

Physiological Studies on Flowering and Fruiting Of Guava Trees

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ABSTRACT

The present investigation was undertaken during both 2012/2013 and 2013/2014 growing seasons on "Etmani" cv. guava trees to study the effect spraying some chemicals substances (urea, GA₃ and PP₃₃₃) as well as hand defoliation on fruiting parameters (fruit set and productivity of tree per kg) and fruit characteristics either physical properties such as fruit weight, volume, length, width, fruit shape index and fruit firmness) or fruit chemical characters (TSS %, total acidity %, TSS/acidity ratio, total sugars content and vitamin C content). The objective of this study was turned the summer yield of guava fruits to late crop "winter crop" to obtain fruits of good quality and to help farmers to obtain good income by high prices of guava yield. Data obtained indicated that, all investigated treatments under study significantly decreased yield (kg/tree) as compared to the control except with sprayed trees with PP₃₃₃ at 500 ppm treatment in the two seasons of study. Whereas both treatments induced the highest significant increase of tree yield, however hand defoliation treatment exhibited significantly the lowest value of tree yield (kg/tree). Moreover, results indicated also that, all studied fruit physical properties (fruit weight, volume, length and width) were induced a positive relationship with GA₃ sprayed trees. Meanwhile, both fruit firmness and fruit shape index were statistically increased by trees sprayed with PP₃₃₃ treatments, since the least significant values of all fruit physical properties induced by trees treated with hand defoliation treatment. In addition, data obtained revealed that, chemical investigated treatments under study were significantly and a positive effect in most fruit chemical properties as compared to the control treatment. However, trees sprayed with (GA₃, PP₃₃₃ and urea) resulted in significantly increase in total sugars content, vitamin C content, TSS/acid ratio and TSS % as well as total acidity %, respectively. Whereas, both control and hand defoliation treatments exhibited the lowest significant values of these fruit chemical properties under study. Generally, it could be concluded that, the different investigated spray treatments of chemical substances in this study were improved the fruit quality either physical or chemical properties of guava fruits. Also, the higher concentrations of studied treatments were the most effective for improving the fruiting parameters and fruit quality of "Etamani" guava trees.

Key words: Guava, chemicals substances, hand defoliation, fruit set, productivity

Introduction

Guava is one of the most common fruits in Egypt, value and good tastes. It is also the cheapest and richest source in vitamin "C" as well as it contains small amounts of vitamin A, B, Carbohydrates, oils and proteins. It is also, rich in pectins which has industrial uses for jelly or juice production (Bose and Mitra, 1990). Addition to that, it contains a good source of both calcium and phosphorus (Siddiqui *et al.*, 1991). Beside, guava fruits are eaten in fresh form or it can be consume as good products such as jam, jelly and juice. Also, guava paste or guava cheeses are popular dishes in some parts of the world.

Botanically, guava (*Psidium guajava* L.) is one of the members of Myrtaseae family, the genus Psidium which include the specie guajava, but guava is probably considered as the most important one in this family.

It is well known that, guava trees grown normally at tropical and sub- tropical regions, since its native home located at the area between Mexico and Peru (Chandler, 1958). Therefore, it can be successfully grown now in more than 60 countries of the world.

In Egypt, on the last few years, guava orchard increased especially in the newly reclaimed lands. However, guava trees grow well in different kinds of soil and under a wide range of climatic condition

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(Bourk, 1976). Meanwhile, it gives good crop when the condition of soil is well (Bailly, 1960). Also, guava trees are fairly salt and drought resistant and alkalinity of soil up to PH 8.2 (Samson, 1980).

According to the recent and the latest statistic of Ministry of Agriculture 2014, the total cultivated area of guava in Egypt reached about (40831) feddans with annual production about (349626) tons of fruits.

Guava plants can be cropping practically all round the year, but if system of pruning and fertilization are practiced, flowering and fruiting can be cycled certain peak periods to regulate production and meet factory needs (Bittender and Koloyashi, 1990).

In Egypt, guava trees were forced to produce their fruits in winter as affected by some agricultural practices as preventing partially from irrigation for four months to help defoliation, ploughed, fertilized then irrigated. Most of winter production of guava fruits is exported to other countries, so improving productivity and fruit quality is important issue to earn more commercial advantages. Besides, guava fruits are desired to local market and aboard in winter. In addition, introducing a new approach of pruning, irrigation, fertilization and defoliation, the application of different safe compounds as urea and GA₃ has been extensively applied to guava trees in vigours vegetative growth to change yield patterns (Shigeura *et al.*, 1975 and Singh *et al.*, 1991) work in guava has been mainly limited to urea and GA₃.

