts compared to unsprayed ones. Spraying garlic, turmeric or roselle extracts were very effective in improvement the yield/vine and cluster traits. Moreover, these treatments significantly improved the berry quality in terms of increasing the berry weight, total soluble solids and anthocyanin in skin of berries compared to unsprayed ones. The best results were obtained on the vines that sprayed with 0.2% turmeric extract. No significant differences were obtained among the tested extract. It could be concluded that spraying turmeric, roselle or garlic extract at 0.1% three times annually was necessary to get high yield with good cluster and berry quality of Flame Seedless grapevines.

Keywords: Plant extracts, Garlic, Turmeric, Roselle, Grapevines.

Introduction

Grapes are one of the most important deciduous fruit crop in the world and Egypt for local consumption and export, for nice taste, high nutritional values and excellent flavor. In Egypt, due to its high net return, the cultivated area has grown rapidly in the last two decades reaching 171882 fed and produced 1596169 tons of fruits (M.A.L.R., 2014). Seedless grapes are attracting huge interest for their better eating quality and higher returns to the farmer, but some of them have smaller in berry size, higher shot berries and lower cluster traits which might represent a problem for commercialization.

Most cultural practices of the vineyard are still in need for experimentation to achieve high yield production with good quality. There are many factors face the growers to improve and maximize their productivity for example, fertilization, irrigation and other horticultural practices (El-Salhy *et al.*, 2006).

The use of natural products in horticultural practices instead of synthetic chemical products is becoming as a main target to produce many fruit crop, since the world market has been growing rapidly in recent years for organic fruit production (Verna, 1990 and Dimitri and Oberholtzer, 2006). Plant extracts as natural products were used in many ways. These natu-

ral products were used for 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 constituents seem to have synergistic effects on growth and fruiting of fruit trees (Paik and Chung, 1997 and Srivestava and Lal, 1997).

The beneficial effects of garlic extract on promoting the growth and yield of grapevines might be attributed to its higher content of sulfur containing compounds, amino acids and various volatiles-sulfur in constitute of the three amino acids cysteine, cysteine and methionine and hence proteins. They play definite roles in enhancing the biosynthesis of GA₃, indoles, free water, total carbohydrates and most organic foods and reducing total phenols and ABA (Kubota *et al.*, 1999 and Kubota *et al.*, 2000).

Roselle (*Hibiscus sabdariffa*), family Malvaceae extract contains higher amount of anthocyanins, organic acids, ascorbic acid, calcium oxalate and hibicine hydrochloride (Raffaut, 1967). The own higher content of turmeric extract 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).

Previous studies emphasized the beneficial effects of using plant extracts on growth and fruiting of grapevines (Kubota *et al.*, 1999; Kubota *et al.*, 2000; Vargas *et al.*, 2008; Corrales-Maldonado *et al.*, 2010; Ali-Mervat *et al.*, 2012; Gadel-Kareem and Abdel-Rahman, 2013; Abdelaal

and Aly, 2013; Abada, 2014; Ahmed *et al.*, 2014; Uwakiem, 2014; Gouda-Fatma El-Zahraa, 2016 and Rizkalla, 2016).

Therefore, the goal of this study was examining the effect of some plant extracts application on growth, vine nutritional status and fruiting of Flame Seedless, grapevines.

Materials and Methods

The present study was executed in 2013, 2014 and 2015 seasons on Flame Seedless grapevines grown in a private vineyard situated at Tenda village, Malay, Minia Governorate, Egypt. Soil of the vineyard is clay texture, well drained and surface irrigation system was followed using Nile water sandy loam. The vines were 10 years old at the starting of this experiment and spaced at 1.75x2.25 meters apart. The vines trained according to the double cordon system and supported with Y modified shape method. Pruning was carried out at the end of December by leaving 16 fruiting spurs with 3 buds on each spur plus six replacement spurs with 2 buds each. Forty two healthy vines, with no visual nutrient deficiency symptoms and at almost uniform in their vigor were chosen and divided into seven different treatments including the control. The treatments were as follows:

- Control (spraying water).
- Spraying garlic extract at 0.1%.
- Spraying garlic extract at 0.2%.
- Spraying turmeric extract at 0.1%.
- Spraying turmeric extract at 0.2%.

- Spraying roselle extract at 0.1%.
- Spraying roselle extract at 0.2%.

