Assiut J. Agric. Sci., (48) No. (2) 2017 (59-74) *ISSN: 1110-0486*
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Response of Manfalouty Pomegranate Trees to Foliar Application of Salicylic Acid

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Received on: 2 /1/2017 **Accepted for publication on:** 2/2/2017

Abstract

This study was carried out during 2014 and 2015 seasons for examining the effect of different concentrations (50,100 and 200 ppm) and frequencies of application (once, twice or thrice) of salicylic acid on fruit splitting%, yield and fruit quality of Manfalouty pomegranate trees grown under Minia region conditions.

Treating Manfalouty pomegranate trees with salicylic acid once, twice or thrice at 50 to 200 ppm was very effective in stimulating all growth aspects, leaf pigments, N, P, K, Mg, Ca, Zn, Fe, Mn and Cu, initial fruit setting% and fruit retention%, gross and marketable yields, physical and chemical characteristics of the fruits relative to the control treatment. The promotion was materially associated with increasing concentrations from 50 to 200 ppm and frequencies of application from once to thrice. Fruit shape, fruit pomace% and reducing sugars were unaffected with salicylic acid treatments. Fruit splitting % was greatly declined with salicylic acid treatments.

Carrying out two sprays of salicylic acid at 100 ppm at growth start and again just after fruit setting was responsible for controlling fruit splitting % and improving yield and fruit quality of Manfalouty pomegranate trees grown under Minia region conditions.

***Keyword**: Salicylic acid, Manfalouty pomegranate trees, yield, fruit quality, fruit splitting.*

Introduction

Investigation on compounds capable of reducing the stress (biotic and abiotic stresses) and sensitivity of fruit crops are of great importance from both the theoretical and the practical point of view. Salicylic acid (SA) was demonstrated to play a definite role in increasing the tolerance of different fruit crops to all stresses. SA is a phenolic growth regulators found in plants with role in enhancing photosynthesis, uptake and transport of nutrients, cell division and the biosynthesis of plant pigments. It prevents the accumulation of reactive oxygen species (ROS) that resulted in protecting plant cells from death (Taiz and Zeiger, 2002 and Joseph *et al*., 2010).

Fruit splitting in pomegranate cv. Manfalouty is a serious problem facing marketing of such cv. in local and foreign markets. The main reasons of fruit splitting were male and unbalancing nutrition, variation of cultivars, irregular irrigation, climatic and environmental conditions and pest infestation (Taiz and Zeiger, 2002). Many attempts were carried out for alleviating such unsuitable phenomenon by using different chemicals, auxius and nutrients. Searching about non-traditional methods that are responsible for solving such problem was ascertained by

pomologists. Recently, salicylic acid was used due to its great function in physiology field.

Previous studies supported the beneficial effects of using salicylic acid on controlling fruit splitting and improving yield and fruit quality of different fruit crop species (El-Kady-Hanaa, 2011; El-Hanafy, 2011; Karmi *et al*., 2012; Mohamed-Ebtesam, 2012; Gad El-Kareem and Abd El- Rahman, 2013, Osman, 2014; Ayed, 2014; Mohamed, 2014; Akl *et al*., 2014; Abd El-Rady, 2015; Mohamed-Attiat, 2016).

The target of this study was testing the effect of different concentrations and frequencies of application of salicylic acid on reducing fruit splitting as well as improving yield and fruits quality of Manfalouty pomegranate trees grown under Minia region conditions.

Material and Methods

This study was carried out during the two successive seasons of 2014 and 2015 on thirty uniform in vigour 9- years old Manfalouty pomegranate trees (*Punica granatum* L.) grown in a private orchard situated at West Samalout, Samalout district, Minia Governorate. The trees are planted in sandy soil (Table 1) at 3.5 x 3.5 m apart. Drip irrigation system using well water was adopted. Regular horticultural management were applied to all the experimental trees as recommended:

1- Soil analysis:

A composite sample of the tested soil at 0.0 – 0.9 M depths was collected and subjected to mechanical, physical and chemical analysis according to the standard methods which are reported by Carter, (1993).

