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EFFECT OF SOME FERTILIZATION TREATMENTS ON GROWTH OF TREES, PRODUCTIVITY AND QUALITY OF GUAVA (*Psidium guajava* l.) FRUITS CV. "ETMANI". II. UNDER FASTING SYSTEM.

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ABSTRACT

A series of field experiments was carried out in a private orchard at Qalyob region, Qalubia governorate, Egypt during 2011/12, 2012/13 and 2013/14 seasons for winter production of 9-years-old guava (*Psidium guajava* L.) cv. "Etmani" trees, planted on clay loam soil at a distance of 5 x 5 m and fasted from April, 1st to July end, beside improving yield and quality of such winter crop by application of organic compost at either full, ¾ or ½ the recommended dose (40, 30 and 20 kg/tree, respectively) + both feldspar and rock phosphate at either full, ¾, ½ or ¼ the recommended dose for each + biofertilizer mixture comprising nitropeine + phosphoreine + potasseine at the recommended dose for each, where all previous compost were arranged in 12 combinations plus the control.

The gained results have shown that most fertilization treatments employed in this work raised the means of shoot length, number of leaves/m, leaf area and number of flower buds/m over those of control with various significant levels in the 3 seasons. Similarly, were those results of No. of fruits/m, fruit weight, yield, fruit length, diameter and volume, as well as flesh thickness. The prevalence in all aforenamed characters was for the combination of 75 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizers mixture which gave the utmost high means over control and other combinations in most cases of the three seasons. The percent of TSS was significantly increased in the first season only by 100 % compost + 25 % feldspar + 25 % rock phosphate + biofertilizers mixture combined treatment, but in the 2nd and 3rd seasons, it was slightly improved by the different used combinations with non-significant differences in between or with control. The acidity % exhibited a similar behaviour in the three growing seasons, but the least percent of acidity was found due to the combining between 100 % compost, 25 % feldspar + 25 % rock phosphate and biofertilizer mixture (T_4), especially in the 1st and 2nd seasons. In the 3rd season, however, the least acidity % was attained by 75 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizer nixture (T5). So, the best ratio of TSS/acidity was obtained in the first and second seasons by T_4, while in the 3rd one by T_5. Vitamin C content and flesh thickness were also improved by the used fertilization combinations, but the highest records of them was obtained by different treatment in every season. The percent of N, P, K, Ca and Mg in the leaves of fertilized plants was, in general improved over that of control in the three seasons by the different used treatments, but no one of them had the superior effect over the others.

Hence, it can be advised to fertilize the 9-years-old trees of guava cv. "Etmani" grown on clay loam soil at 5 x 5 m apart under Qalubia governorate conditions and fasted from April, 1st to end of July with 75 % of recommended compost dose (30 kg/tree) + 100 % of both feldspar (1.2 kg/tree) and rock phosphate dose (1.3 kg/tree) plus biofertilizer mixture used in this study to get the highest and best quality winter crop from point of commercial and economic view.

INTRODUCTION

Guava (*Psidium guajava* L.) is still one of the most cheap and popular fruits in Egypt, as it used for both fresh consumption and processing. It excels most other fruit trees in productivity, hardiness, adaptability and rich in vitamin C and some minerals useful for human health. Besides its high nutritive value, it bears heavy crop every year and gives good economic returns involving very little cost (Thonte and Chakrawar, 1982).

The main guava crop usually appears in Egyptian local markets in summer, in which the fruits are in low quality because they are affected by high temperature, which causes browning of colour, fast decay and short shelf life (El-Baz et al 2011) . So, it was urgent to identify a modern, innovative and more suitable methods to overcome these problems, one of such methods may be fasting (Singh, 2007). Some efforts were done in order to late guava production to winter. In this connection, Mikhail *et al*., (2007) revealed that shoot length, No. of leaves and fruit set of 10-years-old guava trees were significantly increased as affected by fasting till July, 15^{th} more than fasting till August, 15^{th}, whereas fruit weight, flesh thickness and yield were significantly increased by fasting till August, 15^{th} than that till July, 15^{th}. The seed % of August fasting was markedly reduced than that of July one. The early fasting surpassed the late one in vitamin C and tannins contents, while TSS and TSS/acid ratio were increased more in the fruits of late fasting than the early one. Furthermore, El-Shobaky (2007) and El-Baz *et al*., (2011) who found that irrigation at 1^{st} June or July greatly raised firmness, TSS, total sugars, acidity, vitamin C and phenol contents in common guava fruits, but decreased yield compared to irrigation at mid February or 1^{st} April and May. In general, the least decay % and high quality of fruits obtained from late irrigation at 1^{st} June or July and that gave high price covered greatly the reduce in the yield.

Summer crop is usually affected with attack of fruitfly due to which most of the fruits are destroyed and does not remain marketable. On the other side, the winter crop is free from such attack and good quality fruits are produced. But due to bumper crop in summer season, the trees become exhausted and as a result the bearing of winter crop is seriously affected. If proper nutrient level of soil and trees is maintained for winter crop, we can get improved production (Muhammad *et al*., 2000). Hence, in order to get good winter crop, we must be use organic and inorganic manures in combination to score better results. In this regard, Muhammad *et al*., (2000) observed that combined application of farmyard manure and NPK increased the fruit size, weight and total yield of winter crop of guava. Dashora *et al*., (2007) found that the maximum days taken to initiation of flowering, maximum No. fruits/shoot, maximum fruit set, highest fruit retention and maximum yield of winter crop of guava cv. Sardar were recorded in vermicompost (1 kg/tree) + 50 % recommended dose of NPK + PSB (10 g/tree) treatment as compred to control.

Similar results were also discovered on winter crop of guava by Bshir *et al*., (2009), El-Sharkawy and Osman (2009), Dwivedi *et al*., (2012) and Elmehart *et al*., (2012) whom claimed that combining between 75 % recommended NPK fertilizers and biofertilizers (PGPR) at 9.52 l/ha gave the best results for weight loss, decreasing firmness and decay, increasing vitamin C, TSS, sugars, improve colour and decreasing total acidity as compared to fruits of untreated trees.