Garlic, turmeric and roselle extracts were made by soaking 1 or 2 g powder of each one in one liter distilled water for 24 h at 25°C in a lighted room to give concentration of 0.1 or 0.2%. Solutions were filtered through cheesecloth after soaking, then the filtrate was taken to give the final water extract. The selected vines received three sprays from each substance at growth start (1st week of March), just after berry setting (2nd week of April) and at three weeks later (1st week of May). The experiment was arranged in a randomized complete block design with three replications consisting of two vines per each.

The following parameters were measured to evaluate the effects of different plant extracts spraying on growth, yield and berry quality.

1- Some vegetative growth parameters:

The average leaf area (cm²): Twenty leaves for each vine from those opposite to basal clusters were measured according to the following equation that was reported by Ahmed and Morsy (1999) leaf area = $0.56(0.79 \times w^2) + 20.01$, where, W = the maximum leaf width, as well as chlorophylls a & b and total carotenoids, according to Von-Wettstein (1957).

Weight of pruning wood (g) was estimated by weighing the removal one year old wood after pruning at the end of growing season.

2- Yield:

At harvest date, the yield per vine was recorded in terms of weight (kg) and number of clusters per vine.

3- Cluster and berry characteristics:

At harvest time, two clusters were randomly taken from the yield of each vine to determine the cluster and berry traits such as cluster weight and length as well as cluster compactness coefficient. Berry quality such as berry weight, reducing sugar percentage, total soluble solids % and total acidity % (expressed as gm tartaric acid per 100 ml juice), berry properties were evaluated according to A.O.A.C. (1985). In addition to the anthocyanin content was determined according to Markham (1982). All the obtained data were tabulated and analyzed according to Gomez and Gomez, (1984) using L.S.D. test for distinguishing the significance differences between various treatment means according to Steel and Torrie (1980).

Results

1- Effect on growth characteristics and leaf pigments:

Table (1) exhibit the effect of garlic, turmeric and roselle extracts spraying on some growth aspects of Flame Seedless grapevines in 2013, 2014 and 2015 seasons. Data proved that all treatments significantly increased leaf area, weight of pruning wood, chlorophyll A and B in leaves compared to untreated vines. Spraying garlic extract was resulted in more announced and highly significant increment in these studied traits compared to unsprayed ones (control). The promotion in such growth traits was associated with increasing concentration of any extract from 0.1

to 0.2%. The maximum values were recorded on vines that sprayed with 0.2% garlic (139.3 cm², 2.10 kg, 21.93% & 33.39% as an av. three studied seasons for leaf area, pruning wood weight and chlorophyll A & B percentage in the leaves, respectively. On the other hand, the minimum values of these traits were recorded on unsprayed vines (128.9 cm², 1.92 kg, 18.97% & 27.20% as an av. the three studied seasons), respectively.

Hence the increment percentage of pruning wood weight (9.38%), leaf area (8.07%), Chlo. A (15.60%), Chlo. B (22.75%) as an av. three studied seasons due to spray with 0.2% garlic extract compared to unsprayed ones. No significant differences were found either due to spray any of the three extracts or to increase the concentration of each. Thus, it could be concluded that spraying either garlic, turmeric or roselle extract concentration improve the vegetative growth and vigour of vine.

2- Yield and cluster traits:

Data present in Table (2) showed that the number of clusters borne on the vine on the first season was unaffected with varying the

spraying treatments. On the second studied season, all spraying treatments significantly increased the cluster number, cluster weight and consequently yield weight/vine compared to unsprayed ones (control).

The highest values of cluster number, cluster weight and yield weight/vine were recorded on vines that sprayed at 0.2% garlic extract, whereas, the lowest ones were recorded on the vines that sprayed with water (control). No significant differences were found due to increase the extract concentration as well as any extract spraying, whatever garlic, turmeric or roselle.

The obtained yield weight was (11.51, 11.55, 11.24, 11.43, 11.10, 11.28 & 10.12 kg/vine as an av. the three studied seasons) due to spray the vines with 0.1% garlic, 0.2% garlic, 0.1% turmeric, 0.2% turmeric, 0.1% roselle, 0.2% roselle and unsprayed ones, respectively. Hence, the percentage of increment on yield/vine due to spray with these extracts over unsprayed ones attained (13.74, 14.13, 11.07, 12.94, 9.68 & 11.46% as an av. the three studied seasons), respectively.

Table 1. Effect of some plant extracts on some growth traits of Flame Seedless grapevines during 2013, 2014 and 2015 seasons.