Table 1. Analysis of the tested soil at the trial location:

Constituents	values
Particle size distribution:	
Sand %	: 81.1
Silt %	: 8.9
Clay %	: 10.0
Texture	: Sandy
pH (1:2.5 extract)	: 7.71
E.C (1:2.5 extract) (mmhos/ cm/ 25 ^{O}C)	: 0.97
O.M. %	: 0.20
$CaCO_3$ %	: 3.29
Total N %	: 0.01
Available P (ppm, Olsen)	: 3.8
Available K (ppm) (ammonium acetate)	: 33
EDTA extractable micronutrients (ppm)	
Fe	1.1
Mn	1.3
Zn	1
Cu	0.25

This investigation included the following ten treatments from different concentrations and frequencies of application of salicylic acid arranged as follows:

1- Control (untreated trees).

2- Spraying salicylic acid at 50 ppm once at growth start (1st week of Mar.)

3- Spraying salicylic acid at 50 ppm twice at growth start and again just after fruit setting (last week of Apr.)

4- Spraying salicylic acid at 50 ppm thrice at growth start, just after fruit setting and one month later (last week of May.)

5- Spraying salicylic acid at 100 ppm once at growth start (1st week of Mar.)

6- Spraying salicylic acid at 100 ppm twice at growth start and

again just after fruit setting (last week of Apr.)

7- Spraying salicylic acid at 100 ppm thrice at growth start, just after fruit setting and one month later (last week of May.)

8- Spraying salicylic acid at 200 ppm once at growth start (1st week of Mar.)

9- Spraying salicylic acid at 200 ppm twice at growth start, just after fruit setting (last week of Apr.)

10- Spraying salicylic acid at 200 ppm thrice at growth start, just after fruit setting and one month later (last week of May.) Before spraying salicylic acid the known weight was dissolved in two ml of ethyl alcohol for facilitating the solubility of compound. Triton B as a wetting agent was used at 0.025%. Spraying was done till runoff (10 litres per tree).

This experiment was arranged in a randomized complete block design (RCBD) with ten treatments, each replicated three times, one tree per each.

During both seasons, the following parameters were recorded:

1- Some vegetative growth characteristics namely number of new shoots/tree, main shoot length (cm), leaf area (cm^2) and total surface area per tree (m^2). (Mofeed, 2009).

2- Leaf chemical components namely pigments i.e chlorophylls a& b, total chlorophylls and total carotenoids mg/ 100 g fresh weight (F.W.) (von- Wettstein, 1957). as well as leaf content of N, P, K, Mg and Ca (as %) and Zn, Fe, Mn and Cu (as ppm). (Cottenie *et al*., 1982 and Wilde *et al*., 1985).

3- Percentages of initial fruit setting and fruit retention.

4- Yield per tree expressed in number of fruits/tree and gross and marketable yield (in weight kg.).

5- Percentage of fruit splitting.

6- Physical characteristics of the fruits namely weight, height, diameter and shape of fruit, fruit peel weight% and fruit peel thickness (cm), percentages of grain weight, juice and fruit pomace and edible to non-edible portion of the fruit.

7- Chemical characteristics of the fruits namely T.S.S.%, total – reducing and non- reducing sugars, total acidity % (A.O.A.C, 2000), total soluble tannins % (Balbaa, 1981) and total anthocyannis in the peels and grain of fruit (mg/ 100 g F.W.) (Fulcki and Francis, 1968).

Statistical analysis was done using randomized complete block design (RCBD) (according to Mead *et al*., 1993). New L.S.D at 5% parameter was used for made all comparisons among various treatment means.

Results and Discussion

1. Effect of different concentrations and frequencies of application of salicylic acid (SA) on some vegetative growth characteristics:

It is clear from the data in Table (2) that all treatments of SA on Manfalouty pomegranate trees once (at growth start), twice (growth start and again just after fruit setting) and thrice (growth start, just after fruit setting and one month later) with SA at 50 to 200 ppm significantly stimulated the five growth aspects namely the number of new shoots/tree, shoot length, number of leaves per shoot, leaf area and total surface area/tree comparing to the control treatment. The promotion on these growth characteristics was associated with in-

creasing concentrations from 50 to 200 ppm and frequencies of application of SA from once to thrice. Significant differences on these growth traits were observed among most concentrations except between 100 and 200 ppm and frequencies of application except among twice or thrice. The maximum values of number of new shoots/tree (129.9 & 137.0), shoot length (85.3 & 87.3 cm), number of leaves/shoot (59.3 & 65.3), leaf area (7.05 & 7.14 m^2) and total surface area/tree (5.43 & 6.39 m^2) were observed on the trees that received three sprays of SA at 200 ppm during both seasons, respectively. The lowest values were recorded on untreated trees. These results were true during both seasons.