To reduce both high costs and environmental pollution of using mineral fertilizers, many researches resorted to new attitude by using organic manures and biofertilizers instead of chemical ones. This was documented on common guava by Mitra *et al*., (2010), Wali *et al*., (2011), Barue *et al*., (2011), Devi *et al*., (2012), Yadav *et al.,* (2013), Hernandez *et al*., (2013), Binepal *et al*., (2013), Nunes *et al*., (2014)and Ram *et al*., (2014), as they all affirmed that the combined application of organic and inorganic manures along with biofertilizers gave better results than their individual application giving better economic response.

The purpose of this study is to investigate the role of fasting in turning the summer crop of guava cv. "Etmani" to winter one plus improving yield and quality of such winter crop by organic compost and mineral rocks in presence of biofertilizers to be more suitable for local marketing and export.

MATERIALS AND METHODS

Three field experiments were undertaken in a private orchard at Qalyob region, Qalubia governorate, Egypt throughout the three successive seasons of 2011/12, 2012/13 and 2013/14 to study the effect of fasting on lating flowering and fruiting of guava (*Psidium guajava* L.) cv. "Etmani" trees, and to determine the best combined treatment of organic compost, rocks and biofertilizers necessary for improving fruit yield and quality of the resulted winter crop.

Table (1): The mechanical, physical and chemical properties of the studied soil in the 3 seasons.

Property		**Values**
Mechanical analysis	Coarse sand	7.41 (%)
	Lime Sand	23.71 (%)
	Silt	28.89 (%)
	Clay	30.72 (%)
Texture (physical)	Clay loam	
Chemical analysis	pH	7.62
	E.C. (dSm-1)	3.1
	O.C.	0.71
	O.M.	1.24 (%)
	T. N.	0.17
	W.H.C.	54.32
Anions and Cations (meq L-1)	Bicarbonate (HCO_3^-)	8.4
	Chloride (Cl^-)	11.71
	Sulphate (SO_4^{--})	16.43
	Calcium (Ca^{++})	8.53
	Magnesium (Mg^{++})	2.57
	Sodium (Na^+)	22.93

Soil analysis was done by: Soil, Water and Environment Res. Inst., ARC, Giza Egypt.

Thus, homogenous trees of 9-years-old planted on clay loam soil at 5 x 5 m apart and received the regular cultural practices were forced to flowering in September by preventing the surface irrigation for 4 months, commencing from first of April to end of July for each season. After fasting, the foliage was manually dropped and the soil was digged, fertilized and irrigated. Fruits were harvested during the period from mid- February to end of March.

The fertilization was accomplished using the following materials at the recommended doses: Al-Obour compost (40 kg/tree), feldspar (1.2 kg/tree) and rock phosphate (1.3 kg/tree). The physical and chemical analysis of the soil and Al-Obour compost were determined and illustrated in Tables (1 and 2 respectively), while those of feldspar and rock phosphate are shown in Table (3).

Table (2): Physical and chemical analysis of Al-Obour compost used in the three seasons.

Al-Obour compost	
Character	**Content**
Weight of/m^3 (kg)	500-550
Humidity (%)	25-30
pH (1-2.5)	7.5-8.0
Ec (1:5)	3.-4
Water hold capacity	250-300 %
Total nitrogen	1-1.4 %
Organic matter	34-38 %
Organic carbon	19.8-22 %
C/N ratio	1-14.2
NaCl	1.1-1.25 %
Total phosphorus	0.5-0.75 %
Total potassium	1.25-1.75 %
Fe (ppm)	1500-1800
Mn (ppm)	25-50
Cu (ppm)	50-75
Zn (ppm)	150-225

The used compost manufactured from residues and free from heavy minerals and pollution.
Compost analysis by: Producer Company.

Table (3): The chemical analysis of feldspar and rock phosphate used in the three seasons.

Component (%)	Feldspar		Rock phosphate	
	From	To	From	To
SiO_2	68.56	70.23	10.60	12.78
TiO_2	0.02	0.04	0.02	0.03
Al_2O_3	13.23	16.25	0.35	0.65
Fe_2O_3	0.17	0.40	1.12	1.35
MnO	0.02	0.06	0.07	0.08
Mg O	0.03	0.05	0.33	0.61
Ca O	0.26	0.47	44.12	48.63
Na_2O	2.25	3.69	0.18	1.12
K_2O	6.20	8.12	0.03	0.05
P_2O_5	0.02	0.03	20.00	22.00
SO_3 (%)	-	-	0.32	1.98

Mineral rock analysis by: Producer Company.

The previous materials were applied in combination at different proportions (100, 75, 50 , 25 and 0 % for each) in the presence of nitropeine (a mixture of N-fixing bacteria) at 120 g/tree, phosphoreine (a mixture of p-solubilizing bacteria) at 25 g/tree and potasseine (a commercial product that contains 30 % K_2O and 8 % P_2O_5) at 134 cm/tree form the following 12 combined treatments:

1.. Control (25kg as FYM + 1.5kg as SO_4 $(NH)_2$ +1kg as CA H_2 P_2 O_5 and 1kg as k_2 so_4/ tree)..
2. 100 % Compost + 100 % Feldspar + 100 % Rock-P + Biofertilizers (T_1)
3. 100 % Compost + 75 % Feldspar + 75 % Rock-P + Biofertilizers (T_2)
4. 100 % Compost + 50 % Feldspar + 50 % Rock-P + Biofertilizers (T_3)
5. 100 % Compost + 25 % Feldspar + 25 % Rock-P + Biofertilizers (T_4)
6. 75 % Compost + 100 % Feldspar + 100 % Rock-P + Biofertilizers (T_5)
7. 75 % Compost + 75 % Feldspar + 75 % Rock-P + Biofertilizers (T_6)
8. 75 % Compost + 50 % Feldspar + 50 % Rock-P + Biofertilizers (T_7)
9. 75 % Compost + 25 % Feldspar + 25 % Rock-P + Biofertilizers (T_8)
10. 50 % Compost + 100 % Feldspar + 100 % Rock-P + Biofertilizers (T_9)
11. 50 % Compost + 75 % Feldspar + 75 % Rock-P + Biofertilizers (T_{10})
12. 50 % Compost + 50 % Feldspar + 50 % Rock-P + Biofertilizers (T_{11})
13. 50 % Compost + 25 % Feldspar + 25 % Rock-P + Biofertilizers (T_{12})

On September, 1^{st} of each season, the total amount of biofertilizers were mixed thoroughly with that of compost plus the total one of rock phosphate were added to the soil at a depth of 20-25 cm in circled narrow trenches at 1 m away around trunk of each tree just before irrigation, and then covered completely with soil. As for feldspar doses, they were splitted into two equal splits, where the first one was applied with compost and biofertilizers on September, 1^{st}, while the second one was applied on the first of December. A complete randomized design with three replicates, as each one contained only one tree (Mead *et al*., 1993) was employed in the three studied seasons.

