

RESPONSE OF MANFALOUTY POMEGRANTE TREES TO SPRAYING WITH GA₃ AND ANTIRANSPIRANT GREEN MIRACLE UNDER UPPER EGYPT CONDITIONS

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ABSTRACT

This study dealing with the effect of different concentrations of GA₃ (0.0, 50, 100 or 150 ppm) and the antitranspirant Green Miracle (0.0, 0.5, 1.0 and 2.0 %) on counteracting fruit splitting, yield and fruit quality of Manfalouty pomegranate trees grown under Upper Egypt conditions.

The results showed that spraying GA₃ at 50 to 150 ppm and antitranspirant Green Miracle at 0.5 to 2.0 % had no effect on leaf area, T.S.S., acid. Yet, improved the yield, fruit weight, percentages of moisture in the seeds and peels and vitamin C content. Total and reducing sugars, as well as fruit splitting were tended gradually to decrease with increasing concentrations of GA₃ and Green Miracle.

In most cases no material effect on such parameters was observed among the higher two concentrations of GA₃ and Green Miracle. Whereas, combined application of 100 ppm GA₃ and 1.0 % Green Miracle as antitranspirant twice at the first week of July and August is suggested for alleviating fruit splitting % and improving yield and fruit quality of Manfalouty pomegranate trees growing under sandy soils.

INTRODUCTION

Pomegranate is considered one of the most important and favourable fruit crops in south valley regions. Most pomegranate trees in this area are growing in sandy soil where they suffer from water stress salinity and high temperatures which cause a great decline on the production. The reasons for yield reduction are due to great dropping of flowers, lower fruit retention and high fruit splitting. Many attempts were conducted to improve yield of pomegranates through reducing fruit splitting and improving both fruit retention and fruit weight by using GA₃ and antitranspirants.

Previous studies showed that fruit splitting in most fruit crops especially pomegranates might be attributed to many factors namely susceptibility, higher temperature, deficiency of K, Zn, and B (Nijjar, 1985) as well as irregular irrigation during maturation and ripening of fruits.

The promoting effect of GA₃ on cell elongation and cell wall elasticity as well as the biosynthesis of proteins could explain its negative effect on fruit splitting as well as its positive action on fruit production (Nickell, 1982; Sharifi and Sepahi, 1984; Sepahi and Sharifi, 1986; Sepahi, 1986; El-Kassas *et al.*, 1989; El-Masry, 1989; Abbas and Mehana, 1992, Desai *et al.*, 1995 and Ahmed *et al.*, 1996).

Antitranspirants form a thin glassy film coat on the sprayed leaves which reflects the excess of light and temperatures and maintains healthy foliage. They also acts as spongy parenchymas cells that lead to reduce intercellular spaces and maintain turgor of the tissues. These effects certainly retard water stress and water transpiration and save energy with plant tissues. These great benefits of antitranspirants on plant metabolism surely

reflected on enhancing yield and fruit quality (Gale and Hagan , 1966; Albigo and Brown, 1970 and Al-Hmedawi , 2003).

This study aimed to presented the effect of GA₃ and the antitranspirant (Green Miracle) on alleviating fruit splitting and improving yield in Manfalouty pomegranate trees.

MATERIALS AND METHODS

This experiment was conducted during 2005 and 2006 seasons on 48 uniform in vigour 10 years-old own rooted Manfalouty pomegranate trees in a private orchard situated at Naja Hamady district, Qena Governorate where the texture of the soils is sandy. The selected trees are planted at 5x5 meters apart, under Surface irrigation system.

Soil analysis of the tested soil (According to **Wilde, et al., 1985**) are shown in Table (1).

Table (1) : Analysis of the tested soil

Sand %	65.2
Silt %	24.0
Clay %	10.8
Texture	Sandy
pH	8.00
O.M. %	0.5
Total CaCO₃ %	1.8
Total N %	0.02
Available K (ppm)	60

The present treatment included GA₃ at 0.0 , 50 , 100 and 150 ppm and antitranspirant (Green Miracle) at 0.0 , 0.5 , 1.0 and 2.0 %. So, this experiment included 16 treatments (4 GA₃ concentrations x 4 Green Miracle concentrations). Each treatment was replicated three, one tree per each replicate. Complete Randomized blocks design in split plot arrangement was adopted. The four concentrations of GA₃ and the four concentrations of antitranspirants occupied the main and sunplots , respectively. Both GA₃ and the antitranspirant (Green Miracle) were applied twice during each growing season at the first week of July and again at one month later (at the first week of August). Triton B as a wetting agent was added to all spraying solutions at 0.05 % till run off (5 L/tree).