2. Effect of different concentrations and frequencies of application of salicylic acid (SA) on the leaf chemical composition:

It is obvious from the obtained data in Tables (2 to 4) that subjecting Manfalouty pomegranate trees once, twice or thrice with SA at 50 to 200 ppm was significantly accompanied with enhancing leaf pigment namely chlorophylls a & b, total chlorophylls, total carotenoids, N, P, K, Mg, Ca, Zn, Fe, Mn and Cu relative to the control treatment. There was a gradual promotion on these leaf components with increasing concentrations of SA from 50 to 200 ppm and frequencies of application from once to thrice. Increasing concentrations from 100 to 200 ppm and frequencies of application from twice to thrice failed to show significant differences on these chemical components. Treating the trees three times with SA at 200 ppm gave the maximum values of chlorophyll a (7.33 & 7.54 mg/100 g F.W), chlorophyll b (2.55 & 2.57 mg/100 g F.W), total chlorophylls (9.88 & 10.11 mg/100g F.W), total carotenoids (2.32 & 2.22 mg/100g F.W), N (1.88 & 2.01%), P (0.23 & 0.23%), K (1.41 & 1.42%), Mg (0.86 & 0.87), Ca (2.57 & 2.86%), Zn (65.6 & 63.9 ppm), Mn (67.0 & 67.6 ppm), Fe (67.9 & 67.0 ppm) and Cu (1.10 & 1.10 ppm) during both seasons, respectively. The untreated trees produced the lowest values. Similar results were announced during both seasons.

3. Effect of different concentrations and frequencies of application of salicylic acid (SA) on the percentages of initial fruit setting and fruit retention:

It is clear from the obtained data in Table (5) that treating Manfalouty pomegranate trees with SA once, twice or thrice at 50 to 200 ppm significantly stimulated the percentages of initial fruit setting and fruit retention relative to the check treatment. There was a gradual promotion on such two parameters with increasing concentrations from 50 to 200 ppm and frequencies of application from once to thrice. Increasing concentration of salicylic acid from 100 to 200 ppm and frequencies of application from twice to thrice had meaningless promotion on such two fruit setting aspects. The maximum values of initial fruit setting (62.6 & 62.6) and fruit retention % (36.0 & 37.0 %) were recorded on the trees that received three sprays of salicylic acid at 200 ppm. The untreated trees produced the minimum values. Similar trend was noticed during both seasons.

4. Effect of different concentrations and frequencies of application of salicylic acid (SA) on the yield/tree:

Data in Table (5) show that number of fruits/trees as well as gross and marketable yield of Manfalouty pomegranate trees were significantly affected by varying concentrations and frequencies of application of SA. Subjecting the trees once, twice or thrice with salicylic acid from 50 to 200 ppm was significantly favourable in improving number of fruits/tree and gross and marketable yields relative to the control treatment. There was a gradual promotion on these parameters with increasing concentrations and frequencies of application of salicylic acid. No significant differences on these parameters were observed among the higher two concentrations (100 & 200 ppm) and frequencies of applications (twice or thrice). Therefore, from economical point of view, it is necessary to use salicylic acid twice at 100 ppm. Under such promised treatment number of fruits per tree reached 145 and 155 fruits, gross yield reached 63.9 and 69 kg and marketable yield reached 59.2 and 65 kg during both seasons, respectively. The untreated trees produced 101 & 100 fruits/tree, 40.5 & 40.2 kg gross yield and 32.4 & 32.2 kg marketable yield during 2014 and 2015 seasons, respectively. The percentage of increment on the number of fruits/tree reached 43.6 and 55.0%, gross yield reached 57.8 and 71.9% and marketable yield reached 82.7 and 101.9 due to application of salicylic acid twice at 100 ppm over the control treatment during both seasons, respectively. Similar trend was noticed during both seasons.