Data recorded:

At the proper time, data were registered as follows:

*** Vegetative and flowering growth:**

Shoot length (cm), number of leaves/lm, leaf area (cm^2) using planimeter and number of flower buds/lm.

*** Fruit characteristics and yield:**

Number of fruits/lm, length and diameter of fruit (cm), fruit size (cm^3), fruit weight (g), flesh thickness (cm), fruit firmness (g/cm^2) and yield (kg/tree).

*** Fruit chemical properties:**

- Total soluble solids (TSS %) were determined by a`bbe refractometer using the method of A.O.A.C. (1995).
- Total acidity (%) was measured by titration method described by A.O.A.C. (1975).
- TSS/acidity was calculated as a ratio.
- Vitamin C (ascorbic acid) was evaluated by the method of Horwitz (1970) as mg/100 g fruit flesh.
- Leaf content of minerals.

In dry leaf samples taken from the middle part of the shoot, the percentages of nitrogen (A.O.A.C., 1995), phosphorus (Wide *et al*., 1985), potassium (by flame photometer set as indicated by Jackson, (1973) and calcium and magnesium (Dewis and Freitas, 1970) were assessed.

*** Statistical analysis:**

Data were then tabulated and statistically analyzed according to SAS Institute program (1994) using Duncan's Multiple Range Test (Duncan, 1955) for elucidating the significancy between the means of various treatments.

RESULTS AND DISCUSSION

Effect of fertilization treatments on:

1- Vegetative growth and flower bud number:

It is obvious from data recorded in Table (4) that the means of shoot length (cm), No. of leaves/m and leaf area (cm^2) were increased over those of control by some fertilization combined treatments used in the present study, while other combinations gave means slightly higher or lower than those of control with non-significant differences between them in the three growing seasons. In general, the superiority in the three seasons was for the combination of 75 % compost + 100 % feldspar + 100 % rock phosphate + biofertlilizer mixture which gave the highest values relative to other combinations in most cases of the 3 seasons. A similar trend was also obtained concerning the number of flower buds/m, as the previously mentioned super combination also scored the utmost high means over control and other used combinations in the 3 studied seasons giving the highest No. flower buds/m.

This may be ascribed to the synergistic effect of compost, mineral rocks and biofertilizers as indicated before in case of irrigated guava cv. "Etmani" (Part, I). In this connection, Dwivedi *et al*., (2012) mentioned that increasing "Red Flashed" guava growth may be attributed to increase in level of readily available N, P, K and other nutrients in the presence of organic manure which often enhanced growth mechanism in plants. Increasing soil chemical and physical properties that were induced by organic manure application may be a direct reason for improving growth (Muhammad *et al*., 2000). Glick (2004) suggested that plant growth promoting rhizobacteria (PGPR) could benefit plants growth and yield through: biological N-fixation, phosphate solubilization, the production of siderophors, the production of secondary metabolites such as antibiotic, hydrogen, cyanid and plant hormones (i.e., IAA), releasing of K and antagonism to soil borne root pathogens.

4-

The previous results are in great accordance with those revealed on guava cvs. by Mikhail *et al*., (2007), El-Sharkawy and Osman (2009), Mitra *et al*., (2010), Devi *et al*., (2012) and Yadav *t al*., (2013) whom reported that application of various organic substances increased plant spread and No. branches/plant. On winter season crop of guava cv. Sardar, Dashora *et al*., (2007) found that the minimum days taken to initiation of flowering and maximum No. of flowers/shoot were recorded by vermicompost (10 kg/plant) + 50 % recommended dose of NPK + P-solubilizing bacteria (20 g/plant) treatment.

2- Yield and fruit characteristics:

From data averaged in Table (5), it can be summarized that 75 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizer mixture combined treatment mostly induced the best improvement in No. of fruits/m, fruit weight (g), yield (kg/tree), fruit length (cm), diameter (cm) and volume (cm^3), as well as flesh thickness (cm) where such combination elevated the means of these parameters to the utmost high values in comparison to control and other combinations, with few exceptions in the 3 studied seasons.

This may be comprehensible because this combination gave the best vegetative and flowering growth throughout the three growing seasons as indicated before in Table (4), and that was usefully, reflected on increasing yield and improving fruit characteristics. In this regard, Dwivedi *et al*., (2012) mentioned that application of biofertilizers in the presence of organic manure was more effective in enhancing fruit growth parameters due to the increased availability of nutrients which might have reflected the increase in fruit weight, length and breadth.

Similar results were also attained by El-Shobaky (2007), Bashir *et al*., (2009), El-Sharkawy and Osman (2009), El-Baz *et al*., (2011) and Dwivedi *et al*., (2012) on winter crop of guava. Furthermore, Devi *et al*., (2012) concluded that application of FYM at 26 kg/tree/y + azotobacter (100 g/tree) + P-solubilizer (100 g/tree) + K-mobilizer (100 g/tree) in two splits (January and August) is the economically profitable treatment for cultivation of guava cv. "Sardar".

Table (5): Effect of fertilization treatments on yield and fruit characteristics of (*Psidium guajava* L.) "Etmani" cv. tree under fasting system during 2011/12, 2012/13 and 2013/14 seasons.