All the undertaken trees were subjected to the same common horticultural practices that are usually applied in the orchard except the application of GA₃ and any antitranspirants .

Twenty full mature leaves/tree from the third and fourth, basal nodes of shoots were picked (last week of August) for measuring the leaf area (cm²) according to the following equation outlined by Ahmed and Morsy (1999).

$$\text{Leaf area (cm}^2\text{)} = 0.41(\text{ length x width }) + 1.83$$

At harvesting time (1st week of October in both seasons), the yield/tree expressed in weight (kg) was recorded. Fruit splitting % was estimated by counting the number of splitted fruits / tree and dividing this number by the total number of fruits / tree and multiplying the product by 100.

Ten fruits / tree was taken randomly to determine the following physical and chemical characters of the fruits.

- 1- Fruits weight (g.)
- 2- Percentages of moisture in the seeds and peels of fruits (according to A.O.A.C. 1985)
- 3- T.S.S. / acid.
- 4- Percentages of total and reducing sugars according to Lane and Eynon volumetric method that outlined in A.O.A.C. (1985)
- 5- Vitamin C content (as mg/ 100 ml, juice) by using 2,6 dichlorophenol endophenol dye (according to A.O.A.C., 1985)

The obtained data were tabulated and statistically analyzed according to Gomez and Gomez (1984) using L.S.D. parameter for determining the significantly between different treatment means.

RESULTS AND DISCUSSIONS

1- Effect of GA₃ and Green Miracle on the leaf area :

It is clear from Table (2) that using GA₃ at 50 to 150 ppm and Green Miracle as antitranspirant at 0.5 to 2.0 % had a slight stimulation on the leaf area compared to the check treatment. The stimulation was associated with increasing concentrations. Unsignificant effect was attributed to using GA₃ and green Miracle either singly or in combinations on the leaf area. Such trend was logically true, since both GA₃ and Green Miracle were applied lately after the development of leaf (i.e. after the leaves became mature).

Table (2): Effect of different GA₃ and Green Miracle concentrations on the leaf area, yield / tree and percentage of fruit splitting of Manfalouty pomegranate trees during 2005 and 2006 seasons.

Conc. of GA ₃ (A) (ppm)	2005				2006			
	Green Miracle concentrations (B)							
	Leaf area (cm) ²							
	0.0	0.5	1.0	2.0	0.0	0.5	1.0	2.0
0.0	7.97	8.00	8.10	8.20	8.20	8.22	8.25	8.31
50	7.99	8.12	8.19	8.26	8.23	8.26	8.30	8.34
100	8.27	8.29	8.39	8.40	8.27	8.34	8.39	8.42
150	8.36	8.39	8.46	8.50	8.33	8.40	8.45	8.51
L.S.D. 5%	A	B	AB		A	B	AB	
	NS	NS	NS	NS	NS	NS	NS	NS
	Yield / tree (kg)							
	0.0	0.5	1.0	2.0	0.0	0.5	1.0	2.0
0.0	28.5	31.2	37.0	37.7	33.8	35.5	41.0	41.8
50	31.0	34.6	41.0	41.8	35.5	37.6	45.0	45.5
100	43.0	47.1	59.0	59.9	46.0	48.1	62.0	62.5
150	43.8	47.5	59.5	60.1	46.8	49.1	63.0	63.3
L.S.D. 5%	A	B	AB		A	B	AB	
	1.4	1.2	2.4	1.9	1.6	3.2		
	Fruit splitting %							
	0.0	0.5	1.0	2.0	0.0	0.5	1.0	2.0
0.0	26.0	23.0	21.0	20.1	28.0	25.1	22.6	20.0
50	24.1	20.0	19.0	18.0	22.0	19.8	17.4	16.7
100	12.4	10.6	9.0	8.0	13.2	11.4	9.5	8.6
150	12.0	10.2	8.8	7.9	13.0	11.0	9.0	8.4
L.S.D. 5%	A	B	AB		A	B	AB	
	1.0	1.1	2.2	1.1	1.4	2.8		

2-Effect of GA₃ and Green Miracle on yield/ Tree :

As Table (2) show that GA₃ application at 50 to 150 ppm significantly improved the yield of Manfalouty pomegranate trees compared to the control. The promotion on the yield was associated with increasing concentrations of GA₃. Increasing GA₃ concentrations from 100 to 150 ppm had no significant effect on the yield. Therefore, the economical yield was recorded on the trees received two sprays of GA₃ at 100 ppm. Yet, the untreated trees produced the minimum values.