Those consideration led us to build the present investigation to study the response of some fruiting parameters i.e., (fruit set % and yield) as well as fruit quality of "Etmani" guava trees to spraying the different chemical compounds (urea, GA₃ and PP₃₃₃) at different concentrations and hand defoliation in order to turn the summer yield of guava fruits to late crop (winter yield) to obtain fruits of good quality and high suitable for marketability in local and export markets as well as help farmers to obtain a good income by high pattern of guava yield.

Material and Methods

The present investigation was carried out in a private orchard at Qalyub district, Qalyubeia Governorate, Egypt. This study has been extended for the two consecutive seasons of 2012/2013 and 2013/2014 on 11-year-old, guava trees planted at 5 meters apart in square system and grown in a clay loamy soils as well as flood irrigation was used. Trees were carefully selected to be healthy, nearly uniform as possible in their growth vigour and received regularly the same horticultural practices i.e., fertilization, irrigation. The different spray investigated treatments in this study were as follows:

- 1- Control treatment (tap water spray only).
- 2- Leaves defoliation (removing the leaves with hand).
- 3- Spraying with urea at 10 %.
- 4- Spraying with urea at 15 %.
- 5- Spraying with GA₃ at 75 ppm.
- 6- Spraying with GA₃ at 150 ppm.
- 7- Spraying with PP₃₃₃ at 250 ppm.
- 8- Spraying with PP₃₃₃ at 500 ppm.

In this study, the trees were prevented from irrigation for four months (beginning the end of March to the end of July to induce defoliation). Thirty two trees were devoted and the complete randomized block design was used whereas, each treatment was replicated four times and every replicate was represented by a single tree. On each tree four main branches well distributed around the periphery (one branch on each direction) were tagged.

Treatments were sprayed one time on mid July during both 2013 and 2014 seasons of study taking into consideration that super film at 0.1 % was added as a surfactant agent to all treatments solutions including the control. Moreover, five liters of spray solutions were sufficient to be used to cover the whole foliage spray of tree canopy. Then, the following parameters were determined.

Fruiting parameters:

Fruit set percentage:

Number of flowers and set fruitlets on the tagged branches were counted and recorded in all treatments, fruit set % was estimated by the following equation according to Westwood (1978).

$$\text{Fruit set (\%)} = \frac{\text{Number of fruitlets}}{\text{Total No. of flowers at full bloom}} \times 100$$

Yield (kg/ /tree):

The average yield as kg/tree for each treatment was recorded at the picking time.

Fruit characteristics:

Samples of twenty mature fruits at harvesting time from each tree (replicate) were randomly collected, then taken to the laboratory for determining the following characters of both physical and chemical fruit properties as follows:

Fruit physical properties: The average values of fruit weight (gm), fruit volume (ml³) fruit dimensions (fruit height and fruit width in cm), fruit shape index (fruit height/fruit width ratio); fruit firmness (lb/inch²) which was determined using pressure tester with 7/18 inch plunger according to Magness and Taylor (1925).

Fruit chemical properties: The following five fruit juice chemical characters of mature fruits were determined as follows:

Total soluble solids (T.S.S. %): Total soluble solids content in fruit juice was determined as percentage (TSS %) by using a Carl Zeiss hand refractometer according to Chen and Mellenthin (1981).

Fruit titratable acidity (mg citric acid/100 ml. juice): 5 ml sample of fruit juice was used to determine the titratable acidity by the titration against 0.1 N sodium hydroxide in the presence of phenolphthalein as an indicator according to A.O.A.C. (1980).

TSS/acid ratio: TSS/acid ratio was estimated from results recorded of fruit juice TSS and total acidity by dividing TSS % over total acidity.

Total sugars content (mg/100 g): Total soluble sugars were determined according to Dubosi *et al.*, (1956).

Vitamin C content (mg/100 ml juice): Vitamin C content (mg/100 ml juice) was determined according to A.O.A.C. (1980).

Statistical analysis:-

All the obtained data during the two seasons of study were subjected to analysis of variance method according to Snedecor and Cochran (1990). Meanwhile, differences among means were compared using Duncan's multiple range tested at 5 % level (Duncan, 1955).