Treatments	No. fruits per lm	Fruit weight (g)	Yield (kg/tree)	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)	Flesh thickness (cm)
First season: 2011/2012							
Control	17.78g	46.55c	24.67f	4.57f	4.03e	46.00c	1.37c
100 % C + 100 % K + 100 % P + Bio-F.	24.61e	48.35b	30.00de	5.03de	4.63a-c	46.67c	1.33c
100 % C + 75 % K + 75 % P + Bio-F.	29.05bc	51.55a	39.00ab	5.43b-d	4.40b-e	51.00ab	1.43bc
100 % C + 50 % K + 50 % P + Bio-F.	26.12de	51.52a	35.33bc	5.23c-e	4.17de	51.67a	1.50a-c
100 % C + 25 % K + 25 % P + Bio-F.	27.99b-d	50.58a	28.00ef	5.33b-d	4.47a-d	50.00b	1.37c
75 % C + 100 % K + 100 % P + Bio-F.	31.43a	52.30a	42.33a	5.77ab	4.43a-d	51.33a	1.67a
75 % C + 75 % K + 75 % P + Bio-F.	27.27cd	51.53a	29.67de	5.77ab	4.80a	51.00ab	1.43bc
75 % C + 50 % K + 50 % P + Bio-F.	22.24f	50.92a	30.00de	5.67a-c	4.77ab	50.67ab	1.50a-c
75 % C + 25 % K + 25 % P + Bio-F.	25.13e	51.38a	33.00cd	5.33b-d	4.60a-c	51.33a	1.50a-c
50 % C + 100 % K + 100 % P + Bio-F.	25.95de	50.57a	33.33cd	5.70a-c	4.33c-e	50.67ab	1.67a
50 % C + 75 % K + 75 % P + Bio-F.	29.71ab	51.18a	33.00cd	4.83ef	4.17de	50.67ab	1.67a
50 % C + 50 % K + 50 % P + Bio-F.	24.89e	50.90a	35.67bc	5.17de	4.43a-d	51.33a	1.47bc
50 % C + 25 % K + 25 % P + Bio-F.	26.46de	50.83a	33.33bc	6.03a	4.27c-e	50.67ab	1.60ab
Second season: 2012/13							
Control	18.89f	50.95f	29.00e	4.93b-e	4.10bc	49.67e	1.57c-f
100 % C + 100 % K + 100 % P + Bio-F.	27.11d	51.43ef	34.33b	5.17b-d	4.27bc	50.67d	1.50ef
100 % C + 75 % K + 75 % P + Bio-F.	29.91ab	53.85a	42.33b	5.17b-d	4.23bc	53.33a	1.67b-d
100 % C + 50 % K + 50 % P + Bio-F.	29.58b	53.52ab	39.00b-d	4.80c-e	4.10bc	52.33bc	1.53d-f
100 % C + 25 % K + 25 % P + Bio-F.	28.45b-d	52.56a-e	33.67e	4.83c-e	4.10bc	52.00bc	1.50ef
75 % C + 100 % K + 100 % P + Bio-F.	31.47a	53.07a-c	46.33a	5.40b	4.97a	53.33a	1.83a
75 % C + 75 % K + 75 % P + Bio-F.	29.32bc	52.17c-f	35.33de	5.27bc	4.53a-c	51.33bc	1.50ef
75 % C + 50 % K + 50 % P + Bio-F.	24.14e	52.68a-e	35.00de	4.83c-e	4.10bc	52.33bc	1.63b-e
75 % C + 25 % K + 25 % P + Bio-F.	27.43d	52.85a-d	36.00c-e	4.70de	4.77ab	52.67ab	1.47f
50 % C + 100 % K + 100 % P + Bio-F.	25.18e	52.37b-e	37.00c-e	5.10b-d	4.03c	52.67ab	1.77ab
50 % C + 75 % K + 75 % P + Bio-F.	28.62b-d	52.58a-e	42.00b	4.57e	3.93c	52.33bc	1.73ab
50 % C + 50 % K + 50 % P + Bio-F.	25.29e	52.32b-e	40.00bc	5.33bc	4.63a-c	52.33bc	1.70a-c
50 % C + 25 % K + 25 % P + Bio-F.	27.70cd	51.62d-f	36.00c-e	5.97a	4.30bc	50.67d	1.67b-d
Third season: 2013/14							
Control	22.93g	51.56d	32.00d	6.00b	3.80bc	50.00d	1.57de
100 % C + 100 % K + 100 % P + Bio-F.	28.82f	51.66d	40.33c	6.27ab	4.13a-c	50.67d	1.50e
100 % C + 75 % K + 75 % P + Bio-F.	34.14b	57.08a	50.33b	6.53ab	3.67c	55.33a	1.77ab
100 % C + 50 % K + 50 % P + Bio-F.	30.87c-e	55.27b	46.00bc	6.00b	4.07a-c	55.00a	1.63b-d
100 % C + 25 % K + 25 % P + Bio-F.	32.33bc	53.15cd	40.33c	6.60a	3.67c	53.00b	1.57de
75 % C + 100 % K + 100 % P + Bio-F.	35.99a	55.13b	56.33a	6.37ab	4.53a	54.67a	1.87a
75 % C + 75 % K + 75 % P + Bio-F.	32.81bc	53.79bc	42.00c	6.20ab	3.97bc	53.00b	1.73b
75 % C + 50 % K + 50 % P + Bio-F.	29.27ef	52.59cd	41.00c	6.37ab	3.70c	52.33bc	1.63b-d
75 % C + 25 % K + 25 % P + Bio-F.	32.01cd	52.59cd	42.33c	5.97b	3.90bc	52.00c	1.77ab
50 % C + 100 % K + 100 % P + Bio-F.	30.11d-f	53.18cd	41.67c	6.30ab	4.27ab	52.00c	1.77ab
50 % C + 75 % K + 75 % P + Bio-F.	32.68bc	53.30cd	45.00bc	6.23ab	4.07a-c	52.67bc	1.73b
50 % C + 50 % K + 50 % P + Bio-F.	29.20ef	52.91cd	45.33bc	5.97b	3.87bc	52.67bc	1.70bc
50 % C + 25 % K + 25 % P + Bio-F.	30.23d-f	53.27cd	40.00c	6.30ab	3.80bc	52.67bc	1.60b-d

*** C: Compost; K: Feldspar; P: Rock phosphate, Bio-F.: Nitrobeine, Phosphorene, Potasseine and lm: Longitudinal meter.**

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

3- Chemical composition and firmness of fruits:

Data in Table (6) show that mean of TSS % was increased significantly only in the first season to 11.23 % by 100 % compost + 25 % feldspar + 25 % rock phosphate + biofertilizer mixture combined treatment against 10.57 % for control, while other combinations slightly improved such parameter with non-significant differences among them in most cases. In the second and third seasons, however, all fertilization treatments caused a slight improvement in this trait also, without significant differences in between. Likely the percent of acidity went to a similar behaviour, as the differences between treatments and control were non-significant in the 3 studied seasons, but the least percent of acidity was recorded in the 1st and 2nd seasons by fertilizing with 100 % compost + 25 % feldspar + 25 rock phosphate + biofertilizer mixture combined treatment, whereas in the 3rd one, that was attained by 75 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizer mixture combined one, which directly followed by a combination reduced acidity to the minimal values in the 1st and 2nd seasons that mentioned above. Hence, the highest ratio of TSS/acidity was recorded in the 1st and 2nd seasons by combining between 100 % compost, 25 % feldspar, 25 % rock phosphate and mixture of biofertilizers, while in the 3rd one, that was achieved by combining between 75 % compost, 100 % feldspar, 100 % rock phosphate and biofertilizer mixture. The other fertilization treatments slightly improved such ratio without significant differences with control in the 3 growing seasons.

In the matter of vitamin C content (mg/100 g fresh flesh) and fruit firmness (g/cm^2), data in Table (6) clear that means of these two measurements reached the maximum in the first season by a combination of 75 % compost + 75 % feldspar + 75 % rock phosphate + biofertilizer mixture, while in the second season that was established by a combination of 100 % compost + 25 % feldspar + 25 % rock phosphate + biofertilizer mixture. In the 3rd season, 50 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizer mixture combined treatment gave the highest content of vitamin C over control and other combinations, but a combined one comparing 100 % compost + 100 % feldspar + 100 % rock phosphate + biofertilizer mixture registered the highest average of fruit firmness at all.

These gains may be interpretted and discussed as done before in case of vegetative growth, yield and fruit characteristics. Analogous findings were also detected on winter guava by Mikhail *et al*., (2007), Dashora *et al*., (2007), Bashir *et al*., (2009) and Dwivedi *et al*., (2012) who suggested that improving physical and chemical characteristics of guava fruits may be attributed to the better vegetative growth of the fertilized plants which resulted in higher quantities of photosynthates (starch, carbohydrates, … etc) and their translocation to the fruits, thus improving the various quality parameters. Application of P-solubilizers significantly influenced vitamin C content in guava over the control during winter season. When biofertilizers were grouped together, P-solubilizers were found to have more beneficial influence on fruit physico-chemical parameters of "Red Fleshed" guava than the N-fixers (Dey *et al*., 2005). This could perhaps be due to better availability of phosphorus to the plant which improves the quality characteristics of the fruits. Beneficial effect of organic compost is ascribed to the presence of macro-and micro-nutrients and vital plant promoting substances in organic compost (Singh, 2007).

Table (6): Effect of fertilization treatments on chemical composition and firmness of (*Psidium guajava*) L. "Etmani" cv. fruits under fasting system during 2011/12, 2012/13 and 2013/14 seasons.

Treatments	TSS (%)	Acidity (%)	TSS/ acidity ratio	Vitamin C (mg/100 g f.f.)	Fruit Firmness (g/cm^2)
First season: 2011/12					
Control	10.57d	0.400a	28.37a-d	42.73d	113.0g
100 % C + 100 % K + 100 % P + Bio-F.	10.87a-d	0.400a	28.37a-d	43.70a-c	115.7fg
100 % C + 75 % K + 75 % P + Bio-F.	10.93a-d	0.367a	30.44a-c	44.20ab	121.3d-f
100 % C + 50 % K + 50 % P + Bio-F.	10.87a-d	0.433a	25.38b-d	43.43b-d	132.0b
100 % C + 25 % K + 25 % P + Bio-F.	11.23a	0.333a	33.75a	43.80a-c	125.0c-e
75 % C + 100 % K + 100 % P + Bio-F.	10.83a-c	0.467a	22.92d	44.20ab	131.0bc
75 % C + 75 % K + 75 % P + Bio-F.	11.10ab	0.400a	27.75b-d	44.60a	139.7a
75 % C + 50 % K + 50 % P + Bio-F.	11.00a-c	0.433a	25.65b-d	44.07a-c	119.7ef
75 % C + 25 % K + 25 % P + Bio-F.	10.67cd	0.433a	24.95cd	43.13cd	121.3d-f
50 % C + 100 % K + 100 % P + Bio-F.	11.00a-c	0.367a	30.58a-c	43.90a-c	124.7c-e
50 % C + 75 % K + 75 % P + Bio-F.	10.80b-d	0.433a	25.17b-d	43.57b-d	126.7b-d
50 % C + 50 % K + 50 % P + Bio-F.	10.70cd	0.400a	27.93a-d	44.07a-c	121.7d-f
50 % C + 25 % K + 25 % P + Bio-F.	11.03a-c	0.367a	31.08bc	43.70a-c	130.7bc
Second season: 2012/13					
Control	10.67a	0.433a	24.85c	42.87b	110.0e
100 % C + 100 % K + 100 % P + Bio-F.	10.93a-d	0.433a	25.52c	44.07a	136.7a
100 % C + 75 % K + 75 % P + Bio-F.	10.80a	0.333a	33.14ab	42.93b	119.7d
100 % C + 50 % K + 50 % P + Bio-F.	10.90a	0.400a	28.44bc	44.40a	128.7bc
100 % C + 25 % K + 25 % P + Bio-F.	10.93a-d	0.300a	36.44a	44.33a	138.3a
75 % C + 100 % K + 100 % P + Bio-F.	10.90a	0.333a	33.31ab	43.80ab	121.3d
75 % C + 75 % K + 75 % P + Bio-F.	11.10a	0.400a	30.83b	43.87ab	134.0ab
75 % C + 50 % K + 50 % P + Bio-F.	10.97a	0.333a	33.56ab	43.70ab	124.7cd
75 % C + 25 % K + 25 % P + Bio-F.	10.73a	0.333a	32.78ab	43.53ab	133.3ab
50 % C + 100 % K + 100 % P + Bio-F.	10.90a	0.400a	28.50bc	43.77ab	133.0ab
50 % C + 75 % K + 75 % P + Bio-F.	10.67a	0.433a	24.95c	44.13a	129.0bc
50 % C + 50 % K + 50 % P + Bio-F.	11.00a	0.433a	25.65c	44.23a	119.0d
50 % C + 25 % K + 25 % P + Bio-F.	10.83a	0.433a	25.28c	44.23a	130.3bc
Third season: 2013/14					
Control	9.43a	0.400a-c	24.49c-e	42.60e	121.0f
100 % C + 100 % K + 100 % P + Bio-F.	9.33a	0.367a-c	26.03b-e	43.20ab	156.3a
100 % C + 75 % K + 75 % P + Bio-F.	9.90a	0.367a-c	27.47a-c	44.03a-c	136.0b-e
100 % C + 50 % K + 50 % P + Bio-F.	9.47a	0.367a-c	26.14b-e	42.70de	131.0e
100 % C + 25 % K + 25 % P + Bio-F.	9.60a	0.333bc	30.28ab	43.80a-c	131.0e
75 % C + 100 % K + 100 % P + Bio-F.	9.93a	0.300c	32.00a	44.07a-c	134.0c-e
75 % C + 75 % K + 75 % P + Bio-F.	9.73a	0.333bc	29.72ab	43.57b-d	140.0bc
75 % C + 50 % K + 50 % P + Bio-F.	9.43a	0.433ab	22.02de	43.13c-e	140.7b
75 % C + 25 % K + 25 % P + Bio-F.	9.73a	0.400a-c	25.39b-e	43.57b-d	133.0de
50 % C + 100 % K + 100 % P + Bio-F.	9.47a	0.433ab	22.03de	44.70a	137.7b-d
50 % C + 75 % K + 75 % P + Bio-F.	9.63a	0.367a-c	26.56b-d	43.47b-e	138.0b-d
50 % C + 50 % K + 50 % P + Bio-F.	9.83a	0.367a-c	27.31a-c	43.30b-e	135.7b-e
50 % C + 25 % K + 25 % P + Bio-F.	9.90a	0.467a	21.48e	44.07a-c	137.3b-d