The promoting effect of GA₃ on fruit weight and dimensions as well as the counteracting effect of it on fruit splitting could result in enhancing the yield. In addition, the beneficial effect of GA₃ on withstanding the trees to unfavourable and stress conditions could give another explanation. (Nickell, 1982). Since, these results are in harmony with those obtained by Sharifi and Sepahi (1984), Ahmed *et al.*, (1996) and El-Salhy (1996a).

Concerning the effect of Green Miracle as antitranspirant on the yield (Table 2) show clearly that the yield was positively affected by spraying such compound at 0.5 to 2.0 % rather than the control. Significant differences on the yield were detected among all Green Miracle concentrations except for the higher two concentrations (1 and 2.0). The promotion on the yield was associated with increasing Green Miracle concentrations. Economically point of view, using such antitranspirant at 1% was recommended for improving the yield of Manfalouty pomegranate trees. The untreated trees produced the minimum values.

The interaction between GA₃ and Green Miracle had significant effect on the yield. Since, the best results for yield of Manfalouty pomegranate trees were obtained with spraying the trees twice with a mixture containing 100 ppm GA₃ plus 1 % Green Miracle. Under such promising treatment the yield per tree reached 59.0 and 62.0kg in both seasons, respectively. The untreated trees produced 28.5 and 22.8 kg in 2005 and 2006 seasons, respectively.

The beneficial of Green Miracle on increasing the withstanding of trees to stress conditions could result in stimulating growth and nutritional status of the trees in favour of increasing the yield. These results regarding the effects of antitranspirants on the yield are in concordance with those obtained by Bacha and Ibrahim (1979) and Al-Hmedawi (2003).

3-Effect of GA₃ and Green Miracle on fruit splitting % :

It is clear from Table (2) that spraying GA₃ at 50 to 150 ppm or Green Miracle at 0.5 to 2.0 % significantly was very effective in reducing fruits splitting % rather than the check one. The reduction was associated with increasing concentration of GA₃ from 50 to 150 ppm and Green Miracle from 0.5 to 2.0 %. Significant reduction on fruit splitting % was observed among all GA₃ and Green Miracle concentrations except among the higher two concentrations namely 100 and 150 ppm GA₃ and 1.0 and 2.0 % Green Miracle. The lowest values of fruit splitting % were recorded on the trees received to two sprays of GA₃ at 100 ppm in combined with Green Miracle at 1.0 %. Percentages of fruit splitting in such promising treatment reached 9.0 and 9.5 % in 2005 and 2006 seasons, respectively. Percentages of fruit splitting in untreated trees reached 26.5 and 28.0 % in both seasons,

respectively. The promoting effect of GA₃ on cell elongation and cell wall elasticity (Nickell, 1982) give reasonable explanation for the reducing effect of it on fruit splitting %.

The effect of antitranspirants on reducing fruit splitting might be attributed to their reducing effect on intercellular spaces which helps the plants for maintaining the turgor of the tissues. The effect of antitransplants on reducing the loss of water via transpiration from peels could result in decreasing fruit splitting. These results regarding the effect of GA₃ are in harmony with those obtained by Sepahi and Sharifi (1986) and El- Kassas *et al.*, (1989). Furthermore, the reducing effect of the antitranspirants on fruit splitting was supported by the results of Albigo *et al.*, (1970) and Bacha and Ibrahim (1979).

4-Effect of GA₃ and Green Miracle on fruit weight :

Data in Table (3) show clearly that foliar application with GA₃ at 50 to 150 ppm or Green Miracle at 0.5 to 2.0 % significantly improved fruit weight rather than non application. The promotion on fruit weight was in proportional to the increase in concentrations of each material. Significant differences on fruit weight were recorded among all concentrations of GA₃ and Green Miracle except among 100 and 150 ppm GA₃ as well as 1.0 and 2.0 % Green Miracle.

Table (3): Effect of different GA₃ and Green Miracle concentrations on fruit weight (g) and percentages of moisture in the seeds and peels of Manfalouty pomegranate trees during 2005 and 2006 seasons.

