

## Controlling Fruit Splitting and Improving Productivity of Manfalouty Pomegranate Trees by Using Salicylic Acid and Some Nutrients

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**Abstract:** An attempt was made for alleviating fruit splitting and improving productivity of Manfalouty pomegranate trees grown under Assiut region conditions by spraying salicylic acid at 100ppm, magnesium sulphate at 0.5%; chelated -Zn at 0.05%, boric acid at 0.05% and calcium chloride at 2% either singly or in all possible combinations. The selected trees received four sprays at the first week of March, April, May and June. Single and combined applications of salicylic acid at 100ppm, magnesium sulphate at 0.5%; chelated -Zn at 0.05%, boric acid at 0.05% and calcium chloride at 2% was very effective in checking fruit splitting and improving yield as well as physical and chemical characteristics of the fruits. Nutrients were superior than salicylic acid in this respect. The promotion was materially associated with using calcium chloride, boric acid, chelated- Zn, magnesium sulphate and salicylic acid, in descending order. For reducing fruit splitting and improving productivity of Manfalouty pomegranate trees grown under Assiut region conditions, it is suggested to spraying the trees four times with a mixture containing salicylic acid at 100 ppm, magnesium sulphate at 0.5%; chelated -Zn at 0.05%, boric acid at 0.05% and calcium chloride at 2%.

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### 1. Introduction

Cracking or splitting of fruits is a serious problem faces pomegranate growers. It occurs more frequently in dry atmosphere of the arid regions. The loss in yield due to this undesirable phenomenon reached 40% in some pomegranate cvs. In addition, the cracking fruits are sweeter, loss keeping quality, unfit for shipment and liable to rot (**Malhatra et al, 1983**). Hot dry weather, heredity, variety, fruit growth and cultural practices are the main factors involved in enhancing fruit cracking of pomegranate (**Saad et al, 1988**). The later waves of fruit set have more tendency to split than the early ones (**Mohamed, 2004**). There are many horticultural practices used to reduce this problem. Out of these treatments correct nutrition with calcium, magnesium, boron and zinc as well as using antioxidants (**Morsy et al, 2008**).

Calcium and magnesium were found to be important in controlling fruit splitting due to the role of both Ca and Mg as constituents of cell walls in the form of Ca and Mg pectates. The formation of firm cell walls was attributed to the stabilization of membrane systems and the formation of Ca and Mg pectates which increased rigidity of the middle lamella and cell wall. Also, Ca and Mg are responsible for strengthening the bonds between epidermal and other fruit cells resulting in better strength and low cracking (**Poovalah, 1986**). Moreover, the role of Ca in stopping

the formation of abscission zone between fruit pedicles and bearing branches as well as regulating the activity of enzymes and photosynthesis (**Tony and John, 1994, Mighani et al, 1995 and Jackman and Stanley, 1995**) could result in controlling fruit splitting %.

Zinc plays many important regulatory roles in plant development. It activates many enzymes involved in plant metabolism and enhances the biosynthesis of some organic foods and IAA as well as stimulates cell division, cell enlargement, water absorption and nutrient transport. It is also important for strengthening cell wall and reducing the formation of the abscission zone (**Yagodin, 1990**).

Boron plays an important role in the extension of plant cell walls through its association with cell wall pectins (**Kaneko et al, 1997**). It is known also the role of boron in plant metabolism including many physiological aspects such as nucleic acid metabolism, protein, natural hormone biosynthesis, building and translocation of carbohydrates, photosynthesis, cell division, cell wall synthesis membrane function, water uptake and pollen germination (**Mengel et al, 2001**).

Previous studies showed that using different nutrients (**El- Kholy, 1999; Kuldeep et al, 2001; Abdel- Aziz et al, 2001; Hasaballa, 2002 and Abdelaal, 2007**) were very effective in reducing fruit splitting and, yield and fruit quality of fruit crops.

Antioxidants especially salicylic acid are safe to human and environment and play an important role in protecting the cells from senescence and preventing free radicals from oxidation of lipids the components of plasma membrane. Salicylic acid is also involved in minimizing of the stresses through enhancing antioxidant system. It is responsible for enhancing natural hormones that play a key part in regulating plant growth and development (Senarataa *et al*, 2004). Using salicylic acid was very effective in enhancing yield and fruit quality of different fruit crops (Ahmed *et al*, 2010; Abada and Abd El-Hameed, 2010 and Wassel *et al*, 2011).

