ISSN 1819-1894

Asian Journal of Agricultural Research

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OPEN ACCESS Asian Journal of Agricultural Research

ISSN 1819-1894
DOI: 10.3923/ajar.2019.6.12

Research Article
Assessment of the Yield and Fruit Quality of Manfalouty and Higazy Pomegranate Cultivars under the Influence of Gibberellic Acid and Micronutrients

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Abstract

Background and Objective: Gibberellic acid (GA_3) and micronutrients play an important role in many plant growth and development processes. In order to evaluate the yield and fruit quality of pomegranates, two representative cultivars (Manfalouty and Higazy) grown in heavy loam soil at the Experimental Orchard, Faculty of Agriculture, Assiut University during 2016 and 2017 growing seasons were treated by Foliar application of GA_3 and micronutrients separately or their combinations. **Materials and Methods:** The treatment categories were T_1 (GA_3 at 100 ppm), T_2 (compound mineral fertilizer "Fetrilon Combi 2" at 1000 ppm), T_3 (GA_3 100 ppm+Fetrilon Combi 2" 1000 ppm) and T_4 (Control). **Results:** The results revealed that the treatments increased significantly the yield components and fruit quality and decreased fruit splitting percentage as compared to the control. The most elevated estimations yields were obtained from GA_3+micronutrients treatment, which led to 23.9 and 29.2% increments over the control one and decrement fruit splitting percentage of 55.3 and 67.2% less than the control one for the two successive seasons, respectively. **Conclusion:** Therefore, it is recommended to spray the pomegranate trees with the combination of GA_3 and micronutrients twice, on the mid of June and a month later to improve the fruit quality.

Key words: Fruit quality, GA3, micronutrients, pomegranate, yield

Citation: Mokhtar Mamdouh Shaaban, 2019. Assessment of the yield and fruit quality of manfalouty and higazy pomegranate cultivars under the influence of gibberellic acid and micronutrients. Asian J. Agric. Res., 13: 6-12.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Pomegranate (*Punicagranatum* L.) is a standout among the most favorite edible fruits of tropical and climatic zone regions and economically developed for its sweet acidic taste. It's native to Iran and Himalayas in northern India and widely developed in Mediterranean areas[1-3]. The edible part of the fruit is named arils, which is eaten crisp and can be preserved as syrup or used for making jam. The fruit peel, stem, root bark and leaves are a good source of secondary products such as tannins, dyes and alkaloids. All parts of pomegranate tree are wealthy in cancer prevention agents. Pomegranate has basic restorative activities against cardiovascular diseases, anticancer and antimicrobial activities.

For years ago, the pomegranate culture in Egypt was limited and for the most areas, it was considered as a minor crop. Presently, pomegranate acreage is quick increasing for exportation goals. Manfalouty and afterward Higazy are seen as the most basic pomegranate cultivars grew viably in Upper Egypt and especially in Assiut Governorate, which occupies the first rank in the area and production[4].

The bloom period commenced from the 1st of April until the terminus of June in 4-6 waves. The first 2 or 3 waves of flowering contributed most of the commercial yield, while the later waves did not procure fruit maturity standards and give lower and non-commercial fruits[5,6]. Grading and sorting of the fruits during harvest according to their sizes are very consequential and should be exercised in obtaining a good price[5,7].

The most solemn problem affecting the productivity of pomegranate trees in economic terms is the fruit splitting. It is a physiological disorder that occurs because of the different magnification rates between the skin and flesh of the fruit[8]. There are many factors that cause fruit cracking such as sultry dry weather, soil moisture, climate, tree alimentation and cultivars[2,6,9]. This problem caused a consequential loss in the production of some pomegranate cultivars may reach more[2] than 50%.

Gibberellic acid (GA_3 i.e., Berlex) was widely used in many horticultural crops, including pomegranate for ameliorating fruit set, yield and quality[10,11]. The effect of GA_3 has at least three essential actions, intensifies an organ's ability to act as a nutrient sink, facility to increment the synthesis of IAA in plant tissues and involves the synthesis expedition of hydrolytic enzymes as amylase and other hydrolytic enzymes in aleuronat cells[12].