5. Effect of different concentrations and frequencies of application of salicylic acid (SA) on the percentage of fruit splitting:

It is clear from the obtained data in Table (6) that significant differences on the percentage of fruit splitting was observed among the investigated salicylic acid treatments. Treating the trees once, twice or thrice with salicylic acid at 50 to 200 ppm significantly was followed by controlling the percentage of fruit splitting relative to the control treatment. There was a gradual reduction on the percentage of fruit splitting with increasing concentrations of salicylic acid from 50 to 200 ppm and frequencies of application from once to thrice. Increasing concentrations from 100 to 200 ppm and frequencies of application from twice to thrice failed to show significant reduction on such undesirable phenomenon. The lowest values (6.9 & 5.7%) were recorded on the trees that received three sprays of salicylic acid at 200 ppm. Untreating the trees with salicylic acid gave the highest values namely 20.0 & 19.9% during both seasons, respectively. These results were similar during both seasons.

6. Effect of different concentrations and frequencies of application of salicylic acid (SA) on some physical and chemical characteristics of the fruits:

It is revealed from the obtained data in Tables (6 to 8) that treating Manfalouty pomegranate trees once, twice or thrice with SA at 50 to 200 ppm was significantly preferable for improving the physical and chemical

characteristics of the fruits in terms of increasing fruit weight and dimensions, grain weight, juice%, eidible to non-edible portions, T.S.S.%, total sugars%, reducing sugars% as well as total anthocyanins in the fruit peel and grain and reducing fruit peel weight and thickness, total acidity% and total soluble tannins% over the check treatment.

There was a progressive promotion on fruit quality with increasing concentrations of SA from 50 to 200 ppm and frequencies of applications from once to thrice. Increasing concentrations of SA from 100 to 200 ppm and frequencies of applications from twice to thrice had no significant effect on most physical and chemical characteristics of the fruits. The studies SA treatments had no effect on fruit shape, fruit pomace% and non-reducing sugars%. The best results with regard to fruit quality were obtained due to using SA thrice at 200 ppm, but from economical point of view, it is suggested to use SA at 100 ppm twice for obtaining good results with regard to fruit quality, since no significant promotion was observed among the highest two concentrations and frequencies of application of SA. The untreated trees produced unfavourable effects on both physical and chemical characteristics of the fruits.

Values of total anthocyanins in the fruit peel reached 3.29 & 3.33 mg/100g F.W and 3.41 & 3.51 mg/100g F.W in the grain in the trees treated with SA thrice at 200 ppm during 2014 and 2015 seasons, respectively. This trend significantly reflected on improving colouration of fruits externally and internally and these reflected on solving the problem of irregular colouration of Manfalouty pomegranate trees. These results were true during both seasons.

Discussion

The beneficial effects of salicylic acid in enhancing the tolerance of fruit crop species to biotic and abiotic stresses and the biosynthesis of sugars, amino acid and plant pigments and the promoting effect of salicylic acid on cell division could explain the present results. The reducing effect of salicylic acid on the formation of reactive oxygen species and preventing cell death gave another explanation (Taiz and Zeiger, 2002 and Joseph *et al*., 2010).

These results are in harmony with those obtained by (El-Kady-Hanaa, 2011; El-Hanafy, 2011; Karmi *et al*., 2012; Mohamed-Ebtesam, 2012; Gad El-Kareem and Abd El- Rahman, 2013; Osman, 2014; Ayed, 2014; Mohamed, 2014; Akl *et al*., 2014; Abd El-Rady, 2015 and Mohamed-Attiat, 2016).