The objective of this study was examining the effect of spraying salicylic acid and some nutrients on controlling fruit splitting and improving yield and fruit quality of Manfalouty pomegranate trees grown under Assiut conditions.

## 2. Material and Methods

This study was carried out during the two successive seasons of 2012 and 2013 on thirty – three uniform in vigour 9- years old Manfalouty pomegranate trees grown in a private orchard situated at Bany- Shokair village, Manfalouty district, Assiut Governorate. The trees are planted in heavy clay soil (Table 1) at 3.5 x 3.0 m apart. Surface irrigation system using Nile water was adopted. Regular horticultural management were applied to all the experimental trees as recommended:

**Table (1): Analysis of the soil at the trial location:**

Constituents	values
<b>Particle size distribution:</b>	
Sand %	: 6.00
Silt %	: 13.21
Clay %	: 80.79
Texture	: Clay
pH (1:2.5 extract)	: 7.71
E.C (1:2.5 extract) (mmhos/ cm/ 25 <sup>o</sup> C)	: 0.70
O.M. %	: 2.21
CaCO <sub>3</sub> %	: 1.50
Total N %	: 0.01
Available P (ppm, Olsen)	: 3.8
Available K (ppm) (ammonium acetate)	: 411.3

This investigation included the following eleven treatments from salicylic acid and different nutrients (Mg, Ca, Zn and B).

- 1- Control ( untreated trees).
- 2- Spraying salicylic acid at 100 ppm ( 0.1 g -1L)
- 3- Spraying magnesium sulphate at 0.5%.
- 4- Spraying chelated- Zn at 0.05%
- 5- Spraying boric acid at 0.05%.
- 6- Spraying calcium chloride at 2%
- 7- Spraying salicylic acid at 100 ppm + magnesium sulphate at 0.5%.

- 8- Spraying salicylic acid at 100 ppm + chelated-Zn at 0.05%
- 9- Spraying salicylic acid at 100 ppm + boric acid at 0.05%.
- 10- Spraying salicylic acid at 100 ppm + calcium chloride at 2%
- 11- Spraying salicylic acid at 100 ppm + magnesium sulphate at 0.5% + chelated-Zn at 0.05% + boric acids at 0.05% + calcium chloride at 0.5%

Each treatment was replicated three times, one tree per each. Salicylic acid as well as magnesium sulphate (9.6 % Mg); chelated-Zn, boric acid (17 % B) and calcium chloride were sprayed four times at the first week of Marsh (growth start setting), May and June. All nutrients were easily soluble in water, however, salicylic acid was dissolved in distilled water and the pH was adjusted at 6.5 with NaOH. Triton B as a wetting agent was added at 0.05% to all spraying solution before application. Spraying was done till run off (5 L / tree). The control trees were sprayed with water containing Triton B.

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

During both seasons, the following measurements were recorded.

- 1- Total surface area / tree (m<sup>2</sup>) (Ahmed and Morsy (1999) and the leaf content of total carbohydrate (Smith *et al*, 1956); N, P, K, Mg and Ca (Summer, 1985) and Wilde *et al*, (1985) and C/N in the leaves.
- 2- Number of flowers / shoot and percentages of initial and fruit retention.
- 3- Yield expressed in number of fruits, as well as gross (kg,) and marketable yield/ tree (kg.).
- 4- Fruit splitting % and weight of splitted fruits per tree.
- 5- Physical and chemical characteristics of the fruits namely fruit weight (g.), fruit grain %, fruit peel weight %, juice %, T.S.S. %, total and reducing sugars %, total acidity % (as citric acid (A.O.A.C., 1995) and total soluble tannins % (Balbaa, 1981).

Statistical analysis was done and the treatment means were compared using new L.S.D. at 5 % (Mead *et al*, 1993).

## 3. Results and Discussion

### 1-Effect of spraying salicylic acid and different nutrients on the total surface area/ tree and leaf chemical compositions.