Micronutrients play many major roles in plant nutrition and take part in the functioning of number of enzyme systems, which are essential steps in photosynthesis and many other metabolic processes, as well as ameliorate fruit yield and quality[13-17]. Foliar sprays with fertilizers including microelements such as zinc (Zn), boron (B), copper (Cu), manganese (Mn) and iron (Fe) have been shown to be convenient for field use have a good efficacy and very rapid plant replication[18-20]. Furthermore, foliar fertilizers associate to avoid toxicity symptoms that may occur after soil application of the same microelements[10,11,21].

Although several workers have evaluated the effect of nutrients and growth regulators on fruit quality of pomegranate in different parts of the world; the present examination was intended to evaluate of the yield and fruit quality of Manfalouty and Higazy pomegranate cultivars under the influence of gibberellic acid and micronutrients.

MATERIALS AND METHODS

Materials and treatments: The experiment was carried out during two successive seasons of 2016 and 2017 at the Experimental Orchard at Fruit Section, Faculty of Agriculture, Assiut University on Manfalouty and Higazy pomegranate cultivars. The soil was heavy loam. Regular agricultural managements were applied to all experimental trees as recommended. The trees space was (5×5) apart and they were 32 years old at the commencement of the experiment. Sixteen uniform trees were selected for each cultivar and divided into four treatments including control, each treatment was executed on four trees (Replicates).

The treatment categories were T_1 (Foliar application with GA_3 at 100 ppm), T_2 (Foliar application with compound mineral fertilizer "Fetrilon Combi 2" which consists of (Fe 4%, Zn 4%, Mn 3%, B 1.5%, Mg 2.2%, Ca 3.3%, Cu 0.6%, Mo 0.05% at 1000 ppm), T_3 (Foliar application with GA_3 100 ppm+"Fetrilon Combi 2"1000 ppm) and T_4 (Control) spraying with water only. The GA_3 and micronutrients were dissolved according to the pre-mentioned concentrations. The trees were sprayed with a knapsack sprayer. A total volume of 20 L was sufficient for spraying 4 trees until runoff. The spraying treatments executed twice, on the setting fruits on the mid of June and a month later during the two seasons.

Plant measurements

Yield components: At harvest, the fruits of all treated trees were picked on the second half of October in the two seasons. Fruits per tree were counted and weighted to estimate the total number of fruits and yield/tree (kg). The fruits were graded into three grades as following, for Manfalouty cultivar, Grade I (fruits of 400-500 g or above in the weight), Grade II (fruits of 300-400 g in the weight) and

Grade III (fruits of 200-300 g or less in the weight) and for Higazy cultivar, Grade I (fruits of 300-400 g in the weight), Grade II (fruits of 200-300 g in the weight) and Grade III (fruits of 100-200 g in the weight). As well the cracked fruits were sorted, counted, weighted and the percentage of fruit splitting was calculated relative to the total yield weight or the total number of fruits[5,7].

Physical properties: Samples of four fruits per tree replication were collected randomly and directly transported to the laboratory for determining the physical properties. Fruit weight was quantified utilizing an electronic balance. In order to determine peel and aril weight percentage, fruits were manually peeled and the weight of total aril and peel were quantified and then the percentage of aril relative to fruit weight was calculated.

Chemical properties: Total acidity was determined using titration by NaOH at 0.1 N and phenolphthalein as an indicator then, expressed as citric acid, according to AOAC[22]. Total soluble solids (TSS as %) was quantified utilizing the hand refractometer and then, TSS/Acid ratio was calculated. Percentage of reducing sugars in juice was estimated, according to AOAC[22].

Statistical analysis: The experiment was set as a complete randomized design (CRD) including four treatments and four replicates per each treatment. Data were tabulated and statistically analyzed according to Steel and Torrie[23]. Means separation was made according to the Least Significant Differences (LSD) at 5% level of the probability.

RESULTS

Yield components and fruit splitting: The perusal of data in Table 1 indicated that foliar application of GA_3 and micronutrients, separately or combined, increased significantly the total yield compared to control of the two tried cultivars for the two progressive seasons. The most elevated estimations yields (87.1 and 79.1 kg/tree) were obtained from GA_3 + micronutrients treatment, which led to 23.9 and 29.2% increments over the control one (70.3 and 61.2 kg/tree) regardless of cultivars for the two progressive seasons, respectively.

Moreover, Higazy pomegranate cultivar had significantly the highest total yield compared to Manfalouty cultivar regardless of treatments for the two seasons. For the interaction, Higazy pomegranate cultivar recorded the highest yield (92.4 and 89.6 kg/tree) when sprayed with GA_3+micronutrients compared to control of Manfalouty cultivar which recorded the least value (67.8 and 56.4 kg/tree) for the two seasons of study, respectively.