Table 2. Effect of different concentrations and frequencies of application of salicylic acid on some vegetative growth characteristics and chlorophyll a in the leaves of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	No. of new shoots/tree		Shoot length (cm)		No. of leaves/shoot		Leaf area $(cm)^2$		Total surface area/tree $(cm)^2$		Chlorophyll a (mg/100g F.W)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	89.0	90.0	60.0	61.4	45.6	51.0	5.50	5.61	2.23	2.57	6.11	6.20
Salicylic acid at 50 ppm once	95.0	98.0	65.0	66.5	48.0	54.0	5.79	5.90	2.64	3.12	6.36	6.45
Salicylic acid at 50 ppm twice	101.0	104.0	69.0	70.6	51.0	57.0	6.11	6.30	3.15	3.73	6.71	6.80
Salicylic acid at 50 ppm thrice	102.0	105.0	70.0	71.0	52.0	58.0	6.14	6.34	3.26	3.86	6.75	6.81
Salicylic acid at 100 ppm once	115.0	121.0	76.0	78.3	55.0	62.0	6.59	6.89	4.17	5.17	7.00	7.15
Salicylic acid at 100 ppm twice	128.0	135.0	84.0	86.9	58.0	64.6	6.92	7.11	5.14	6.20	7.31	7.50
Salicylic acid at 100 ppm thrice	129.0	136.0	84.9	87.1	58.9	65.0	6.98	7.13	5.30	6.30	7.32	7.52
Salicylic acid at 200 ppm once	116.0	122.0	77.0	78.4	55.5	62.6	6.61	6.90	4.26	5.27	7.05	7.16
Salicylic acid at 200 ppm twice	129.0	136.0	84.9	87.0	58.6	65.0	6.95	7.12	5.25	6.29	7.33	7.51
Salicylic acid at 200 ppm thrice	129.9	137.0	85.3	87.3	59.3	65.3	7.05	7.14	5.43	6.39	7.33	7.54
New L.S.D at 5%	**3.9**	**4.0**	**2.3**	**2.4**	**2.0**	**2.1**	**0.19**	**0.21**	**0.33**	**0.34**	**0.11**	**0.13**

Table 3. Effect of different concentrations and frequencies of application of salicylic acid on some leaf chemical components of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Chlorophyll b (mg/100g F.W)		Total chloro-phylls (mg/100g F.W)		Total caro-tenoids (mg/100g F.W)		Leaf N %		Leaf P %		Leaf K %	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	1.74	1.85	7.85	8.05	1.60	1.58	1.55	1.61	0.11	0.12	1.11	1.10
Salicylic acid at 50 ppm once	1.90	2.00	8.26	8.45	1.71	1.73	1.64	1.71	0.14	0.14	1.17	1.16
Salicylic acid at 50 ppm twice	2.09	2.16	8.80	8.96	1.87	1.89	1.74	1.81	0.16	0.16	1.23	1.22
Salicylic acid at 50 ppm thrice	2.11	2.17	8.86	8.98	1.89	1.90	1.75	1.82	0.17	0.17	1.24	1.23
Salicylic acid at 100 ppm once	2.31	2.35	9.31	9.50	2.00	2.09	1.80	1.92	0.20	0.19	1.34	1.32
Salicylic acid at 100 ppm twice	2.52	2.55	9.83	10.05	2.15	2.19	1.86	1.99	0.22	0.21	1.39	1.39
Salicylic acid at 100 ppm thrice	2.53	2.56	9.85	10.08	2.31	2.20	1.87	2.00	0.23	0.22	1.40	1.40
Salicylic acid at 200 ppm once	2.32	2.36	9.37	9.52	2.01	2.10	1.81	1.93	0.21	0.20	1.33	1.33
Salicylic acid at 200 ppm twice	2.53	2.56	9.86	10.07	2.16	2.20	1.87	2.00	0.22	0.22	1.40	1.41
Salicylic acid at 200 ppm thrice	2.55	2.57	9.88	10.11	2.32	2.22	1.88	2.01	0.23	0.23	1.41	1.42
New L.S.D at 5%	**0.09**	**0.11**	**0.12**	**0.10**	**0.08**	**0.07**	**0.05**	**0.07**	**0.02**	**0.02**	**0.03**	**0.04**