*** C: Compost; K: Feldspar; P: Rock phosphate, and Bio-F.: Nitrobeine, Phosphorene and Potasseine..**

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

4- Mineral content of the leaves:

According to the fluctuated data listed in Table (7), it can be concluded that the percentages of N, P, K, Ca and Mg in the leaves of fertilized trees were generally improved over control ones, with few exceptions in the three studied seasons. No treatment among the fertilization ones used in this study had the upper hand in improving minerals content. Thus, it is difficult to recommended one of them over the others.

Improvement mineral content in the leaves of treated plants may indicate the role of biofertilizers grouped with organic compost and mineral rocks in solubilizing most of the major and minor elements are thought to be present in such organic manure and rocks in unavailable form and converted them into available ones (Muhammad, 2000). These results, however go in line with those obtained on various guava cvs. by Mitra *et al*., (2010), Wali *et al*., (2011), Barne *et al*., (2012), Hernandez *et al*., (2013), Nunes *et al*., (2014) and Ram *et al*., (2014) whom revealed that maximum leaf N, P, K, Ca and Zn in guava cv. Allahabad Safeda was noticed at application of *Ficus bengalensis* leaves compost (250 g/tree) + 5 % Amritpani + organic mulching, Mg at application of vermicompost (30 kg/tree) + Azospirillum (250 g/tree) + PSB (50 g/tree) and Cu and Mn were recorded with FYM (30 kg/tree) as compared to control.

From the aforestated findings, it is clear that fertilizing winter crop of guava cv. "Etmani" with 75 % of recommended compost dose (30 kg/tree) + 100 % of recommended feldspar dose (1.2 kg/tree) + 100 % of recommended rock phosphate dose (1.3 kg/tree) plus the used biofertilizers mixture may be one of the best and economic way for organic production of cv. "Etmani" guava in winter under Qalubia governorate conditions.

Table (7): Effect of fertilization treatments on mineral content of (*Psidium guajava* L.) "Etmani" cv. leaves under fasting system during 2011/12, 2012/13 and 2013/14 seasons.