Results and Discussion

Fruiting parameters:

Fruit set percentage:

With respect to the effect of various tested treatments under study. Data obtained during both seasons as shown in Table (1) displayed clearly that, the fruit set percentage was responded by both PP₃₃₃ treatments either at (500 ppm) or (250 ppm) which increased the fruit set percentage of "Etmani" guava trees over that of the remained investigated treatments, differences in fruit set percentage due to the different concentrations of PP₃₃₃ were not significant as compared each other during the second season of study. Contrary to that, the lowest values of fruit set percentage was always in significant relationship to both GA₃ treatments either at (150 ppm) or (75 ppm) meanwhile,

the higher concentrations of GA₃ i.e., (150 ppm) induced significantly the least percentage in fruit set especially in the first season. On the other hand, the other remains investigated treatments i.e., (urea 10 % & 15 %, defoliation and control) were in between the abovementioned two extents, respectively, with relatively variable tendency of response. Such trend was true approximately during the two seasons of study.

These results were in agreement with reported by Sanjay and Naresh (2004), Dimple *et al.*, (2005), Mohammed *et al.*, (2006) and Saleh *et al.*, (2011) on guava trees.

Yield (kg/tree):

Regarding the tree yield as kgs of "Etmani" guava trees in response to the effect of all studied treatments in this investigation, it is quite evident from data represented in the same Table that, spraying guava trees with urea at 10 & 15 %, GA₃ at 75 and 150 ppm, PP₃₃₃ at 250 ppm and defoliation treatments exhibited a significant decrease in yield (kg/tree) as compared with both control (water spray) and PP₃₃₃ at 500 ppm treatments which induced significantly the highest yield (72.33 & 77.67 kg/tree) and (69.67 & 77.67 kg/tree) during both the 1st and 2nd seasons of study, respectively. Meanwhile, defoliation treatment resulted significantly in the lowest value of tree yield (50.67 & 53.00 kg/tree) in both seasons, respectively. On the other hand, PP₃₃₃ treatments either at (500 ppm) or (250 ppm) gave the higher significant increase in yield (69.67 & 77.67) and (63.67 & 73.00 kg/tree) when compared with other sprayed chemical treatments in the two experimental seasons. Moreover, sprayed trees with urea at both 15 % and 10 % treatments followed by GA₃ treatments either at 150 ppm or 75 ppm which were statistically intermediate as their yield expressed in kg of fruits per tree to that of the two other abovementioned trends. Such trends were detected in the two seasons of study.

The obtained data are in conformity with those previously mentioned by many investigators, Solar and Cuevas (2008) on Cherimoyo (*Annona cherinoola*), Dwivedi *et al.*, (1990); Almaguer *et al.*, (1992) and Gorakh and Singh (1994) on guava trees.

Table 1: Fruit set (%) and yield (kg/tree) of "Etmani" guava trees in response to spraying of some chemical substances on different concentrations during both 2012/2013 and 2013/2014 seasons.

Treatments	Fruit set (%)		Yield (kg/tree)	
	2012/2013	2013/2014	2012/2013	2013/2014
Control	46.00e	44.33d	72.33a	77.67a
Defoliation	54.00d	49.00c	50.67e	53.00f
Urea at 10 %	65.33b	58.00b	60.33cd	68.33d
Urea at 15 %	60.67c	56.33b	61.33bc	70.67c
GA ₃ at 75 ppm	45.67e	42.00e	52.33e	62.67e
GA ₃ at 150 ppm	42.67f	40.00e	58.00d	69.33cd
PP ₃₃₃ at 250 ppm	68.33a	61.33a	63.67b	73.00b
PP ₃₃₃ at 500 ppm	66.00b	62.67a	69.67a	77.67a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.

Fruit quality:

Fruit physical properties:

Fruit weight (g) and fruit volume (cm³):

With respect to both the fruit weight (gm) and fruit volume (ml³) of "Etmani" guava trees in response to the effect of different investigated treatments under study, data in Table (2) displayed clearly that, all spraying treatments including defoliation treatment increased significantly fruit weight (gm) and fruit volume (ml³) as compared to the water sprayed trees (control) during both the first and second seasons of study. The heaviest and the greatest of both weight and volume fruits are significantly in concern that to GA₃ at (150 ppm) and (75 ppm) for the two seasons of study, respectively. Contrary to that, the control treatment (water sprayed trees) induced significantly the lightest fruits and the lowest values of both weight and volume of fruits in the two seasons. Meanwhile, the average both fruit

weight and fruit volume of the PP₃₃₃ at (500 and 250 ppm) followed by sprayed trees with urea at (15 and 10 %) then defoliation treatments, respectively were statistically intermediate as compared to those both GA₃ and water sprayed trees (control) treatments. Such trend was true during both 2012/2013 and 2013/2014 experimental seasons of study.

