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EFFECT OF SOME FERTILIZATION TREATMENTS ON GROWTH OF TREES, PRODUCTIVITY AND QUALITY OF GUAVA (*Psidium guajava* l.) FRUITS CV. "ETMANI". I. UNDER THE CONVENTIONAL FLOOD IRRIGATION SYSTEM.

Mekhiel, E.G. ; I.M.S. Osman and A.A. El-Taweel
Olive and Fruits of Semiarid Zone Dept., Hort. Res. Inst., ARC, Giza, Egypt.

ABSTRACT

A set of field experiments was conducted in a private orchard at Qalyob district, Qalubia governorate, Egypt during 2012, 2013 and 2014 seasons of 6-years-old uniform trees of guava (*Psidium guajava* L.) cv. Etmani grown on clay loam soil at 5 x 5 m apart and irrigated with the ordinary flood system to study the response of trees to organic compost at either full, ¾ or ½ the recommended dose (40, 30 and 20 kg/tree, respectively) + feldspar at either full, ¾, ½ or ¼ the recommended dose (1200, 900, 600 and 300 g/tree, respectively) + rock phosphate at either full, ¾, ½ or ¼ the recommended dose (1300, 975, 650 and 325 g/tree, respectively) + mixture of bisofertilizers (Nitropeine + phosphoreine + potasseine at 120, 25 g. and 134 cm./tree, respectively) in 12 combined treatments, besides the control.

The obtained results indicated that all fertilization treatments used in this study caused a marked improvement in the means of shoot length, number of leaves/m, leaf area and number of flower buds/m with various significant differences as compared to means of control in the three seasons. A similar trend was also obtained regarding No. of fruits/m, fruit weight, length and diameter, fruit volume, yield and flesh thickness. The percent of TSS was increased in fruits of fertilized trees, while that of acidity was decreased in most cases of the three seasons. So, TSS/acidity ratio was often higher in fruits of treated trees than that in fruits of untreated ones. Moreover, vitamin C content in fruit flesh and fruit firmness were also increased. The leaf content of N, P, K, Ca and Mg was markedly improved as a result of applying fertilization combinations used in such investigation. However, the mastery in most previous parameters was for a combination of 100 % compost + 50 % feldspar + 50 % rock phosphate + bio-fertilizers mixture, which gave the best values in most cases of the three seasons.

Accordingly, it can be recommended to fertilize the 6-years-old irrigated trees of guava cv. "Etmani" with the combination of 100 % compost + 50 % feldspar + 50 % rock phosphate plus mixture of biofertilizers to attain the highest growth, yield and fruit quality from commercial point of view.

INTRODUCTION

Guava (*Psidium guajava* L.) is one of the most lovely popular fruits, as it characterized by its high nutritive value and considered a rich source of vitamin C and several nutrients useful for human health and nutrition. Besides eating it in fresh form, it can be consume as food products, such as jam, jelly or juice (Wilson, 1980). Guava exceeds the majority of tropical and sub-tropical fruit trees in adaptability, productivity and tolerance to a wide range of soil and climatic conditions. It is grown now in more than 60 countries of the world. Owing to its high nutraceutical values, there is a growing consumers preference, and that resulting in expansion of area in many countries (Mitra *et al*., 2010).

Increasing demand for safe and healthy food makes organic farming very urgent, especially that guava is eaten fresh immediately after harvest. The organic farming system greatly relies on application of animal waste or farm yard manure, compost, crop rotation, crop residue, green manure, oil cakes, vermicompost and biofertilizers (Willer and Kilcher, 2010). This truth was documented by Ram *et al*., (2007) who reported that maximum fruit number and yield of guava cv. Allahabad Safeda were recorded consistently for 2 years in trees supplemented with 20 kg FYM and inoculated with Azotabacter. Fruit content of TSS and vitamin C, as well as leaf nutrients (N, P, K, Ca, S, Zn, Cu, Mn and Fe) levels were optimum with the application of different organic treatments. Likewise, Baksh *et al.*, (2008) indicated that the maximum increment in growth of guava cv. Sardar trees (plant height, spread and trunk girth), improvement in yield and yield attributing characters (fruit set, retention and individual fruit weight) and quality of fruit (TSS, vitamin C, reducing and non-reducing sugars) were attained by 100 % NPK + 250g phosphate solubilizing bacteria (PSB) + 250 g Azotobacter treatment, which was at par with 75 % NPK + 250 g PSB + 250 g Azotobacter one.