The GA_3+micronutrients treatment caused a significant increment in the fruit yield of grade I, II and a decrement in grade III compared to other treatments for the two progressive seasons, regardless of cultivars (Table 1). The values of fruit yield of grade I were 37.5 and 33.5 kg/tree with an increment of 36.4 and 40.8% over the control for the two seasons, respectively. This observation primarily because of the increment of fruit weight associated with these treatments and that reflected on the increase of yield weight.

Likewise, the fruit yield of grade II recorded 36.8 and 33.5 kg/tree with an augmentation of 30.0 and 31.9% for the two seasons regardless of cultivars, respectively. There is no significant decrease in the fruit yield of grade III compared to the control for the two seasons. On the other hand, Higazy pomegranate cultivar had the highest value of the most parameters compared to Manfalouty cultivar.

The GA_3+micronutrients treatment likewise caused a significant increment in the commercial fruits and a decrement in the non-commercial fruits percentage compared to other treatments for the two progressive seasons, regardless of cultivars (Table 1). The values of the commercial fruits were 85.5 and 85.1% with an increment of 7.4 and 5.8% over the control for the two seasons, respectively.

Furthermore, foliar application of GA_3+micronutrients increased significantly the number and the average fruit weight (g) of grade I, II and reduced the number and average fruit weight of grade III for the two progressive seasons regardless of cultivars (Table 2). The average fruit weight of grade I were 459.0 and 467.6 g with an increment of 7.8 and 12.6% over the control for the two seasons, respectively.

Likewise, the average fruit weight of grade II were 326.3 and 320.8 g with an increment of 11.9 and 12.0% for the two seasons, respectively. There is no significant decrease in the fruit weight of grade III compared to the control for the two seasons.

The foliar application of GA_3 and micronutrients, separately or in combination, decreased significantly the percentage of fruit splitting compared to control of the two tried cultivars for the two progressive seasons (Table 3). The most reduced fruit splitting (3.4 and 4.0%) were acquired with the GA_3+micronutrients treatment, which prompted a decrement of 55.3 and 67.2% less than the control one regardless of cultivars for the two successive seasons, respectively.

Table 1: Effect of foliar application of GA_3 and micronutrients on fruit yield per tree of Manfalouty and Higazy pomegranate cultivars during 2016 and 2017 seasons

Cultivar (A)	Total yield (kg)			Yield I (kg)			Yield II (kg)			Yield III (kg)			Com. fruits (%)			Non-com. fruits (%)		
treatment (B)	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean
2016																		
Control	67.8	72.8	70.3	26.0	29.0	27.5	28.0	28.5	28.3	13.8	15.3	14.5	80.0	79.1	79.6	20.0	20.9	20.4
GA_3	74.0	86.6	80.3	32.3	34.8	33.5	30.8	35.3	33.0	11.0	16.6	13.8	85.2	80.9	83.0	14.8	19.1	17.0
Micronutrients	76.4	80.9	78.6	33.5	31.4	32.4	32.0	33.8	32.9	10.9	15.8	13.3	85.8	80.5	83.2	14.3	19.5	16.9
GA_3+micronutrients	81.9	92.4	87.1	38.9	36.1	37.5	33.8	39.8	36.8	9.3	16.5	12.9	88.7	82.2	85.5	11.3	17.8	14.6
Mean	75.0	83.1		32.7	32.8		31.1	34.3		11.2	16.0		84.9	80.7		15.1	19.3	
LSD	A:3.9	B:5.5	AB:7.7	A: ns	B:3.6	AB:5.2	A:2.4	B:3.3	AB:4.7	A:1.8	B: ns	AB:3.6	A:1.9	B:2.7	AB:3.9	A:1.9	B:2.7	AB:3.9
2017																		
Control	56.4	66.0	61.2	21.9	25.8	23.8	23.5	27.3	25.4	11.0	13.0	12.0	80.5	80.3	80.4	19.5	19.7	19.6
GA_3	61.5	80.1	70.8	26.5	32.1	29.3	24.8	33.3	29.0	10.3	15.0	12.6	83.5	81.6	82.5	16.6	18.8	17.7
Micronutrients	64.1	78.9	71.5	28.4	31.3	29.8	26.3	33.3	29.8	9.5	14.4	11.9	85.1	81.6	83.4	14.9	18.2	16.6
GA_3+micronutrients	68.5	89.6	79.1	31.5	35.5	33.5	28.5	38.5	33.5	8.5	15.6	12.1	87.7	82.6	85.1	12.3	17.5	14.9
Mean	62.6	78.7		27.1	31.2		25.8	33.1		9.8	14.5		84.2	81.5		15.8	18.5	
LSD	A:3.4	B:4.8	AB:6.8	A:1.8	B:2.5	AB:3.6	A:1.4	B:1.9	AB:2.8	A:1.4	B: ns	AB:2.8	A:1.8	B:2.6	AB:3.7	A:1.9	B:2.6	AB:3.7