Fruit firmness (lb/inch²):

Concerning the effect of various investigated treatments under study on fruit firmness (lb/inch²), data in Table (2) indicated obviously that, fruit firmness of "Etmani" guava was specifically responded to all investigated treatments under study. Hence, an obvious increase in fruit firmness was generally exhibited with spraying chemical solutions and defoliation treatments. Moreover, trees sprayed with PP₃₃₃ at either 500 or 250 ppm concentrations were superior treatments which induced significantly fruits firmer flesh texture (9.07 & 9.25) and (9.04 & 9.17) as compared to any investigated treatments followed statistically by GA₃ at 150 ppm treatment during the two seasons of study. On the other hand, the opposite trend was found with those trees sprayed with water (control) treatment which resulted in significantly the most softened fruits (7.12 & 7.19) in both seasons of study respectively. In addition, other remain treatments i.e., urea at 15 % & 10 %, GA₃ at 75 ppm and defoliation induced fruits had significantly the firmest flesh texture in between the aforesaid two texture. Such trends were true during both the first and second seasons of study.

Table 2: Some fruit physical properties (fruit weight, volume and firmness) as affected by spraying some chemical compounds on "Etmani" guava trees at different concentrations during both 2012/2013 and 2013/2014 seasons.

Treatments	Fruit weight (gm)		Fruit volume (ml ³)		Firmness (lb/inch ²)	
	2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014
Control	93.00g	102.67g	97.67g	107.67f	7.12e	7.19e
Defoliation	103.00f	114.33f	110.33f	123.33e	8.16d	8.25d
Urea at 10 %	154.00e	164.00e	163.00e	170.33d	8.45c	8.57c
Urea at 15 %	164.33d	171.33d	172.33d	179.67c	8.50c	8.66c
GA ₃ at 75 ppm	171.67b	184.00b	185.33b	189.67ab	8.51c	8.11d
GA ₃ at 150 ppm	185.33a	189.00a	189.33a	192.00a	8.64b	8.86b
PP ₃₃₃ at 250 ppm	167.67c	179.00c	174.33d	186.67b	9.04a	9.17a
PP ₃₃₃ at 500 ppm	168.67bc	181.33c	178.67c	188.00b	9.07a	9.25a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.

Fruit length and fruit width (cm):

Considering the fruit length and fruit width (in cm) of "Etmani" guava as influenced by foliar spray of different investigated chemical solution and defoliation treatments, data tabulated in Table (3) showed obviously that, sprayed trees with GA₃ treatments at (150 and 75 ppm) were statistically the superior and more the greatest values of both fruit length and fruit width as compared to those of the other treatments during the two seasons of study. In addition to that, the opposite trend was found with defoliation treatment which significantly the inferior as exhibited the lowest value of both fruit length and width during the two seasons of study. On the other hand, other sprayed treatments (PP₃₃₃ and urea) were intermediate the abovementioned discussed two extents meanwhile, both fruit length and fruit width of "Etmani" guava sprayed with either (PP₃₃₃) or (urea) were statistically the same in the first season only. Whereas, in the second one, the higher concentrations of both (PP₃₃₃) and (urea) exhibited significantly the highest values of fruit length and fruit width than those of lower concentrations of (PP₃₃₃) and (urea).

Fruit shape index:

Regarding the effect of different studied treatments on fruit shape index (fruit length/fruit width ratio) of "Etmani" guava, data represented in Table (3) revealed obviously that, the response was completely absent from the standpoint of statistic in most cases during both the first and second

seasons of study. Furthermore, GA₃ treatment at 150 ppm was statistically the superior as showed significantly the highest value of fruit shape index in the two seasons of study. On the other hand, other remain investigated treatments tended to be nearly equality in fruit shape index and differences between those treatments were completely absent, also these treatments exhibited the least significant value of fruit shape index except with both control treatment in the first season and GA₃ at 75 ppm in the second one which were statistically in between the abovementioned two extents as their effect on fruit shape index.