Similar observations were also postulated on various cultivars of guava by Dutta *et al*., (2009), Shalini *et al*., (2010), Rubee Lata *et al.*, (2011), Goswami and Shant Lal Misra (2012), Trivedi *et al*., (2012), Akash Sharma Wali *et al*., (2013) and Meena *et al*., (2013) who found that application of 2/3 quantity of recommended dose of fertilizers, i.e. 500: 200 : 500 g NPK + 25 kg FYM + 250 g Azospirillum + 250 g Azotobacter in rejuvenated guava orchard cv. Sardar significantly increased number of fruits/ plant, yield/plant and yield/ha, as well as the leaf content of N, P and K.

Recently, Adak *et al.,* (2014) and El-Taweel *et al*., (2005) stated that soils fertilized with vermicompost, biofertilizers and organic mulching showed improvement in growth and yield of guava as compared to NPK + FYM application. Moreover, Devi *et al*., (2014) declared that for cultivation of "Sardar" guava organically, application of FYM (26 kg/tree/year) + Azotobacter (100 g/tree) + phosphorus solubilizers (100 g/tree) + potash mobilizers (100 g/tree) in two splits (January and August) is the economically profitable treatment.

On olive cv. Picual, Gowda *et al*. (2011) noticed that feldspar at 3 kg/tree gave the highest vegetative growth, increased leaf pigments and mineral contents, higher values of fruit set, tree yield and fruit quality. Likely, El-Iraqy (2014) concluded that added olive pomace, compost, rock phosphate and feldspar alone or combined with nitropeine, phosphoreine and potaseine biofertilizers improved both vegetative growth, flowering, production and fruit quality parameters.

However, this work was set out to explore the enhancement effect of biofertilizers on increasing the beneficial returns of compost and mineral rocks on growth, fruit productivity and quality of guava fruits cv. "Etmani" trees under the ordinary surface irrigation system.

MATERIALS AND METHODS

A field experiment was carried out in a private orchard at Qalyob district, Qalubia governorate, Egypt during the three consecutive seasons of 2012, 2013 and 2014 to examine the effect of compost, mineral rocks and biofertilizers in combinations at various levels on growth, productivity and quality of guava (*Psidium guajava* L.) fruits cv. "Etmani".

Therefore, uniform irrigated trees of 6-years-old planted on clay loem soil at a distance of 5 x 5 m, subjected to flood irrigation and received the useful agricultural practices needed for such plantation were selected well before each season to be similar as possible in their growth vigour, flowering time, fruit physical characteristics and time of maturity and devoted for this study.

The different sources of fertilization materials used in the current work at the recommended doses were as follows: 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), while those of feldspar and rock phosphate are shown in Table (3).

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

Property		Values
Mechannical 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.

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.

However, the abovenamed materials were applied together at different proportion (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 to formalize the following 12 combinations:

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 mid of December for each season, the total amount of biofertilizers was mixed well with that of compost (specified for each treatment), as well as the total one of rock phosphate (also assigned for each treatment) were added to the soil at a depth of 20-25 cm where the most feeder roots of guava are present, in circled narrow trenches at 1 m away around trunk of each tree just before irrigation, and then properly covered with soil. Whereas, the feldspar doses were divided into two equal batches, as the first one applied on mid of December (with compost and biofertilizers) and the second one on June, 1st. The layout of the experiment in the three seasons was a complete randomized design, replicated thrice as each one contained 1 tree (Mead *et al*., 1993).