No.	Chract.→ Treat.↓	Leaf area (cm ²)				Pruning wood weight (kg)				Chlorophyll A (mg/100 g F.W.)				Chlorophyll B (mg/100 g F.W.)			
		2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M
1	Control (water spraying)	126.3	130.6	129.7	128.9	1.61	1.86	2.30	1.92	19.41	18.52	18.98	18.97	27.83	26.67	27.11	27.20
2	Garlic extract at 0.1%	134.5	140.8	138.7	138.0	1.74	2.03	2.49	2.09	22.10	20.56	21.56	21.41	34.53	33.10	33.75	33.79
3	Garlic extract at 0.2%	136.1	141.6	140.1	139.3	1.75	2.05	2.51	2.10	22.64	20.98	22.16	21.93	34.23	33.64	33.30	33.39
4	Turmeric extract at 0.1%	133.2	139.4	137.0	136.5	1.70	1.99	2.43	2.04	21.83	20.11	21.40	21.11	32.50	31.39	31.85	31.91
5	Turmeric extract at 0.2%	132.0	137.8	136.0	135.3	1.71	2.00	2.45	2.05	21.92	20.39	21.65	21.32	33.19	31.90	32.50	32.53
6	Roselle extract at 0.1%	131.9	137.6	135.6	135.0	1.69	1.98	2.42	2.03	20.95	20.16	20.67	20.59	31.60	30.40	30.85	30.95
7	Roselle extract at 0.2%	132.8	138.0	136.0	135.6	1.70	2.00	2.44	2.05	21.18	20.28	20.64	20.70	31.27	30.10	30.56	30.64
	LSD 5%	5.37	6.18	4.52		0.07	0.08	0.11		1.55	1.42	1.67		3.21	3.65	2.96	

Table 2. Effect of some plant extracts on cluster number/vine, yield/vine (kg) and cluster weight (g) of Flame Seedless grapevines during 2013, 2014 and 2015 seasons.

No.	Chract.→ Treat.↓	Cluster number/vine				Yield/vine (kg)				Cluster weight (g)			
		2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M
1	Control (water spraying)	23.15	21.25	23.25	22.55	11.20	9.16	10.00	10.12	478.10	419.30	425.11	440.84
2	Garlic extract at 0.1%	23.10	23.15	25.18	23.81	12.35	10.62	11.55	11.51	526.60	458.7	456.37	480.56
3	Garlic extract at 0.2%	24.25	23.80	25.30	24.45	12.51	10.77	11.36	11.55	523.22	460.81	460.85	482.29
4	Turmeric extract at 0.1%	24.00	23.00	25.40	24.13	12.00	10.42	11.30	11.24	500.00	458.47	448.90	469.12
5	Turmeric extract at 0.2%	23.35	23.40	25.12	23.96	12.28	10.60	11.42	11.43	522.19	460.11	451.80	478.03
6	Roselle extract at 0.1%	23.75	22.60	24.48	23.61	11.90	10.29	11.10	11.10	501.00	447.30	450.00	466.10
7	Roselle extract at 0.2%	24.00	22.75	24.70	23.82	12.10	10.38	11.37	11.28	505.20	457.20	460.38	474.28
	LSD 5%	N.S.	1.16	1.03		0.51	0.68	0.56		21.38	20.12	21.18	

In addition data in Table (3) indicated that spraying garlic, turmeric or roselle extracts significantly increased the cluster length. Number of berries per cluster was unaffected by three plant extract compared to unsprayed ones. Hence, all extracts spraying significantly decreased the compactness coefficient of cluster. No significant differences were observed among all spraying with any of the three extracts. The lowest clus-

ter compactness coefficient (5.80 av. the three studied seasons) was obtained due to spray with 0.2% garlic extract. Contrarily, the highest cluster compactness coefficient (6.73) was observed on unsprayed vines (control). Hence the corresponding decrement of cluster compactness coefficient was (13.81%).

So, it could be concluded that spraying garlic, turmeric or roselle extracts three times annually maxi-

mized the yield and improved the cluster traits.

3- Berry quality:

Tables (3 & 4) cleared that all spraying treatments significantly improved the berry quality in terms of increasing berry weight, total soluble solid %, reducing sugars % and anthocyanin in berry skin and decreasing titratable acidity % compared to unsprayed ones. The best results regarding the berry quality was obtained on the vines that sprayed with 0.2% turmeric extract. No significant differences were obtained either due to spray any of the three extracts or to any concentration used. The heaviest berry weight was 2.56 g, whereas the lightest ones was 2.12 g as an av. the three studied season was found on vines that unsprayed. Hence, the increment percentage of berry weight due to 0.2% turmeric extract over unsprayed one was (20.75%). The increase in berry weight and size result an increase in packable yield.