Table 3: Some fruit physical properties (fruit length, width and shape index) as affected by spraying some chemical compounds on "Etmani" guava trees at different concentrations during both 2012/2013 and 2013/ 2014 seasons.

Treatments	Fruit length (cm)		Fruit width (cm)		Fruit shape index	
	2012/2013	2013/ 2014	2012/2013	2013/ 2014	2012/2013	2013/ 2014
Control	6.31c	6.31c	6.28b	6.30c	1.01b	1.00c
Defoliation	6.04e	6.09g	6.05c	6.06e	1.00bc	1.00c
Urea at 10 %	6.11de	6.12ef	6.12c	6.13de	1.00bc	1.00c
Urea at 15 %	6.13d	6.16d	6.12c	6.16d	1.00bc	1.00c
GA ₃ at 75 ppm	7.32b	7.38b	7.43a	7.20b	0.99c	1.02b
GA ₃ at 150 ppm	8.33a	8.34a	7.37a	7.28a	1.13a	1.15a
PP ₃₃₃ at 250 ppm	6.13d	6.11f	6.13c	6.13de	1.00bc	1.00c
PP ₃₃₃ at 500 ppm	6.15d	6.13e	6.13c	6.15d	1.00bc	1.00c

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.

Fruit chemical characteristics:

Fruit juice total soluble solids percentage (TSS %):

Referring the fruit juice TSS % as influenced by the effect of investigated treatments under study, data tabulated in Table (4) displayed clearly that, the highest values of soluble solids content (SSC) were concomitant to such fruit produced by trees sprayed with urea treatments either 15 % or 10 %. However, two treatments of urea resulted in significantly the greatest value of fruit juice TSS % (10.80 & 11.15) and (10.71 & 11.16 %) during both seasons of study, respectively. But the differences did not reach level of significance between the two treatments. On the contrary, "Etmani" guava trees sprayed with water (control) treatment exhibited the poorest fruit in their TSS % and produced fruits with the lowest value in this concern. On the other hand, other remain treatments i.e., (defoliation, GA₃ and PP₃₃₃) were statistically in between the abovementioned two extents, respectively. Such trends were detected during the first and second experimental seasons.

Fruit juice total acidity percentage (TA %):

Considering the fruit juice total acidity % (TA %) as affected by different tested treatments in this investigation, data in Table (4) show obviously that, guava trees sprayed with the higher level of urea (15 %) treatment exhibited statistically the richest fruits in their content of total acidity and the highest value of total acidity (0.313 & 0.250 %), followed by both treatments of urea at 10 % (0.287 & 0.227 %) and control (0.213 & 0.183) during both the first and second seasons of study, however differences were significantly as compared to each other during the two seasons. On the other hand, "Etmani" guava trees sprayed with PP₃₃₃ either at the higher concentration (500 ppm) in the first season or at the lower concentration (250 ppm) in the second one induced the poorest fruits in their content of total acidity and exhibited fruits with the least value (0.140 & 0.137 %) of total acidity percentage during the two seasons of study, respectively. In addition to that, the other investigated treatments were in between the aforesaid two extents with a slight tendency of variability in their effectiveness. Such trends were true during both 2012/2013 and 2013/2014 of experimental seasons of investigation.

Rate of fruit juice total soluble solids percentage/total acidity percentage (TSS/acid ratio):

Regarding the effect of different investigated treatments under study on TSS/acid ratio of "Etmani" guava trees, data obtained during the two seasons of study and tabulated in the same Table displayed clearly that, TSS/acid ratio was generally responded significantly. Whereas, "Etmani" guava trees were sprayed with PP₃₃₃ at both the higher concentration (500 ppm) in the first season and the lower (250 ppm) in the second one were significantly more effective and induced statistically the highest values of TSS/acid ratio. Moreover, the opposite trend was inclosed relationship to the trees sprayed with urea treatments either at 15 % or 10 % which exhibited statistically the least value of TSS/acid ratio (34.50 & 37.32) and (44.60 & 49.16) in the two seasons, respectively, however the response was completely absent from the standpoint of statistic between the two treatments during both seasons of study. On the other hand, the other remain treatments under study were intermediate with a tendency of variability in their effectiveness as compared to the abovementioned two extents. Such trend was detected during both seasons of study.

Table 4: Some chemical properties (TSS, acidity and TSS/acidity ratio) as affected by spraying some chemical compounds on "Etmani" guava trees at different concentrations during both 2012/2013 and 2013/ 2014 seasons.