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 clear from data averaged in Table (4) that means of shoot length (cm), number of leaves/m and leaf area (cm^2) were mostly improved in response to the different fertilization treatments employed in this study with various significant differences compared to control in the three studied seasons. However, the superiority was for 100 % compost + 50 % feldspar + 50 % rock phosphate + biofertilizer mixture combined treatments, which gave the highest records in most cases of the three seasons and followed by a combination of 75 % compost + 50 % feldspar + 50 % rock phosphate + biofertilizer mixture that recorded means closely near to those of super treatment with non-significant differences among them, especially in the traits of number of leaves/m and leaf area. A similar trend was also gained regarding the number of flower buds/m character, as the means of such parameter were increased in the three seasons to the maximal values by the super treatment mentioned above and followed by the same combination also indicated before.

This improvement in vegetative growth of guava trees may by attributed to the synergistic effect of organic matter compost which can improve the soil physical and chemical properties, increase water holding capacity, nutrient availability, soil organic matter content, cation exchange capacity and fertility, as well as EC and pH of the soil (Willer and Kilcher, 2011), feldspar which improve soil aggregation, structure, permeability and infiltration corresponding with the reduction of pH, EC, SAR and Na/Ca ratio which leads finally to create better soil conditions (Meena *et al*., 2013) and rock phosphate which slowly supplies plants which mono-and di-phosphate, the most absorbing forms by plants (Adak *et al*., 2014). In this concern, Manning (2010) mentioned that feldspar as a source of K^+ reduced the osmotic pressure and increased water uptake which due to K^+ influx in soil solution, consequently increased the availability of some macro and micronutrients, and this may indicate its role in promoting and enhancing the metabolic process and regulating water balance. Moreover, the positive effects of feldspar not only ascribed to the multi-benefits of K^+ ions, but also to its containing 70.23 % SiO_2, 16.25 % Al_2O_3, 8.12 % K_2O_3.69 % Na_2O and traces of other elements such as Fe, Mg, P, Mn, Ca and Ti (as indicated in Table, (3).

In addition, biofertilizers (such as those used in the current work) in the presence of organic compost, feldspar and rock phosphate play a vital role in decomposing and solubilizing N, P, K, Ca and other minerals to be available for plants. In this connection, Devi *et al*., (2014) suggested that microorganisms of biofertilizers may fix atmospheric N_2, secrete some growth promoting factors, e.g. gibberellin, cytokinin- like substances, auxins and some vitamins and may release K and P2O5 ions from rocks and organic materials to be available for plants. Subba-Rao (1993) declared that Azotobacter bacteria synthesize antifungal antibiotics which allow additional advantage for the use in field of crop production.

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The previous results go in line with those postulated on guava by Ram *et al*., (2007), Baksh *et al*., (2008), Dutta *et al*., (2009), Rubee Lata *et al*., (2011), Trivedi *et al*., (2012) and Akash Sharma Wali *et al*., (2013) who decided that the highest soil and leaf N, P, Ca and Mg contents was obtained with the treatment comprising Azotobacter + 25 % of N/tree through FYM + 75 % of N/tree through inorganic fertilizer, whereas the highest soil and leaf K contents was obtained with the application of Azotobacter + 50 % of N/tree through FYM + 50 % of N/tree through inorganic fertilizer.

2- Fruit characteristics and yield:

Parallel observations to those of vegetative growth were also obtained in the matter of fruit characteristics and yield of irrigated guava trees, where data listed in Table (5) exhibited that No. of fruits/longitudinal meter, fruit weight (g), yield (kg/tree), fruit length and diameter (cm), fruit volume (cm3) and flesh thickness (cm) were generally improved as a result of applying the various fertilization treatments used in this trial with the mastery of 100 % compost + 50 % feldspar + 50 % rock phosphate + bio-fert. combined treatment, which recorded the utmost high values over control and other combinations in most instances of the 3 studied seasons, but the combination of 75 % compost + 100 % feldspar + 100 % rock phosphate + bio-fert. occupied the second category in this concern.