Treatments	N (%)	P (%)	K (%)	Ca (%)	Mg (%)
First season: 2011/12					
Control	1.593c	0.107j	1.175g	1.755f	0.386j
100 % C + 100 % K + 100 % P + Bio-F.	1.847b	0.188ef	1.374bc	1.853vd	0.634c
100 % C + 75 % K + 75 % P + Bio-F.	1.427d	0.116ij	1.386bc	1.960a	0.490f
100 % C + 50 % K + 50 % P + Bio-F.	1.427d	0.176fg	1.426a	1.882bc	0.515e
100 % C + 25 % K + 25 % P + Bio-F.	1.453d	0.366a	1.401ab	1.796e	0.661b
75 % C + 100 % K + 100 % P + Bio-F.	2.127a	0.341b	1.320d	1.895b	0.588d
75 % C + 75 % K + 75 % P + Bio-F.	2.137a	0.227d	1.314de	1.937a	0.447g
75 % C + 50 % K + 50 % P + Bio-F.	1.567c	0.316c	1.356c	1.853cd	0.436gh
75 % C + 25 % K + 25 % P + Bio-F.	1.567c	0.194e	1.322d	1.855cd	0.479f
50 % C + 100 % K + 100 % P + Bio-F.	1.587c	0.124ij	1.367c	1.896b	0.415hi
50 % C + 75 % K + 75 % P + Bio-F.	1.287e	0.164g	1.355c	1.825de	0.690a
50 % C + 50 % K + 50 % P + Bio-F.	1.447d	0.127i	1.225f	1.805e	0.402ij
50 % C + 25 % K + 25 % P + Bio-F.	1.447d	0.146h	1.288e	1.799e	0.697a
Second season: 2012/13					
Control	1.427e	0.115h	1.282f	1.812g	0.415f
100 % C + 100 % K + 100 % P + Bio-F.	1.563d	0.197ef	1.416e	1.825g	0.624b
100 % C + 75 % K + 75 % P + Bio-F.	1.567d	0.223d	1.579ab	1.902cd	0.470e
100 % C + 50 % K + 50 % P + Bio-F.	1.557d	0.192f	1.617a	1.899d	0.518d
100 % C + 25 % K + 25 % P + Bio-F.	1.533d	0.332b	1.464d	1.825g	0.435f
75 % C + 100 % K + 100 % P + Bio-F.	2.547a	0.245c	1.451de	1.932b	0.569c
75 % C + 75 % K + 75 % P + Bio-F.	2.267b	0.227d	1.507c	1.960a	0.467e
75 % C + 50 % K + 50 % P + Bio-F.	2.267b	0.375a	1.541bc	1.882de	0.466e
75 % C + 25 % K + 25 % P + Bio-F.	1.597d	0.210de	1.537bc	1.928b	0.488e
50 % C + 100 % K + 100 % P + Bio-F.	1.987c	0.121h	1.610a	1.942ab	0.416f
50 % C + 75 % K + 75 % P + Bio-F.	1987c	0.159g	1.588a	1.867ef	0.670a
50 % C + 50 % K + 50 % P + Bio-F.	1.987c	0.128h	1.415e	1.925bc	0.676a
50 % C + 25 % K + 25 % P + Bio-F.	2.267b	0.347b	1.544bc	1.853f	0.682a
Third season: 2013/14					
Control	1.427i	0.125h	1.462i	1.761f	0.425h
100 % C + 100 % K + 100 % P + Bio-F.	2.267c	0.219e	1.615e	1.853de	0.611c
100 % C + 75 % K + 75 % P + Bio-F.	1.987f	0.167fg	1.627de	1.950a	0.515e
100 % C + 50 % K + 50 % P + Bio-F.	2.077d	0.219e	1.817a	1.914b	0.575d
100 % C + 25 % K + 25 % P + Bio-F.	2.267c	0.338b	1.726b	1.583de	0.706a
75 % C + 100 % K + 100 % P + Bio-F.	2.337b	0.375a	1.572fg	1.882b-d	0.713a
75 % C + 75 % K + 75 % P + Bio-F.	2.407a	0.248d	1.656cd	1.908b	0.595c
75 % C + 50 % K + 50 % P + Bio-F.	1.567h	0.306c	1.627de	1.768f	0.493f
75 % C + 25 % K + 25 % P + Bio-F.	1.647g	0224e	1.629de	1.825e	0.512e
50 % C + 100 % K + 100 % P + Bio-F.	1.650g	0.169fg	1.666c	1.892bc	0.475g
50 % C + 75 % K + 75 % P + Bio-F.	2.057d	0.178f	1.557g	1.912b	0.649b
50 % C + 50 % K + 50 % P + Bio-F.	1.987f	0.155g	1.515h	1.862cd	0.465g
50 % C + 25 % K + 25 % P + Bio-F.	2.017e	0.166fg	1.604ef	1.883b-d	0.599c

*** C: Compost; K: Feldspar; P: Rock phosphate, and Bio-F.: Nitrobeine, Phosphorene and Potasseine.**

*** 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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تأثير بعض معاملات التسميد على نمو وإنتاج وجودة ثمار الجوافة (صنف عتمانى). 2) تحت نظام التصويم

إبراهيم محمد سيد عثمان ، عبد العزيز أحمد الطويل وعماد جرجس ميخائيل
قسم بحوث الزيتون وفاكهة المنطقة شبه الجافة، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر.

أجريت سلسلة من التجارب الحقلية بأحد بساتين الفاكهة الخاصة بمنطقة قليوب، محافظة القليوبية، مصر خلال مواسم 2012/2011، 2013/2012، 2014/2013 لإنتاج الجوافة شتوياً، حيث استخدمت أشجار جوافة (صنف عتمانى) عمر (9) سنوات، منزرعة فى تربة طميية طينية على مسافات 5 × 5 م تم تصويمها لمدة (4) أشهر بدءاً من أول أبريل وحتى نهاية يولية، بهدف تحسين إنتاج وجودة هذا المحصول الشتوى، وذلك بإضافة كومبوست المادة العضوية بمعدلات: كل، ¾ أو ½ الجرعة الموصى بها (40، 30، 20 كجم/شجرة) + صخر الفلسبار بمعدلات: كل، ¾، ½ أو ¼ الجرعة الموصى بها (1200، 900، 600، 300 جم/شجرة) + صخر الفوسفات بمعدلات: كل، ¾، ½ أو ¼ الجرعة الموصى بها (1300، 975، 650، 325 جم/شجرة) + مخلوط الأسمدة الحيوية المشتمل على نيتروبين + فوسفورين + بوتاسين بالجرعات الموصى بها لكل على حدة، حيث استخدمت المكونات سالفة الذكر فى عمل أثنى عشرة توليفة سمادية، بجانب المقارنة (بدون تسميد).