Treatments	TSS (%)		Acidity (%)		TSS/acid ratio	
	2012/2013	2013/ 2014	2012/2013	2013/ 2014	2012/2013	2013/ 2014
Control	9.19d	9.38e	0.213c	0.183c	43.15d	51.26e
Defoliation	10.01b	10.19b	0.190d	0.160d	52.68c	63.69cd
Urea at 10 %	10.71a	11.16a	0.287b	0.227b	37.32e	49.16f
Urea at 15 %	10.80a	11.15a	0.313a	0.250a	34.50e	44.60f
GA ₃ at 75 ppm	9.95b	9.89c	0.163e	0.140e	61.04b	70.64ab
GA ₃ at 150 ppm	9.97b	9.87c	0.167e	0.160d	59.70b	61.69d
PP ₃₃₃ at 250 ppm	9.78c	9.71d	0.153ef	0.137e	63.92b	70.88a
PP ₃₃₃ at 500 ppm	9.82c	9.75d	0.140f	0.147de	70.14a	66.33bc

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.

Vitamin C (mg/100 ascorbic acid ml juice):

As for the vitamin C content of "Etmani" guava fruits in response to the effect of investigated treatments under study. Data in Table (5) revealed obviously that, the richest fruits in vitamin C content was achieved by those trees sprayed with PP₃₃₃ at higher concentration (500ppm) followed by the lower concentration (250 ppm) treatments. The superiority of the aforesaid two treatments over the other investigated treatments was closely observed during the two seasons of study. On the other hand, both treatments of defoliation and control were statistically the inferior as both showed significantly the least values of vitamin C content in fruits (73.33 & 71.21) through the first season, respectively. In addition, other remain treatments i.e., (GA₃ at 150 ppm, GA₃ at 75 ppm and both urea treatments at 15 % and 10 %) came in between the abovementioned two extents with tendency of variability in their effectiveness. Such trend was true during the first season of study. Moreover, the second season followed typically the same trend in this concern.

Total sugars content:

Regarding the effect the different investigated treatments under study on total sugars content of "Etmani" guava fruits, data represented in Table (5) indicated clearly that, total sugars content responded significantly by all investigated treatments as compared to the control treatment during both seasons. However, sprayed guava trees with GA₃ treatments either at 150 or 75 ppm exhibited generally the highest values of total sugars content in guava. The superiority of abovementioned investigated two treatments over the other investigated ones. The ones was clearly observed during both the first and second seasons of study. Moreover, the differences were significant as fruit total sugars content of trees sprayed with any GA₃ at 150 ppm and GA₃ at 75 ppm treatments were compared each other. Such trend was true during the two seasons of study. On the other hand, control trees sprayed with water was statistically the inferior as exhibited the poorest fruits in their total sugars content and the least value in this concern during both seasons of study. Moreover, other

studied treatments were in between the aforesaid discussed two extents with a tendency of variability in their effectiveness whereas, differences in all cases were significant.

The present results concerning the response of studied fruit chemical properties to the investigated treatments under study are in harmony with those previously mentioned by some investigators, Gaur (1996), Bariana and Dhaliwal (2002) and Dhaliwal *et al.*, (2002), Dubey *et al.*, (2002) and Saleh (2011) on guava fruits and Ashgar *et al.*, (2007) on pomegranate trees.

Table 5: Some chemical properties (total sugars and vitamin C) as affected by spraying some chemical compounds on "Etmani" guava trees at different concentrations during both 2012/2013 and 2013/2014 seasons.

Treatments	Total sugars (%)		Vitamin C (mg/100ml)	
	2012/2013	2013/ 2014	2012/2013	2013/ 2014
Control	4.17g	4.14e	71.21e	78.67e
Defoliation	4.75f	4.94d	73.33e	79.33e
Urea at 10 %	5.78e	5.95c	78.00d	86.33e
Urea at 15 %	5.92d	6.03c	79.00d	88.00d
GA ₃ at 75 ppm	6.32b	6.36b	84.00c	92.67c
GA ₃ at 150 ppm	6.56a	6.70a	88.00c	96.00b
PP ₃₃₃ at 250 ppm	6.13c	6.42b	93.67a	101.67a
PP ₃₃₃ at 500 ppm	5.97d	6.05c	89.00b	102.67a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.

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