It is clear from the data in Tables (2 & 3) that foliar application of salicylic acid at 100 ppm, magnesium sulphate at 0.5%, chelated –Zn at 0.05%, boric acid at 0.05 % and calcium chloride at 2% either applied singly or in various combinations significantly

was responsible for enhancing the total surface area per plant and the investigated organic and mineral nutrients (total carbohydrate %, N, P, K, Mg and Ca) in relative to the control treatment. The promotion was significantly depended on using salicylic acid, magnesium sulphate, chelated -Zn, boric acid and calcium chloride, in ascending order. Using the studied nutrients was significantly preferable than using salicylic acid in this connection. The maximum values of total surface area per tree (7.83 and 8.70 m<sup>2</sup>), total carbohydrates (15.33 and 15.41%), N ( 1.95 and 2.07 %), P ( 0.37 and 0.31 %), K ( 1.78 and 1.85 %), Mg ( 0.87 and 0.94%) and Ca ( 2.62 and 2.55 %) were recorded on the trees that were supplied with salicylic acid and all nutrients together during 2012 and 2013 seasons respectively. Untreated trees produced the minimum values. These results were true during both seasons. C.N. in the leave did not significantly alter with the present treatments.

## 2- 1-Effect of spraying salicylic acid and different nutrients on flowering, fruit setting and yield per tree.

Data listed in tables ( 4 & 5) obviously reveal that single and combined applications of salicylic acid, magnesium sulphate, chelated - Zn, boric acid and calcium chloride significantly was accompanied with improving number of flowers per shot, percentages of initial fruit setting and fruit retention, number of fruits per tree as well as gross and marketable yield rather than non - application. Using salicylic acid, magnesium sulphate, chelated -Zn, boric acid and calcium chloride, in ascending order was significantly very effective in enhancing flowering, fruit setting and yield. Using salicylic acid and all nutrients together gave the highest values of gross (126.9 and 135.3kg) and marketable yield ( 121.4 and 129.6 kg) during 2012 and 2013 seasons, respectively. Untreated trees produced the minimum gross (18.9 and 20.1 kg) and marketable yields (15.9 and 16.8 kg) during both seasons, respectively. These results were true during both seasons.

## 3- Effect of spraying salicylic acid and different nutrients on fruit splitting % and weight of splitted fruits / tree.

As shown in Table (5) percentage of fruit splitting was significantly declined in response to foliar application of salicylic acid and nutrients applied either singly or in combination over the check treatment. The reduction on the percentage of fruit splitting was significantly associated with spraying salicylic acid, magnesium sulphate, chelated -Zn, boric acid and calcium chloride, in ascending order. Combined applications of these substances significantly were favourable than using each alone in this respect. The minimum values of fruit splitting were recorded on the trees that received salicylic acid and all nutrients together. Under such promised treatment, fruit splitting % reached 4.3 and 4.2% during both seasons, respectively. Untreated the trees produced the maximum values (15.1 and 16.2%) during both seasons, respectively. The investigated treatments had no significant effect on the weight splitted fruits / tree. These results were true during both seasons.

## 4- Effect of spraying salicylic acid and different nutrients on some physical and chemical characteristics of the fruits.

It is clear from the data in Tables ( 6 & 7) that spraying salicylic acid, magnesium sulphate, chelated - Zn, boric acid and calcium chloride either alone or in all combination significantly resulted in improving fruit quality in terms of increasing fruit weight, fruit grain %, juice %, T.S.S. % as well as total and reducing sugars and decreasing fruit peel weight %, total soluble tannins % and total acidity % in relative to the control treatment. Using salicylic acid, magnesium sulphate, chelated -Zn, boric acid and calcium chloride, in ascending order gave the best results with regard to fruit quality. A noticeable promotion was observed on fruit quality owing to using salicylic acid and all nutrients together. Unfavourable effects on fruit quality were observed on untreated trees. These results were true during both seasons.

Table (2): Effect of spraying salicylic acid and some nutrients on the total surface area/plant as well as total carbohydrates%, C /N and nitrogen% in the leaves of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	Total surface area /tree(m <sup>2</sup> )		Leaf total carbohydrates %		C/N in the leaves		Leaf N %	
	2012	2013	2012	2013	2012	2013	2012	2013
1- Control ( untreated trees)	2.58	2.73	12.31	12.48	8.10	8.05	1.52	1.55
2- Salicylic acid at 100 ppm	2.95	3.21	12.61	12.78	7.98	7.99	1.58	1.60
3-Magnesium sulphate at 0.5%	3.29	3.59	12.92	13.10	7.88	7.89	1.64	1.66
4- Chelated-Zn at 0.5%	3.68	4.04	13.30	13.41	7.78	7.84	1.71	1.71
5- Boric acid at 0.05%	4.18	4.51	13.61	13.62	7.78	7.74	1.75	1.76
6- Calcium chloride at 2%	4.82	5.06	13.99	13.85	7.86	7.57	1.78	1.83
7- Salicylic acid + magnesium sulphate	5.31	5.63	14.30	14.09	7.86	7.49	1.82	1.88
8- Salicylic acid + chelated zinc	5.90	6.44	14.55	14.31	7.82	7.41	1.86	1.93
9- Salicylic acid + Boric acid	6.47	7.08	14.79	14.61	7.78	7.34	1.90	1.99
10- Salicylic acid + Calcium chloride	7.04	7.76	15.09	14.82	7.78	7.30	1.94	2.03
11- Salicylic acid + all nutrients	7.83	8.70	15.33	15.41	7.86	7.44	1.95	2.07
New L.S.D. at 5%	0.29	0.31	0.21	0.20	NS	NS	0.03	0.04