Also, the highest total soluble solids (17.6%) and anthocyanin contents (1.58 mg/g as an av. the three studied seasons) were observed on the vines that received turmeric extract at 0.2%. Contrarily, the least values of total soluble solids (16.1%) and anthocyanins (1.28 mg/g) were recorded on unsprayed vines (control). Hence, the increment percentage of these traits were (9.31%) and (23.44% as an av. of the three studied seasons) due to using the previous treatment over the control, respectively. Also, such spraying treatments induce decrement percentage in titratable acidity (14.75% as an av. of the three studied seasons). As a conclusion, the best results with regard to growth and yield, as well as, cluster traits and berry quality of Flame Seedless grapevines were obtained with spraying turmeric, roselle or garlic extract at 0.1% three times annually.

Table 3. Effect of some plant extracts on some cluster traits of Flame Seedless grapes during 2013, 2014 and 2015 seasons.

No.	Chract.→ Treat.↓	No. berries/cluster				Cluster length (cm)				Compactness coefficient				Berry weight			
		2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M
1	Control (water spraying)	177.6	168.4	163.9	170.0	24.8	26.0	25.1	25.30	7.18	6.49	6.52	6.73	2.17	2.05	2.14	2.12
2	Garlic ex- tract at 0.1%	178.2	165.3	159.0	167.5	27.2	28.8	27.8	27.90	6.52	5.71	5.64	5.96	2.60	2.46	2.55	2.54
3	Garlic ex- tract at 0.2%	171.5	163.6	157.1	164.1	27.6	28.9	28.3	28.10	6.23	6.65	5.51	5.80	2.60	2.48	2.59	2.55
4	Turmeric extract at 0.1%	171.9	167.1	156.8	165.3	26.9	28.2	27.6	27.57	6.41	5.88	5.62	5.97	2.59	2.47	2.58	2.54
5	Turmeric extract at 0.2%	176.6	165.3	157.4	166.4	27.0	28.5	27.5	27.67	6.51	5.74	5.66	5.97	2.60	2.48	2.60	2.56
6	Roselle ex- tract at 0.1%	174.1	164.8	161.3	166.7	26.3	27.8	26.9	27.00	6.58	5.85	5.81	6.08	2.56	2.45	2.54	2.52
7	Roselle ex- tract at 0.2%	172.8	165.0	160.8	166.2	26.5	27.7	27.1	27.10	6.46	5.93	5.86	6.08	2.58	2.45	2.55	2.53
	LSD 5%	N.S.	N.S.	N.S.		1.13	1.27	0.98		0.36	0.52	0.41		0.11	0.10	0.15	

Table 4. Effect of some plant extracts on TSS, reducing sugars, acidity % and anthocyanin of Flame Seedless grapes during 2013, 2014 and 2015 seasons.

No.	Chract.→ Treat.↓	TSS				Reducing sugars				Acidity %				Anthocyanin			
		2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M	2013	2014	2015	M
1	Control (water spraying)	15.7	16.1	16.5	16.1	13.15	13.58	13.86	13.53	0.58	0.62	0.64	0.61	1.23	1.28	1.33	1.28
2	Garlic extract at 0.1%	17.0	17.2	17.6	17.3	14.37	14.80	15.12	14.28	0.54	0.57	0.59	0.57	1.49	1.54	1.61	1.55
3	Garlic extract at 0.2%	17.0	17.3	17.9	17.4	14.20	14.63	15.05	14.63	0.52	0.54	0.56	0.54	1.51	1.56	1.62	1.56
4	Turmeric extract at 0.1%	16.9	17.3	17.7	17.3	14.28	14.44	14.71	14.48	0.52	0.56	0.57	0.55	1.48	1.53	1.59	1.53
5	Turmeric extract at 0.2%	17.3	17.5	17.9	17.6	14.50	14.80	15.06	14.79	0.50	0.53	0.54	0.52	1.52	1.58	1.63	1.58
6	Roselle extract at 0.1%	16.9	17.1	17.6	17.2	14.22	14.48	14.80	14.50	0.55	0.58	0.59	0.57	1.50	1.54	1.61	1.55
7	Roselle extract at 0.2%	17.3	17.2	17.7	17.4	14.65	14.39	14.74	14.59	0.52	0.53	0.58	0.55	1.51	1.55	1.62	1.56
	LSD 5%	0.64	0.70	0.61		0.71	0.58	0.66		0.02	0.03	0.03		0.06	0.08	0.08	