These results could be interpreted and discussed as done before in case of vegetative growth and No. of flower buds/m. Similarly were those findings revealed on guava by Shalini *et al*., (2010), Goswami and Sant Lal Misra (2012), Meena *et al*., (2013) and Adak *et al*., (2014). In this concern, Devi *et al*., (2014) found that the higher fruit weight and size of guava cv. Sardar were obtained by application of either neem cake (9 kg/plant/y) or vermicompost (19 kg/plant/y) + Azotobacter (100 g/plant/y) + P-solubilizer (100 g/plant/y) + K-mobilizer (100 g/plant/y). Maximum No. of fruits/plant was produced from plants fertilized with FYM (26 kg/plant/y) + Azotobacter + P-solubilizer + K-mobilizer combined treatment, which also caused maximum yield compared to control.

Table (5): Effect of fertilization treatments on yield and fruit characteristics of (*Psidium guajava* L.) "Etmani" cv. tree under ordinary irrigation system during 2012, 2013 and 2014 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: 2012				
Control	30.63b-d	48.97d	30.00e	3.67bc	2.77e	42.67g	1.43c
100 % C + 100 % K + 100 % P + Bio-F.	31.25bc	49.27d	30.67b-d	3.67bc	3.07bc	49.00f	1.40c
100 % C + 75 % K + 75 % P + Bio-F.	30.74b-d	51.45c	33.33b-d	3.70bc	2.97cd	51.00c-f	1.30d
100 % C + 50 % K + 50 % P + Bio-F.	34.56a	53.16ab	40.00a	5.27a	3.37a	55.00a	1.63a
100 % C + 25 % K + 25 % P + Bio-F.	29.60de	51.15c	28.33d	4.10bc	3.00cd	51.00c-f	1.43c
75 % C + 100 % K + 100 % P + Bio-F.	31.89b	53.71a	39.00a	5.17a	2.93c-e	54.33ab	1.57ab
75 % C + 75 % K + 75 % P + Bio-F.	31.79b	51.86bc	31.67b-d	4.27b	2.93c-e	50.00d-f	1.60ab
75 % C + 50 % K + 50 % P + Bio-F.	30.19c-e	52.05bc	31.33b-d	4.50ab	3.10bc	52.00b-e	1.43c
75 % C + 25 % K + 25 % P + Bio-F.	29.62de	52.06bc	35.67ab	3.70bc	3.03b-d	53.33a-c	1.60ab
50 % C + 100 % K + 100 % P + Bio-F.	30.24c-e	51.38c	33.67bc	3.33c	2.87de	49.33f	1.60ab
50 % C + 75 % K + 75 % P + Bio-F.	27.91f	51.94bc	29.67cd	4.37b	3.07bc	52.33b-d	1.57ab
50 % C + 50 % K + 50 % P + Bio-F.	30.85b-d	51.98bc	31.33b-d	3.73bc	3.10bc	49.67ef	1.53ab
50 % C + 25 % K + 25 % P + Bio-F.	28.86ef	52.58a-c	32.33b-d	3.73bc	3.20b	53.00a-c	1.50bc
			Second season: 2013				
Control	25.97i	51.32e	31.67c	3.80bc	2.83c	43.33f	1.53cd
100 % C + 100 % K + 100 % P + Bio-F.	29.97g	52.18c-e	35.67c	3.90bc	3.20ab	51.00e	1.50cd
100 % C + 75 % K + 75 % P + Bio-F.	33.83cd	52.51b-d	35.00c	3.70bc	3.03bc	51.33de	1.43d
100 % C + 50 % K + 50 % P + Bio-F.	34.82a	54.78a	45.00a	5.37a	3.37a	55.67a	1.70a
100 % C + 25 % K + 25 % P + Bio-F.	29.33h	52.50b-d	34.00c	4.23bc	3.13ab	53.00b-e	1.57bc