Table (3): Effect of spraying salicylic acid and some nutrients on the percentages of P, K, Mg and Ca in the leaves of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	Leaf P%		Leaf K%		Leaf Mg%		Leaf Ca%	
	2012	2013	2012	2013	2012	2013	2012	2013
1- Control ( untreated trees)	0.11	0.09	1.09	1.15	0.31	0.35	1.59	1.70
2- Salicylic acid at 100 ppm	0.14	0.11	1.17	1.23	0.36	0.41	1.65	1.76
3-Magnesium sulphate at 0.5%	0.16	0.14	1.23	1.29	0.60	0.66	1.72	1.84
4- Chelated-Zn at 0.5%	0.18	0.16	1.30	1.36	0.46	0.50	1.80	1.91
5- Boric acid at 0.05%	0.21	0.17	1.36	1.42	0.51	0.55	1.90	1.97
6- Calcium chloride at 2%	0.24	0.20	1.43	1.50	0.55	0.60	2.41	2.33
7- Salicylic acid + magnesium sulphate	0.27	0.22	1.49	1.56	0.82	0.87	2.11	2.11
8- Salicylic acid + chelated zinc	0.30	0.24	1.55	1.61	0.66	0.71	2.22	2.19
9- Salicylic acid + Boric acid	0.32	0.25	1.61	1.69	0.71	0.76	2.31	2.22
10- Salicylic acid + Calcium chloride	0.35	0.27	1.69	1.77	0.78	0.81	2.51	2.40
11- Salicylic acid + all nutrients	0.37	0.31	1.78	1.85	0.87	0.94	2.62	2.55
New L.S.D. at 5%	0.02	0.02	0.06	0.05	0.04	0.05	0.06	0.07

Table (4): Effect of spraying salicylic acid and some nutrients on the number of flowers/shoot, percentage of initial fruit setting and fruit retention and number of fruits per tree of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	No. of flowers/shoot		Initial fruit setting%		Fruit retention%		Number of fruits per tree	
	2012	2013	2012	2013	2012	2013	2012	2013
1- Control ( untreated trees)	2.0	2.0	51.0	51.9	30.0	31.2	54.0	57.0
2- Salicylic acid at 100 ppm	2.0	2.1	52.2	53.2	31.8	33.0	60.0	67.0
3-Magnesium sulphate at 0.5%	2.9	3.0	53.3	54.2	33.6	34.8	95.0	104.0
4- Chelated-Zn at 0.5%	2.9	3.0	54.4	55.5	53.2	36.2	103.0	112.0
5- Boric acid at 0.05%	3.0	3.0	56.0	57.1	37.0	38.2	117.0	122.0
6- Calcium chloride at 2%	3.0	3.0	58.0	59.0	38.6	39.8	126.0	132.0
7- Salicylic acid + magnesium sulphate	3.9	4.0	59.0	60.0	40.5	41.7	177.0	190.0
8- Salicylic acid + chelated zinc	3.9	4.0	60.1	61.1	42.5	43.8	193.0	207.0
9- Salicylic acid + Boric acid	3.9	4.0	60.2	61.2	44.6	45.8	209.0	223.0
10- Salicylic acid + Calcium chloride	3.9	4.0	61.0	62.1	46.7	47.8	225.0	241.0
11- Salicylic acid + all nutrients	4.9	5.0	62.9	63.1	48.9	50.1	308.0	326.0
New L.S.D. at 5%	0.9	0.8	1.0	1.1	1.6	1.4	5.0	5.7