Table 4. Effect of different concentrations and frequencies of application of salicylic acid on some leaf chemical components of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Leaf Mg %		Leaf Ca %		Leaf Zn (ppm)		Leaf Mn (ppm)		Leaf Fe (ppm)		Leaf Cu (ppm)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	0.61	0.69	1.91	1.95	49.1	50.2	51.3	52.2	54.0	53.9	0.91	0.88
Salicylic acid at 50 ppm once	0.66	0.72	2.09	2.11	52.9	53.0	55.0	56.0	56.9	56.9	0.93	0.92
Salicylic acid at 50 ppm twice	0.71	0.76	2.29	2.30	56.9	56.0	59.0	59.9	60.0	59.9	0.97	0.97
Salicylic acid at 50 ppm thrice	0.72	0.77	2.30	2.31	57.0	56.3	59.3	60.0	60.9	60.0	0.98	0.98
Salicylic acid at 100 ppm once	0.79	0.81	2.41	2.46	60.1	59.2	62.9	63.0	63.9	63.0	1.04	1.04
Salicylic acid at 100 ppm twice	0.84	0.85	2.55	2.66	64.1	63.3	66.0	66.6	67.0	66.0	1.08	1.08
Salicylic acid at 100 ppm thrice	0.85	0.86	2.56	2.67	64.9	63.4	66.6	67.0	67.3	66.7	1.09	1.09
Salicylic acid at 200 ppm once	0.80	0.82	2.42	2.47	60.9	59.3	63.0	63.3	64.0	63.3	1.05	1.05
Salicylic acid at 200 ppm twice	0.85	0.86	2.56	2.67	65.0	63.6	66.3	67.0	67.0	66.7	1.09	1.09
Salicylic acid at 200 ppm thrice	0.86	0.87	2.57	2.68	65.6	63.9	67.0	67.6	67.9	67.0	1.10	1.10
New L.S.D at 5%	**0.03**	**0.03**	**0.08**	**0.07**	**2.1**	**2.3**	**2.4**	**2.6**	**2.0**	**1.8**	**0.02**	**0.03**

Table 5. Effect of different concentrations and frequencies of application of salicylic acid on the percentages of initial fruit setting and fruit retention, number of fruits/tree, percentage of fruit splitting and gross as well as and marketable yields/tree of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Initial fruit setting %		Fruit retention %		No. of fruits/tree		Fruit splitting %		Gross yield/tree		Marketable yield/tree	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	51.0	51.3	29.0	28.3	101.0	100.0	20.0	19.9	40.5	40.2	32.4	32.2
Salicylic acid at 50 ppm once	53.0	53.6	30.1	29.9	107.0	110.0	16.5	16.0	43.8	45.1	36.6	37.9
Salicylic acid at 50 ppm twice	55.0	55.5	31.9	31.3	112.0	116.9	14.0	13.0	46.8	49.2	40.2	42.9
Salicylic acid at 50 ppm thrice	55.6	55.7	32.0	31.6	113.0	117.0	13.7	12.7	47.5	49.4	41.0	43.1
Salicylic acid at 100 ppm once	59.0	59.9	33.9	34.0	135.0	140.0	12.0	10.5	58.2	60.9	51.1	54.5
Salicylic acid at 100 ppm twice	61.9	62.0	35.3	36.0	145.0	155.0	7.4	6.0	63.9	69.1	59.2	65.0
Salicylic acid at 100 ppm thrice	62.0	62.3	35.7	36.7	146.0	156.0	7.0	5.9	64.5	69.9	60.0	65.8
Salicylic acid at 200 ppm once	59.3	60.0	34.0	34.6	136.0	141.0	11.9	10.4	58.6	61.5	51.6	55.1
Salicylic acid at 200 ppm twice	62.0	62.2	35.9	36.5	146.0	156.0	7.3	5.9	64.5	69.7	59.8	65.6
Salicylic acid at 200 ppm thrice	62.6	62.6	36.0	37.0	147.0	157.0	6.9	5.7	65.1	70.7	60.6	66.7
New L.S.D at 5%	**1.1**	**1.2**	**0.9**	**1.0**	**4.9**	**5.1**	**1.1**	**0.9**	**1.1**	**1.2**	**1.2**	**1.3**