أوضحت النتائج المتحصل عليها أن معظم معاملات التسميد المطبقة بهذه الدراسة أحدثت زيادة فى متوسطات طول الساق، عدد الأوراق/متر، مساحة الورقة وعدد البراعم الزهرية/متر وبمستويات معنوية متفاوتة عند مقارنتها بالكنترول فى مواسم النمو الثلاثة. بالمثل، كانت أيضاً نتائج عدد الثمار/متر، وزن الثمرة، محصول كل شجرة، طول وقطر وحجم الثمرة وكذلك سمك اللحم. وكانت أفضل المعاملات هى: 75 % كومبوست عضوى + 100 % صخر الفلسبار + 100 % صخر الفوسفات + مخلوط الأسمدة الحيوية والتى أعطت أعلى المتوسطات عند مقارنتها بالكنترول والتوليفات الأخرى فى معظم الحالات بمواسم النمو الثلاثة. ولقد زاد محتوى الثمار من المواد الكلية الصلبة الذائبة (كنسبة مئوية) معنوياً فى الموسم الأول فقط بالمعاملة المشتركة المكونة من: 100 % كومبوست + 25 % صخر الفلسبار + 25 % صخر الفوسفات + مخلوط الأسمدة الحيوية، بينما فى الموسمين الثانى والثالث زاد محتوى هذه المواد الصلبة بدرجة بسيطة بالتوليفات السمادية المختلفة المستخدمة بالدراسة دون وجود أية فروق معنوية فيما بينها أو مع المقارنة. أظهرت النسبة المئوية للحموضة أيضاً سلوكاً مشابهاً فى مواسم النمو الثلاثة، إلا أن أقل نسبة للحموضة أحدثتها التوليفة السمادية المؤلفة من: 100 % كومبوست + 25 % صخر الفلسبار + 25 % صخر الفوسفات + مخلوط الأسمدة الحيوية (المعاملة الرابعة) خاصة فى الموسمين الأول والثانى. بينما فى الموسم الثالث تحققت أقل نسبة مئوية للحموضة بالمعاملة السمادية الخامسة المؤلفة من: 75 % كومبوست + 100 % صخر الفلسبار + 100 % صخر الفوسفات + مخلوط الأسمدة الحيوية. لذلك، فإن أفضل نسبة للمواد الصلبة الذائبة/الحموضة تم الحصول عليها فى الموسم الأول والثانى بالمعاملة الرابعة، بينما فى الموسم الثالث تحقق ذلك بالمعاملة الخامسة. أيضاً أحدثت جميع المعاملات السمادية تحسناً فى محتوى الثمار من فيتامين (C) وفى سمك اللحم، إلا أن أفضل قيم لهذين القياسين حققتها معاملات مختلفة فى كل موسم عن المواسم الأخرى. كذلك تحسن محتوى أوراق الأشجار التى تم تسميدها من عناصر النتروجين، الفوسفور، البوتاسيوم، الكالسيوم والمغنسيوم نتيجة للتسميد بالتوليفات السمادية المطبقة بهذه الدراسة وبفروق معنوية متفاوتة عند مقارنتها بالكنترول فى مواسم النمو الثالثة، إلا أنه لم تكن هناك توليفة سمادية محددة ذات تأثير متفوق أو سائد على التوليفات الأخرى.

وعليه، يمكن النصح بتسميد أشجار الجوافة (صنف عتمانى)، والمنزرعة فى تربة طميية طينية على مسافات 5 × 5 م تحت ظروف محافظة القليوبية، عند تصويمها لمدة (4) أشهر بدءاً من أول أبريل وحتى نهاية يونية بالتوليفة السمادية المكونة من: 75 % من الجرعة الموصى بها لكومبوست المادة العضوية (30 كجم/شجرة) + 100 % من الجرعة الموصى بها لكل من صخر الفلسبار (1.2 كجم/شجرة) وصخر الفوسفات (1.3 كجم/شجرة) + مخلوط الأسمدة الحيوية المستخدم بهذه الدراسة، وذلك للحصول على أعلى إنتاج وأفضل جودة لمحصول الجوافة الشتوى الناتج من الناحية التجارية والاقتصادية.

Table (4): Effect of fertilization treatments on some vegetative growth traits and No. flower buds of (*Psidium guajava* L.) "Etmani" cv. tree under fasting system during 2011/12, 2012/13 and 2013/14 seasons.

Treatments	Shoot length (cm)			No. of leaves/lm			Leaf area (cm^2)			No. flower buds/lm		
	201/12	2012/13	2013/14	201/12	2012/13	2013/14	201/12	2012/13	2013/14	201/12	2012/13	2013/14
Control	17.40cd	19.20b	18.08bc	42.14i	42.37h	50.81h	31.37c	31.46e	29.76f	19.82h	21.98g	24.64g
100 % C + 100 % K + 100 % P + Bio-F.	19.23b	18.30bc	18.62b	53.93h	60.48g	65.19g	40.06ab	53.59a	55.44a	26.00fg	30.54b-d	29.90f
100 % C + 75 % K + 75 % P + Bio-F.	17.57c	18.17c	17.87c	85.45c	97.07ab	97.59bc	38.65bc	46.36ab	53.70ab	29.81cd	31.20bc	34.71b
100 % C + 50 % K + 50 % P + Bio-F.	18.63b	18.13c	17.82c	79.60d	93.95bc	99.16a-c	41.53ab	42.53b-d	49.31a-d	28.09de	30.87b-d	32.55de
100 % C + 25 % K + 25 % P + Bio-F.	17.03c-e	17.57cd	17.65c	93.37a	97.01ab	100.57a-c	40.44ab	48.16ab	51.01a-c	29.95cd	30.55b-d	33.46b-d
75 % C + 100 % K + 100 % P + Bio-F.	21.40a	22.73a	19.48a	91.09ab	99.33a	103.80a	47.95a	45.87bc	54.04a	33.42a	33.16a	37.12a
75 % C + 75 % K + 75 % P + Bio-F.	16.27ef	16.03e	16.98bc	75.86de	81.09d	87.97d	38.81bc	41.50b-d	44.13c-e	31.98ab	32.46ab	34.58bc
75 % C + 50 % K + 50 % P + Bio-F.	17.53c	17.93c	17.65c	92.00a	95.73a-c	100.30a-c	38.50bc	41.87b-d	44.50c-e	24.71g	26.94f	30.21f
75 % C + 25 % K + 25 % P + Bio-F.	18.37cd	18.23bc	18.02c	70.69f	71.92ef	79.00e	38.12bc	35.41de	40.31e	27.06ef	30.00cd	32.75c-e
50 % C + 100 % K + 100 % P + Bio-F.	16.47d-f	17.73cd	17.83c	65.80g	68.52f	74.03f	42.35ab	36.05de	38.91e	27.16ef	27.63ef	30.85ef
50 % C + 75 % K + 75 % P + Bio-F.	15.83f	17.47cd	17.55cd	94.85a	92.79c	97.28c	47.96a	38.65c-e	41.73de	31.18bc	31.30bc	33.25b-d
50 % C + 50 % K + 50 % P + Bio-F.	16.33ef	16.87de	17.47cd	86.54bc	97.64ab	102.53ab	43.29ab	38.52c-e	41.57de	26.52e-g	28.05ef	30.16f
50 % C + 25 % K + 25 % P + Bio-F.	16.67c-f	17.80cd	17.60c	71.68ef	73.05e	84.80d	37.44bc	42.79b-d	46.04b-e	28.19de	29.16de	31.52d-f

*** C: Compost; K: Feldspar; P: Rock phosphate, Bio-F.: Nitrobeine, Phosphorene, Potasseine and lm: Longitudinal meter.**
*** Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test at 5 % level.**