Table (5): Effect of spraying salicylic acid and some nutrients on gross yield, fruit splitting%, number of splitted fruits/tree and marketable yield/tree (kg.) of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	Gross yield/tree (kg)		Fruit splitting%		Weight of splitted fruits/tree		Marketable yield/tree(kg.)	
	2012	2013	2012	2013	2012	2013	2012	2013
1- Control ( untreated trees)	18.9	20.1	15.1	16.2	3.0	3.3	15.9	16.8
2- Salicylic acid at 100 ppm	21.4	24.0	14.1	15.2	3.0	3.6	18.4	20.4
3-Magnesium sulphate at 0.5%	34.4	37.8	12.8	13.9	4.4	5.3	29.6	32.5
4- Chelated-Zn at 0.5%	37.9	41.3	11.0	12.1	4.2	5.0	33.7	29.2
5- Boric acid at 0.05%	43.8	45.8	10.0	11.2	4.4	5.1	39.4	40.7
6- Calcium chloride at 2%	47.9	50.4	9.1	10.2	4.4	5.1	43.5	45.3
7- Salicylic acid + magnesium sulphate	68.1	73.5	8.0	9.1	5.4	6.7	62.7	66.8
8- Salicylic acid + chelated zinc	75.5	81.6	7.1	8.2	5.4	6.7	70.1	74.9
9- Salicylic acid + Boric acid	83.0	89.0	6.3	7.4	5.2	6.6	77.8	82.4
10- Salicylic acid + Calcium chloride	90.5	97.6	5.5	6.6	5.0	6.4	85.5	91.2
11- Salicylic acid + all nutrients	126.9	135.3	4.3	4.2	5.5	5.7	121.4	129.6
New L.S.D. at 5%	1.9	2.1	0.7	0.6	NS	NS	2.0	2.3

Table (6): Effect of spraying salicylic acid and some nutrients on fruit weight (g.), fruit peel weight %, fruit grain weight % and juice % of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	Fruit weight (g.)		Fruit peel weight %		Fruit grain weight %		Juice %	
	2012	2013	2012	2013	2012	2013	2012	2013
1- Control ( untreated trees)	350.9	352.0	45.0	45.7	55.0	54.3	38.0	37.7
2- Salicylic acid at 100 ppm	357.0	358.1	44.1	44.8	55.9	55.2	38.8	38.5
3- Magnesium sulphate at 0.5%	362.0	363.1	43.1	43.8	56.9	56.2	39.9	39.6
4- Chelated-Zn at 0.5%	367.7	368.8	42.1	42.8	57.9	57.2	41.0	40.7
5- Boric acid at 0.05%	374.0	375.6	41.3	42.0	58.7	58.0	41.9	41.6
6- Calcium chloride at 2%	380.0	382.0	40.5	41.2	59.5	58.8	43.7	43.4
7- Salicylic acid + magnesium sulphate	384.9	387.0	39.1	39.8	60.9	60.2	45.0	44.7
8- Salicylic acid + chelated zinc	391.2	394.0	38.3	39.0	61.7	61.0	46.7	46.3
9- Salicylic acid + Boric acid	397.0	399.0	37.5	38.3	62.5	61.7	49.0	48.7
10- Salicylic acid + Calcium chloride	402.0	405.0	36.8	37.3	63.2	62.7	49.7	49.4
11- Salicylic acid + all nutrients	411.9	414.9	35.1	35.9	64.9	64.1	51.6	51.3
New L.S.D. at 5%	4.1	3.9	0.6	0.5	0.7	0.6	0.7	0.7

Table (7): Effect of spraying salicylic acid and some nutrients on some chemical characteristics of the fruits of Manfalouty pomegranate trees during 2012 and 2013 seasons.