75 % C + 100 % K + 100 % P + Bio-F.	34.10bc	53.33b	41.67ab	5.27a	3.33a	55.00ab	1.60a-c
75 % C + 75 % K + 75 % P + Bio-F.	32.76e	52.62b-d	35.00c	4.47a-c	3.07b	51.00e	1.60a-c
75 % C + 50 % K + 50 % P + Bio-F.	34.46ab	53.07bc	34.67c	4.60ab	3.20ab	53.67a-c	1.53cd
75 % C + 25 % K + 25 % P + Bio-F.	31.57f	53.03b-d	40.00b	3.83bc	3.17ab	53.33b-d	1.60a-c
50 % C + 100 % K + 100 % P + Bio-F.	32.02f	52.78b-d	35.00c	3.53c	3.07b	51.67c-e	1.67ab
50 % C + 75 % K + 75 % P + Bio-F.	31.87f	52.98b-d	33.33c	4.60ab	3.17ab	53.67a-c	1.67ab
50 % C + 50 % K + 50 % P + Bio-F.	33.37d	52.83b-d	35.67c	4.03bc	3.17ab	51.67c-e	1.57bc
50 % C + 25 % K + 25 % P + Bio-F.	31.89f	51.95de	35.00c	3.73bc	3.03bc	54.67a-c	1.70a
			Third season: 2014				
Control	34.53d-f	51.93f	34.00d	3.97b-e	2.83e	44.00h	1.63a-c
100 % C + 100 % K + 100 % P + Bio-F.	31.42g	52.15ef	40.00c	3.93c-e	3.17bc	51.00fg	1.43d
100 % C + 75 % K + 75 % P + Bio-F.	35.10d-f	53.80cd	38.33cd	3.87de	3.10b-d	53.00d-f	1.50cd
100 % C + 50 % K + 50 % P + Bio-F.	40.10a	58.23a	51.67a	5.70a	3.67a	60.00a	1.77a
100 % C + 25 % K + 25 % P + Bio-F.	30.70g	53.56cd	36.67cd	4.43b-d	3.13b-d	54.67cd	1.63a-c
75 % C + 100 % K + 100 % P + Bio-F.	37.52b	56.11b	48.33ab	5.57a	3.60a	57.33b	1.77a
75 % C + 75 % K + 75 % P + Bio-F.	35.76c-e	53.50cd	38.33cd	4.67b-d	3.00c-e	51.67e-g	1.70ab
75 % C + 50 % K + 50 % P + Bio-F.	36.93bc	52.97d-f	37.33cd	4.80b	3.30b	53.33c-e	1.57b-d
75 % C + 25 % K + 25 % P + Bio-F.	33.58f	52.90d-f	45.00b	4.13b-e	3.13b-d	55.33c	1.70ab
50 % C + 100 % K + 100 % P + Bio-F.	31.20g	52.75d-f	40.00c	3.57e	2.90de	50.67g	1.70ab
50 % C + 75 % K + 75 % P + Bio-F.	31.84g	53.03de	36.67cd	4.77bc	3.20bc	55.33c	1.67ab
50 % C + 50 % K + 50 % P + Bio-F.	34.48ef	53.26cd	39.00c	4.03b-e	3.20bc	52.33e-g	1.60bc
50 % C + 25 % K + 25 % P + Bio-F.	36.26b-d	54.21c	40.00c	3.87de	3.07b-e	55.33c	1.67ab

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

According to data presented in Table (6), it is clear that TSS % was increased in the fruits of fertilized trees with various significant levels relative to control in the three seasons, whereas acidity % was reduced in most cases of the 3 seasons. However, the highest percent of TSS coupled with the minimest one of acidity was often achieved in the 3 seasons by the combination of 100 % compost + 50 % feldspar + 50 % rock phosphate + bio. fert. So, fruits resulted from such treatment were more delicious than those resulted from other treatments, especially that this treatment was also registered the highest ratio of TSS/acidity, which considered a real indicator for palatability of guava fruits.