Discussion

Since ancient times, plant extracts were used in many ways. Applications of plant extracts are promising in long run in fruit crops production (Srivastava and Lal, 1997). The beneficial effects of garlic extract on breaking bud-endodormancy, promoting the growth and yield of grapevines might be attributed to their higher content of sulfur-containing compounds, amino acids and various volatiles. Sulfur in constitute of the three amino acids cysteine, cysteine and methionine and hence proteins. They play definite roles in enhancing the biosynthesis of GA₃, indoles, free water, total carbohydrates and most organic foods and reducing phenols and ABA (Kubota *et al.*, 1999 and Kubota *et al.*, 2000).

The higher own content of turmeric and roselle extracts from different antioxidants as well as different 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 Okigbo and Emoghene, 2003).

The beneficial effects of these materials were to enhance cell division and elongate as well as the tolerance of plants to different stress. These effects surely reflected on enhancing growth and nutritional status of vines.

These results are in harmony with those obtained by Kubota *et al.* (2000), Vargas *et al.* (2008), Corrales-Maldonado *et al.* (2010), Ali-Mervat *et al.* (2012), Gadel-Kareem and Abdel-Rahman (2013), Abada (2014), Ahmed *et al.* (2014), Uwakiem (2014), Rizkalla (2016) and Gouda-Fatma-El-Zahraa, 2016).

The essential of these materials on enhancing growth and vine nutritional status that shifted the balance of competition between growth and reproductive organs was in favor of the latter. On addition, the positive action of these extracts on stimulating the biosynthesis of sugars and plant pigments surely reflected on advancing maturity and promoting fruit

quality. These results are in agreement with those obtained by Kubota *et al.* (1999), Ali-Mervat *et al.* (2012), Gadel-Kareem and Abdel-Rahman (2013), Abada (2014), Ahmed *et al.* (2014), Uwakiem (2014), Rizkalla (2016) and Gouda-Fatma-El-Zahraa (2016).

Conclusion

On the light of the current results, it could be concluded that foliar application of turmeric, roselle or garlic extract at 0.1%, three times at growth start, after berry set and three weeks later gave an acceptable yield and berries with fairly good quality.

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تأثير رش بعض المستخلصات النباتية على النمو الخضري وإثمار كروم العنب الفليم اللابذري

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الملخص

أجريت هذه الدراسة خلال ثلاثة مواسم متتالية هي ٢٠١٣، ٢٠١٤، ٢٠١٥ علي كروم العنب الفليم اللابذري المنزرعة بمزرعة خاصة بمركز مطاي - محافظة المنيا بهدف دراسة تأثير رش بعض المستخلصات النباتية (ثوم - كركم - كركديه) علي النمو الخضري والإثمار، حيث رشت المستخلصات بصورة فردية وبتراكيز ٠,١ - ٠,٢ % لكل منهم ثلاثة مرات خلال فصل النمو. وقد أظهرت النتائج:

- أظهرت جميع معاملات الرش زيادة معنوية في وزن خشب النقل ومساحة الورقة ومحتواها من صبغة الكلوروفيل مقارنة بعدم الرش.
 - أدي الرش زيادة معنوية لوزن المحصول / كرامة وتحسين لصفات العناقيد من حيث الوزن ومعامل التزاحم مقارنة بعدم الرش.
 - أوضحت المعاملات تحسناً معنوياً في صفات الحبات من حيث وزن الحبة ومحتواها من المواد الصلبة والسكريات وصبغة الأنثوسيانين مقارنة بثمار الكرمات الغير مرشوشة.
 - سجلت أفضل النتائج علي الشجيرات المرشوشة بتركيز ٠,٢ % من مستخلصات الكركم والثوم والكركديه ولم تسجل فروق معنوية بين استخدام أي مستخلص أو بزيادة التركيز من ٠,١ - ٠,٢ %.
- من نتائج هذه الدراسة يمكن التوصية بأهمية رش مستخلصات (الكركم ، الثوم ، الكركديه) بتركيز ٠,١ % ثلاثة مرات في بداية النمو وبعد العقد وبعد ذلك بثلاثة أسابيع وذلك لتحسين النمو الخضري وبالتالي إنتاج محصول عال ذو خصائص عناقيد وحبات جيدة للعنب الفليم اللابذري.