Table 6. Effect of different concentrations and frequencies of application of salicylic acid on some physical characteristics of the fruits of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Fruit weight (g.)		Fruit height (cm)		Fruit diameter (cm)		Fruit shape		Fruit peel weight %		Fruit thickness (cm)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	401.1	402.0	7.90	7.80	8.05	7.96	0.98	0.98	45.9	45.0	0.66	0.68
Salicylic acid at 50 ppm once	409.0	410.0	8.00	7.91	8.15	8.06	0.98	0.98	44.0	43.0	0.62	0.64
Salicylic acid at 50 ppm twice	418.0	421.0	8.10	8.02	8.25	8.17	0.98	0.98	42.0	40.9	0.58	0.60
Salicylic acid at 50 ppm thrice	420.0	422.0	8.12	8.04	8.26	8.18	0.98	0.98	41.9	40.6	0.57	0.59
Salicylic acid at 100 ppm once	431.0	435.0	8.22	8.19	8.38	8.35	0.98	0.98	39.9	38.9	0.54	0.56
Salicylic acid at 100 ppm twice	441.0	446.0	8.30	8.30	8.44	8.50	0.98	0.98	38.7	38.0	0.50	0.52
Salicylic acid at 100 ppm thrice	442.0	448.0	8.31	8.32	8.45	8.51	0.98	0.98	38.5	37.9	0.49	0.51
Salicylic acid at 200 ppm once	431.0	436.0	8.23	8.20	8.39	8.36	0.98	0.98	39.8	38.8	0.53	0.55
Salicylic acid at 200 ppm twice	442.0	447.0	8.31	8.31	8.45	8.50	0.98	0.98	38.6	37.9	0.49	0.51
Salicylic acid at 200 ppm thrice	443.0	450.0	8.32	8.32	8.47	8.52	0.98	0.98	38.4	37.6	0.48	0.50
New L.S.D at 5%	**5.0**	**4.9**	**0.06**	**0.06**	**0.06**	**0.06**	**NS**	**NS**	**0.6**	**0.6**	**0.04**	**0.04**

Table 7. Effect of different concentrations and frequencies of application of salicylic acid on some physical and chemical characteristics of the fruits of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Grain weight %		Juice %		Fruit pomace %		Edible/nonedible portions		T.S.S. %		Total sugars %	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	54.1	55.0	38.1	38.0	16.0	17.0	1.18	1.22	13.8	14.0	12.6	12.7
Salicylic acid at 50 ppm once	56.0	57.0	39.0	39.5	17.0	17.5	1.27	1.33	14.0	14.2	12.9	13.0
Salicylic acid at 50 ppm twice	58.0	59.1	40.0	41.0	18.0	18.1	1.38	1.44	14.3	14.5	13.3	13.3
Salicylic acid at 50 ppm thrice	58.1	59.4	40.2	41.3	17.9	18.1	1.39	1.46	14.4	14.6	13.4	13.4
Salicylic acid at 100 ppm once	60.1	61.1	41.9	42.6	18.2	18.5	1.51	1.57	14.7	14.8	13.7	13.8
Salicylic acid at 100 ppm twice	61.3	62.0	43.0	44.0	18.2	18.0	1.58	1.63	14.9	15.0	14.0	14.1
Salicylic acid at 100 ppm thrice	61.5	62.1	43.3	44.1	18.2	18.0	1.60	1.64	15.0	15.1	14.1	14.2
Salicylic acid at 200 ppm once	60.2	61.2	42.0	42.7	18.2	18.5	1.51	1.58	14.8	14.9	13.8	13.9
Salicylic acid at 200 ppm twice	61.4	62.1	43.3	44.1	18.1	18.0	1.59	1.64	15.0	15.1	14.1	14.2
Salicylic acid at 200 ppm thrice	61.6	62.4	43.6	44.2	18.0	18.2	1.60	1.66	15.1	15.2	14.2	14.3
New L.S.D at 5%	**1.3**	**1.4**	**0.7**	**0.6**	**NS**	**NS**	**0.04**	**0.05**	**0.2**	**0.2**	**0.2**	**0.2**

Table 8. Effect of different concentrations and frequencies of application of salicylic acid on some chemical characteristics of the fruits of Manfalouty pomegranate trees during 2014 and 2015 seasons