Conc. of GA ₃ (A) (ppm)	2005				2006			
	Green Miracle concentrations (B)							
	Fruit weight (g)							
	0.0	0.5	1.0	2.0	0.0	0.5	1.0	2.0
0.0	263.7	276.2	290.1	291.0	280.3	288.3	292.1	243.3
50	270.1	285.5	296.3	297.0	285.3	293.1	300.0	301.2
100	290.1	300.0	309.2	311.1	294.1	301.0	316.3	317.0
150	291.1	301.0	310.1	312.2	295.2	302.2	317.0	318.0
L.S.D. 5%	A	B	AB		A	B	AB	
	1.3	1.4	2.8		1.3	1.1	2.2	
Moisture % of seeds								
0.0	72.9	6.1	79.5	80.0	78.1	80.0	81.5	81.6
50	74.5	78.5	81.0	81.3	79.3	81.5	82.9	83.0
100	79.3	82.1	84.1	84.5	81.5	83.3	96.6	86.8
150	80.0	82.2	84.3	84.7	81.8	83.5	87.0	87.3
L.S.D. 5%	A	B	AB		A	B	AB	
	0.2	0.6	1.2		0.3	0.8	1.6	
Moisture % of peels								
0.0	64.9	68.9	69.5	71.1	67.6	69.7	71.1	72.0
50	66.5	70.4	71.5	72.9	71.3	72.2	73.5	74.0
100	71.3	74.1	75.0	75.3	75.1	77.8	79.3	80.0
150	71.5	74.3	75.6	75.6	75.3	78.1	79.5	80.6
L.S.D. 5%	A	B	AB		A	B	AB	
	0.6	1.0	2.0		0.5	0.9	1.8	

Application of GA₃ at 150 ppm or Green Miracle at 2.0 % gave the maximum values. Yet, the lowest values were detected on untreated trees. The interaction between GA₃ and Green Miracle had significant effect on fruit weight. Since, the maximum fruit weight was recorded on the trees received two sprays of GA₃ at 150 ppm in combined with Green Miracle at 2.0 %.

The effect of GA₃ in promoting cell elongation as well as the effect of Green Miracle on reducing the loss of water from fruits could explain the present results. The present effects of GA₃ are in concordance with those obtained by Sepahi (1986), El-Masry (1989) and Desai *et al.*, (1995). The results of Gale and Hagan (1966); Albigo *et al.*, (1970) and Bacha and Ibrahim (1979) supported the beneficial effect of the antitranspirants on fruit weight.

5- Effect of GA₃ and Green Miracle on percentages of seed and peel moisture :

Table (3) shows that percentages of moisture in the seeds and peels of fruit were significantly increased with GA₃ application and Green Miracle compared to non- application. The promotion on moisture content of seeds and peels was associated with increasing concentrations of GA₃ and Green Miracle. Application with the highest concentrations of GA₃ (150 ppm) and Green Miracle (2 %) were more effectively maximized moisture content in the seeds and peels . The lowest content of moisture in the seeds and peels was recorded on the fruits picked from untreated trees. Treating Manfalouty pomegranate trees twice with GA₃ at 150 ppm plus Green Miracle at 2 % resulted in the maximum percentage of moisture in the seeds and peels of fruit. The effect of both GA₃ and Green Miracle on reducing the loss in fruit moisture could explain the present results.

6- Effect of GA₃ and Green Miracle on some chemical characters of the fruits :

It is clear from Table (4) that spraying GA₃ at 50 to 150 ppm or Green Miracle at 0.5 to 2.0 % significantly reduced TSS/ acid ratio as well as total and reducing sugars and increased vitamin C content than non- application (control).

The effect either in decrease or increase was associated with increasing concentrations. Negligible effects on such characters were detected among the higher two concentrations of GA₃ (100 or 150 ppm) and Green Miracle (1.0 and 2.0 %). The highest concentrations of GA₃ and Green Miracle resulted in great reduction on TSS/acid ratio as well as total and reducing sugars and the great increase in vitamin C content. The untreated trees gave the maximum T.S.S. / acid as well as total and reducing sugars and the minimum vitamin C content in the juice.

The interaction had significant effect on all chemical characters. Yet, the great effects were recorded on the trees received two sprays of 150 ppm GA₃ plus 2 % Green Miracle.

These results might be attributed to the effects of GA₃ and Green Miracle on delaying maturity and to the dilution effect of both as a result of increasing fruit moisture content.