Salicylic acid and nutrient treatments	T.S.S. %		Total sugars %		Reducing sugars %		Total soluble tannins %		Total acidity %	
	2012	2013	2012	2013	12.2	12.1	0.48	0.51	1.313	1.320
1- Control ( untreated trees)	14.0	13.7	12.8	12.7	12.4	12.3	0.46	0.49	1.290	1.297
2- Salicylic acid at 100 ppm	14.2	14.0	13.0	12.9	12.5	12.4	0.43	0.47	1.271	1.278
3- Magnesium sulphate at 0.5%	14.6	14.2	13.0	13.1	12.6	12.5	0.40	0.44	1.240	1.247
4- Chelated-Zn at 0.5%	14.9	14.5	13.2	13.3	12.8	12.7	0.38	0.41	1.210	1.217
5- Boric acid at 0.05%	15.1	14.8	13.3	13.5	13.0	12.9	0.35	0.38	1.190	1.198
6- Calcium chloride at 2%	15.3	15.0	13.5	13.6	13.2	13.1	0.33	0.36	1.160	1.166
7- Salicylic acid + magnesium sulphate	15.5	15.2	13.7	13.8	13.4	13.3	0.32	0.37	1.141	1.148
8- Salicylic acid + chelated zinc	15.7	15.5	13.8	14.0	13.6	13.5	0.30	0.34	1.117	1.124
9- Salicylic acid + Boric acid	15.8	15.7	14.0	14.1	13.7	13.6	0.28	0.31	1.095	1.100
10- Salicylic acid + Calcium chloride	16.0	16.1	14.0	14.2	13.8	13.9	0.24	0.26	1.070	1.061
11- Salicylic acid + all nutrients	16.3	16.3	14.2	14.4	0.2	0.2	0.02	0.02	0.015	0.014
New L.S.D. at 5%	0.2	0.2	0.2	0.2	0.2	0.2	0.02	0.02	0.015	0.014

#### 4. Discussion

The previous positive action of both calcium and magnesium on reducing fruit splitting of Manfalouty pomegranate trees might be attributed to their important roles in strengthening cell wall through building both calcium and magnesium pectates in the middle lamella as well as stabilization of membrane systems and strengthening the bonds between epidermal and other fruit cells. Such two macronutrients also are responsible for reducing the abscission zone formation among fruits and branches as well as regulating the mechanisms of photosynthesis and proteins (Poovaiah 1986, Tony and John, 1994 and Jackman and Stanley, 1995). The reduction on fruit splitting %, surely reflected on improving the yield. The beneficial effect of Ca and Mg in promoting the biosynthesis of sugars and plant pigments as well as checking the uptake of water was accompanied with enhancing maturity and improving fruit quality (Yagodin, 1990 and Mengel *et al*, 2001).

The beneficial effects of zinc on controlling water absorption and nutrient uptake as well as enhancing the biosynthesis of the natural hormone namely IAA surely

reflected on reducing fruit cracking % (Yagodin, 1990). In addition, zinc is responsible for strengthening cell wall and reducing the formation of the abscission zone (Mengel *et al*, 2001). Also, zinc plays many important regulatory roles in plant development through activating different enzymes, the biosynthesis of organic foods, cell division and cell enlargement (Yagodin, 1990). The promotion on yield was attributed to the great decline on fruit cracking %. The promoting effect of Zn on the biosynthesis of organic foods especially carbohydrates could result in promoting quality of the fruits.

The reducing effect on fruit cracking % in response to application of boron was mainly attributed to its important role in the extension of plant cell walls through building of pectins as well as enhancing IAA and water uptake (Yagodin, 1990). In addition, using boron achieved many merits such as building and translocation of carbohydrates and promoting photosynthesis and pollen germination and cell division (Kaneko *et al*, 1997).

These results concerning the beneficial effects of nutrients on fruiting are in agreement with those

obtained by **El- Kholy, (1994); Kuldeep *et al*, (2001); Abdel- Aziz *et al*, (2001); Hasaballa, (2002) and Abdelaal, (2007)** who mentioned that using Ca, Mg, Zn and B was very effective in reducing fruit cracking % in various pomegranate cvs.

The striking effect of salicylic acid on reducing fruit cracking % and promoting productivity of Manfalouty pomegranate trees might be attributed to its beneficial effect on reducing reactive oxygen, species that are responsible for destroying plasma membrane as well as enhancing the biosynthesis of IAA and minimizing the unfavourable effects of different stresses on plant development (**Senarataa *et al*, 2004**).

The promoting effect of different antioxidants on yield and fruit quality was emphasized by the results of **Ahmed *et al*, (2010); Abada and Abd El-Hameed, (2010) and Wassel *et al*, (2011)** on grapevines.

#### Conclusion:

Carrying out four sprays at the first week of March, April, May and June of a mixture of antioxidant and nutrients containing salicylic acid at 100ppm, magnesium sulphate at 0.5%; chelated -Zn at 0.05%, boric acid at 0.05% and calcium chloride at 2% is suggested for controlling fruit splitting and improving yield and Fruit Quality Of Manfalouty Pomegranate Trees Grown Under Assiut Region Conditions.

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