Salicylic acid (SA) treatments	Reducing sugars %		Non-reducing sugars%		Total acidity %		Total soluble tannins %		Total anthocyanins in the fruit peels (mg/100g F.W)		Total anthocyanins in the grain (mg/100g F.W)	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Control (sprayed with water trees)	12.1	12.1	0.5	0.6	1.459	1.465	1.27	1.29	2.91	2.95	2.91	2.88
Salicylic acid at 50 ppm once	12.3	12.4	0.6	0.6	1.420	1.425	1.22	1.23	2.98	3.03	3.00	2.99
Salicylic acid at 50 ppm twice	12.6	12.7	0.7	0.6	1.401	1.405	1.16	1.15	3.11	3.12	3.16	3.11
Salicylic acid at 50 ppm thrice	12.7	12.8	0.7	0.6	1.400	1.406	1.15	1.14	3.12	3.14	3.17	3.12
Salicylic acid at 100 ppm once	13.0	13.1	0.7	0.7	1.370	1.376	1.10	1.09	3.20	3.22	3.29	3.39
Salicylic acid at 100 ppm twice	13.3	13.5	0.7	0.6	1.340	1.345	1.04	1.04	3.27	3.31	3.39	3.49
Salicylic acid at 100 ppm thrice	13.4	13.6	0.7	0.6	1.338	1.344	1.03	1.02	3.28	3.32	3.40	3.50
Salicylic acid at 200 ppm once	13.1	13.2	0.7	0.7	1.368	1.375	1.09	1.08	3.21	3.23	3.30	3.40
Salicylic acid at 200 ppm twice	13.4	13.6	0.7	0.6	1.338	1.344	1.03	1.03	3.28	3.32	3.40	3.50
Salicylic acid at 200 ppm thrice	13.5	13.7	0.7	0.6	1.336	1.343	1.02	1.01	3.29	3.33	3.41	3.51
New L.S.D at 5%	**0.2**	**0.2**	**NS**	**NS**	**0.017**	**0.016**	**0.04**	**0.04**	**0.05**	**0.05**	**0.06**	**0.07**

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استجابة أشجار الرمان المنفلوطى للرش الورقى بحامض السلسليك

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الملخص

أجريت هذه الدراسة خلال موسمى ٢٠١٤، ٢٠١٥ لاختبار تأثير ثلاثة تركيزات (٥٠، ١٠٠، ٢٠٠ جزء فى المليون) وعدد مرات الرش المختلفة (مرة، مرتين، ثلاث مرات) لحامض السلسليك علي النسبة المئوية لتشقق الثمار وكمية المحصول وخصائص الجودة للثمار فى اشجار الرمان المنفلوطى النامية تحت ظروف منطقة المنيا.

كان رش الأشجار بحامض السلسليك مرة، مرتين، ثلاث مرات بتركيز ما بين ٥٠ إلي ٢٠٠ جزء فى المليون فعالا جدا فى تحسين جميع صفات النمو الخضرى وصبغات الورقة وعناصر النيتروجين والفوسفور والبوتاسيوم والماغنسيوم والكالسيوم والزنك والحديد والمنجنيز والنحاس والنسبة المئوية للعقد الأولى وللثمار الباقية علي الشجرة وكمية المحصول الكلية والتى سيتم تسويقها وكذلك الخصائص الطبيعية والكيميائية للثمار وكان التحسن فى هذه الصفات متناسبا طرديا مع زيادة التركيز المستخدم من ٥٠ الي ٢٠٠ جزء فى المليون ومرات الرش المستخدمة من حامض السلسليك من مرة إلي ثلاث مرات.

لم يتأثر شكل الثمرة والنسبة المئوية للتفل والسكريات المختزلة بالمعاملات المختلفة لحامض السلسليك وكان هناك انخفاض واضح فى النسبة المئوية لتشقق الثمار بمعاملات حامض السلسليك.

لآجل تقليل النسبة المئوية لتشقق الثمار وتحسين كمية المحصول وخصائص الجودة فى اشجار الرمان المنفلوطى النامية تحت ظروف منطقة المنيا فإنه يتم رش الأشجار مرتين بحامض السلسليك فى بداية النمو الخضرى وبعد مرحلة عقد الثمار مباشرة بتركيز ١٠٠ جزء فى المليون.

الكلمات الدالة: *حامض السلسليك – أشجار الرمان المنفلوطى – كمية المحصول – خصائص الجودة للثمار – تشقق الثمار.*