Manf: Manfalouty, Hig: Higazy (local Egyptian cultivars), yield of the first, second and third grades were marked with I, II and III, respectively, Com: Commercial included the I and II grades of fruits divided on the total yield weight while, Non-com: Non-commercial included III grade and cracked fruits divided on the total yield weight, ns: Not significant, LSD: Least significant differences at 0.05 of the probability were used to compare the significance between treatment means

Table 2: Effect of foliar application of GA_3 and micronutrients on a number of fruits per tree and fruit weight of Manfalouty and Higazy pomegranate cultivars during 2016 and 2017 seasons.

Cultivar (A)	No. of fruits (I)			Fruit WT. I (g)			No. of fruits (II)			Fruit WT. II (g)			No. of fruits (III)			Fruit WT. III (g)		
treatment (B)	Manf	Hig	Mean	Manf	Hig	Mean	Manf	Hig	Mean	Manf	Hig	Mean	Manf	Hig	Mean	Manf	Hig	Mean
2016																		
Control	51.3	84.5	67.9	508.0	343.5	425.7	82.5	117.5	100.0	340.3	243.1	291.7	51.5	112.8	82.1	265.6	136.9	201.2
GA_3	58.5	95.5	77.0	550.9	363.2	457.0	83.3	131.8	107.5	370.4	267.5	318.9	45.0	90.0	67.5	244.7	184.3	214.5
Micronutrients	64.8	87.8	76.3	522.8	357.8	440.3	89.8	131.5	110.6	356.7	256.8	306.7	47.5	95.5	71.5	231.3	164.9	198.1
GA_3+micronutrients	71.0	97.8	84.4	548.6	369.4	459.0	88.8	146.0	117.4	379.7	272.9	326.3	33.8	90.8	62.3	272.9	181.7	227.3
Mean	61.4	91.4		532.6	358.5		86.1	131.7		361.7	260.1		44.4	97.3		253.6	166.9	
LSD	A:5.5	B:7.7	AB:10.9	A:18.9	B:26.7	AB:37.8	A:7.6	B:10.8	AB:15.2	A:15.2	B:21.5	AB:30.4	A:7.9	B:11.2	AB:15.9	A:23.7	B: ns	AB:47.4
2017																		
Control	44.0	78.0	61.0	499.9	330.6	415.3	70.3	114.3	92.3	334.4	238.6	286.5	48.5	96.3	72.4	227.1	134.7	180.9
GA_3	47.8	90.0	68.9	554.3	357.8	456.0	68.5	130.5	99.5	361.0	255.2	308.1	42.0	84.3	63.1	243.4	179.1	211.2
Micronutrients	51.5	89.5	70.5	551.6	350.3	450.9	72.3	132.5	102.4	363.6	251.5	307.5	37.8	84.8	61.3	251.1	170.6	210.8
GA_3+micronutrients	55.8	95.8	75.8	564.1	371.1	467.6	76.0	144.5	110.3	375.2	266.5	320.8	33.5	85.0	59.3	253.7	183.8	218.7
Mean	49.8	88.3		542.5	352.5		71.8	130.4		358.6	252.9		40.4	87.6		243.8	167.0	
LSD	A:4.4	B:6.2	AB:8.8	A:17.5	B:24.7	AB:35.0	A:5.4	B:7.7	AB:10.8	A:7.9	B:11.2	AB:15.9	A:6.7	B:9.4	AB:13.3	A:8.8	B:12.5	AB:17.7