Table (4): Effect of different GA₃ and Green Miracle antitranspirant concentrations on some chemical characters of Manfalouty pomegranate fruits during 2005 and 2006 seasons.

Conc. of GA ₃ (A) (ppm)	2005				2006			
	Green Miracle concentrations (B)							
	TSS / acid ratio							
	0.0	0.5	1.0	2.0	0.0	0.5	1.0	2.0
0.0	15.6	15.4	15.2	15.1	14.8	14.6	14.4	14.3
50	15.4	15.0	15.0	14.9	14.4	14.2	14.0	13.9
100	15.1	14.7	14.5	14.4	14.3	14.1	14.0	13.7
150	15.0	14.6	14.3	14.2	14.2	14.0	14.0	13.5
L.S.D. 5%	A	B	AB		A	B	AB	
	NS	NS	NS		NS	NS	NS	
	Total sugars %							
0.0	14.1	13.8	13.5	13.4	14.0	13.6	13.3	13.2
50	13.8	13.5	13.0	12.9	13.6	13.2	12.8	12.7
100	13.6	13.2	13.0	12.7	13.2	13.0	12.9	12.8
150	13.5	13.1	12.8	12.6	13.1	12.9	12.6	12.5
L.S.D. 5%	A	B	AB		A	B	AB	
	0.2	0.2	0.4		0.2	0.2	0.4	
	Reducing sugars %							
0.0	13.8	13.5	13.2	13.0	13.7	13.3	13.0	12.9
50	13.5	13.2	12.8	12.7	13.3	13.0	12.6	12.5
100	13.3	13.0	12.5	12.4	12.9	12.7	12.4	12.3
150	13.2	12.8	12.4	12.3	12.8	12.6	12.3	12.2
L.S.D. 5%	A	B	AB		A	B	AB	
	0.2	0.2	0.4		0.2	0.2	0.4	

These results are in harmony with those obtained by Ahmed *et al.*, (1996) who worked on GA₃ and Al-Hmedawi (2003) who worked on antitranspiration.

From this study it is clear that spraying Manfalouty pomegranate trees with GA₃ at 100 ppm and 1.0 % with antitranspiration Green Miracle is suggested to be beneficial for controlling fruit setting % and improving yield and fruit quality of Manfalouty pomegranate trees grown under Upper Egypt conditions.

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إستجابة أشجار الرمان المنفلوطى لرش الجبريلين والمادة المضادة للنتح جرين
ميراكل تحت ظروف منطقة مصر العليا
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أجريت هذه التجربة لدراسة تأثير الرش بتركيزات مختلفة من حمض الجبريليك (صفر ، ٥٠ ، ١٠٠ ، ١٥٠ جزء فى المليون) والمادة المضادة للنتح جرين ميراكل (صفر ، ٥ ، ١ ، ٢ %) على تقليل تشقق الثمار وتحسين المحصول وجودة الثمار فى أشجار الرمان المنفلوطى النامى تحت ظروف منطقة مصر العليا.

ولقد أوضحت النتائج أن رش أشجار الرمان المنفلوطى بحمض الجبريليك بتركيز ما بين ٥٠ إلى ١٥٠ جزء فى المليون والمادة المضادة للنتح جرين ميراكل بتركيز ما بين ٠,٥ إلى ٢ % مرتين لم يكن لهما تأثير على مساحة الورقة والنسبة بين المواد الصلبة الذائبة الكلية للحموضة بينما كان لهما تأثير فى تحسين كمية المحصول ، وزن الثمرة ، والنسبة المئوية للرطوبة فى بذور وقشرة الثمار ومحتوى الثمار من فيتامين ج وذلك بالمقارنة بالكنترول وكانت النسبة المئوية لتشقق الثمار والسكريات الكلية والمختزلة تميل إلى الإنخفاض مع زيادة التركيز المستخدم من كلا المادتين وفى معظم الأحيان فإنه لم يكن هناك فرق واضح ما بين التركيزين الأعلى من هاتين المادتين على جميع الصفات تحت الدراسة.

ومن النتائج المتحصل عليها فإنه يقترح رش الرمان المنفلوطى بحمض الجبريليك بتركيز ١٠٠ جزء فى المليون ، ١ % جرين ميراكل مرتين فى الأسبوع الأول من يوليو وأغسطس لتقليل حدة تشقق الثمار وتحسين المحصول وجودة الثمار تحت ظروف منطقة مصر العليا.