Manf: Manfalouty, Hig: Higazy (local Egyptian cultivars), No. fruits: Number of fruits, fruit WT: Average fruit weight of the first, second and third grades were marked with I, II and III, respectively, ns: Not significant, LSD: Least significant differences at 0.05 of the probability were used to compare the significance between treatment means

Table 3: Effect of foliar application of GA_3 and micronutrients on fruit splitting, aril and peel percentage of Manfalouty and Higazy pomegranate cultivars during 2016 and 2017 seasons

Cultivar (A)	Fruit splitting (%)			Aril of com. fruit (%)			Peel of com. fruit (%)		
treatment (B)	Manfalouty	Higazy	Mean	Manfalouty	Higazy	Mean	Manfalouty	Higazy	Mean
2016									
Control	14.3	0.78	7.6	59.8	56.5	58.1	40.2	43.6	41.9
GA_3	6.8	0.00	3.4	59.0	56.8	57.9	41.0	43.2	42.1
Micronutrients	8.7	0.30	4.5	59.9	57.0	58.4	40.1	43.0	41.6
GA_3+micronutrients	6.5	0.29	3.4	58.8	56.7	57.7	41.3	43.3	42.3
Mean	9.1	0.34		59.4	56.7		40.6	43.3	
LSD	A:0.8	B:1.1	AB:1.5	A:2.1	B: ns	AB: ns	A:2.1	B: ns	AB: ns
2017									
Control	23.3	1.12	12.2	60.0	58.8	59.4	40.1	41.2	40.6
GA_3	8.4	0.49	4.5	60.6	59.5	60.0	39.5	40.5	40.0
Micronutrients	8.9	0.57	4.7	60.3	58.8	59.5	39.7	41.2	40.5
GA_3+micronutrients	7.4	0.46	4.0	59.9	59.6	59.9	40.1	40.2	40.2
Mean	12.0	0.66		60.2	59.2		39.8	40.8	
LSD	A:1.0	B:1.5	AB:2.1	A: ns	B: ns	AB: ns	A: ns	B: ns	AB: ns

Manfalouty and Higazy are two local Egyptian cultivars, fruit splitting percentage was calculated by dividing the number of them on the total number of fruits, Aril of Com. Fruit % and Peel of Com. Fruit % were calculated by dividing each of them on the average fruit weight, ns: Not significant, LSD: Least significant differences at 0.05 of the probability were used to compare the significance between treatment means

In addition, Higazy pomegranate cultivar had the lowest fruit splitting compared to Manfalouty cultivar regardless of treatments for the two seasons. It recorded 0.34 and 0.66% during the two studied seasons, respectively. On the other hand, Higazy pomegranate cultivar treated with GA_3+micronutrients gave the most minimal value of fruit splitting during the two seasons (0.29 and 0.46%) while the control of Manfalouty cultivar gave the highest value (14.3 and 23.3%). The arils and peel percentage neither for the two studied cultivars nor the treatments are significant in most cases.

Fruit chemical properties: Generally, most of the treatments enhanced the fruit chemical traits of the two tried cultivars. It can be seen from the outcomes that the application of foliar application of GA_3+micronutrients treatment caused a significant increment in the TSS (%), TSS/acid ratio, total sugars, reducing sugars and decrease in the acidity, non-reducing sugars compared to other treatments for the two progressive seasons regardless of cultivars (Table 4).

The GA_3+micronutrients treatment recorded the most elevated estimations values of the TSS which accomplished 15.5 and 15.9% with an augmentation of 4 and 6% over the control for the two seasons, respectively. Moreover, the TSS/acid ratios for such treatment were 15.4 and 15.2 with an increment of 7.7 and 10.1% for the two seasons regardless of cultivars, respectively.

DISCUSSION

The study showed the effectiveness of both gibberellic acid and micro-elements in their effect on the yield and the fruit quality of Manfalouty and Higazy pomegranate cultivars. Moreover, the most elevated estimations yields were obtained from GA_3 combined with micronutrients treatment, which led to 23.9 and 29.2% increments over the control one and decrement fruit splitting percentage of 55.3 and 67.2% less than the control one for the two successive seasons, respectively.

The advantageous impacts of gibberellins can be ascribed to its impact on invigorating cell division, cell elongation and membrane permeability to water uptake[24,25]. The better fruit yield with micronutrient treatments may be because of better fruit retention and increment in the fruit weight through involving in various processes related to photosynthesis, enzyme function, carbohydrate chemistry and reproductive system of the plant. Consequences of yield components and fruit splitting related with the utilization of micronutrients and growth regulators in pomegranate has also been reported by Hegazi *et al.*[4], Mohamed[5], Khalil and Aly[10], Merwad *et al.*[11] and Digrase *et al.*[26].

It can fairly be concluded that the foliar application of GA_3+micronutrients was quite effective to improve the physicochemical properties of pomegranate cultivars. These finding may be because of micronutrient impacts on enhancing the development and nutrition uptake and consequently improved the food synthesized that translocated to fruits and enhanced their maturation and improved its contents of chemical constituents. On the other hand, GA_3 might be delayed the fruit maturation. These results are in close conformity with the findings of Hegazi *et al.*[4], Mohamed[5], Khalil and Aly[10], Merwad *et al.*[11] and Digrase *et al.*[26].

Table 4: Effect of foliar application of GA_3 and micronutrients spraying on fruit chemical properties of Manfalouty and Higazy pomegranate cultivars during 2016 and 2017 seasons

Cultivar (A)	TSS (%)			Acidity (%)			TSS/acid ratio			Total sugars (%)			Red. sugars (%)			Non-red. sugars (%)		
treatment (B)	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean	Manf.	Hig.	Mean
2016																		
Control	15.0	14.8	14.9	1.07	1.01	1.04	14.0	14.6	14.3	13.00	12.77	12.88	12.16	12.34	12.25	0.84	0.43	0.63
GA_3	15.4	15.0	15.2	1.05	0.98	1.01	14.7	15.4	15.0	13.70	13.00	13.35	12.8	12.40	12.60	0.90	0.60	0.75
Micronutrients	15.6	15.2	15.4	1.06	0.95	1.00	14.8	16.0	15.4	13.80	13.06	13.43	12.95	12.64	12.79	0.86	0.42	0.64
GA_3+micronutrients	15.7	15.4	15.5	1.06	0.97	1.01	14.9	15.9	15.4	13.98	12.99	13.48	13.10	12.60	12.84	0.88	0.39	0.63
Mean	15.4	15.1		1.06	0.98		14.6	15.5		13.62	12.95		12.75	12.50		0.87	0.46	
LSD	A:0.3	B:0.4	AB:0.6	A:0.03	B: ns	AB:0.05	A:0.5	B:0.7	AB:1.0	A:0.28	B:0.40	AB:0.56	A: ns	B:0.41	AB:0.58	A:0.06	B:0.09	AB:0.13
2017																		
Control	15.1	14.9	15.0	1.24	0.94	1.11	12.1	15.4	13.8	13.95	14.19	14.07	13.11	13.68	13.39	0.85	0.51	0.68
GA_3	15.0	15.8	15.4	1.17	1.06	1.09	12.9	15.5	14.2	14.47	13.96	14.21	13.59	13.44	13.51	0.89	0.52	0.70
Micronutrients	15.3	15.7	15.5	1.27	1.04	1.14	12.4	15.3	13.9	14.11	13.88	13.99	13.26	13.44	13.35	0.85	0.45	0.65
GA_3+micronutrients	15.9	15.8	15.9	1.08	1.01	1.05	14.7	15.7	15.2	14.88	13.63	14.26	13.96	13.23	13.59	0.93	0.40	0.66
Mean	15.3	15.5		1.18	1.01		13.0	15.5		14.35	13.91		13.48	13.45		0.88	0.47	
LSD	A: ns	B:0.7	AB: ns	A:0.05	B:0.08	AB:0.11	A:0.9	B:1.3	AB:1.9	A:0.32	B: ns	AB:0.63	A: ns	B: ns	AB:0.67	A:0.06	B: ns	B:0.12

Manf: Manfalouty, Hig: Higazy (local Egyptian cultivars), TSS: Total soluble solid, (Red sugars) Reducing sugars, Non-Red. Sugars: Non reducing sugars, ns: Not significant, LSD: Least significant differences at 0.05 of the probability were used to compare the significance between treatment means

CONCLUSION

Foliar application of gibberellic acid and micronutrients are quite effective to enhance yield and quality of fruit in Manfalouty and Higazy pomegranate cultivars. They increased number of fruit, fruit weight and yield per tree, along with better quality of fruit in terms of TSS, acidity and total sugars. On the basis of above finding gibberellic acid and micronutrients are optimum recommendation for maximum qualitative yield of pomegranate cultivars.

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