As for content of vitamin C (mg/100 g fruit flesh) and fruit firmness (g/cm^2), they were also increased with few exceptions due to different fertilization treatments used in this work compared to control in the 3 studied seasons, although the variations between values of vitamin C content under various treatments were greatly narrow during the 3 seasons.

In general the prevalence in most aforementioned characters was found due to 100 % compost + 50 % feldspar + 50 % rock phosphate + bio-fertilizers combination, which mostly scored the best averages, especially in the 1st and 2nd seasons. This may be reasonable because such combination established the best vegetative growth during the course of each season, and that positively reflected on fruit productivity and quality. These gains, however conform with those detected on guava cultivars by Ram *et al*., (2007), Baksh *et al*., (2008), Dutta *et al*., (2009), Goswami and Shant Lal Misra (2012) and Trivedi *et al*., (2012) who pointed out that cv. Sardar was more responding to organic manure and biofertilizer, so recorded higher plant height and spread and N uptake than cv. Allahabad Safeda, while Allahabad Safeda registered higher TSS and vitamin C content. On olive cv. Picual, Gowda *et al*., (2011) noticed that feldspar at 3 kg/tree gave higher fruit set, yield, quality and oil content.

Table (6): Effect of fertilization treatments on chemical composition and firmness of (*Psidium guajava* L.) "Etmani" cv. fruits under ordinary irrigation system during 2012, 2013 and 2014 seasons

Treatments	TSS (%)	Acidity (%)	TSS/ acidity ratio	Vitamin C (mg/100 g f.f.)	Fruit firmness (g/cm^2)
First season: 2012					
Control	9.30d	0.533a	17.45e	39.90b	104.00f
100 % C + 100 % K + 100 % P + Bio-F.	9.40d	0.467ab	20.13cd	40.13a	112.0de
100 % C + 75 % K + 75 % P + Bio-F.	9.27d	0.467ab	19.85d	40.13a	107.0ef
100 % C + 50 % K + 50 % P + Bio-F.	10.20a	0.333c	30.63a	40.17a	128.3a
100 % C + 25 % K + 25 % P + Bio-F.	9.23d	0.433ab	21.32cd	39.87b	126.7a
75 % C + 100 % K + 100 % P + Bio-F.	10.00b	0.367bc	27.25ab	40.07ab	128.3a
75 % C + 75 % K + 75 % P + Bio-F.	9.40d	0.467ab	20.13cd	39.97ab	118.3c
75 % C + 50 % K + 50 % P + Bio-F.	9.40d	0.333c	28.23a	40.07ab	115.0cd
75 % C + 25 % K + 25 % P + Bio-F.	9.27d	0.400bc	23.18bc	40.13a	125.0ab
50 % C + 100 % K + 100 % P + Bio-F.	9.03e	0.300c	30.10a	39.97ab	120.0bc
50 % C + 75 % K + 75 % P + Bio-F.	9.30d	0.333c	27.93ab	40.07ab	118.3c
50 % C + 50 % K + 50 % P + Bio-F.	9.30d	0.333c	27.93ab	40.03ab	107.7ef
50 % C + 25 % K + 25 % P + Bio-F.	9.60c	0.467ab	20.56cd	40.03ab	107.7ef
Second season: 2013					
Control	9.33ef	0.567a	16.46e	39.40de	118.3cd
100 % C + 100 % K + 100 % P + Bio-F.	9.70b	0.400c-e	24.25c	40.10a-d	110.0e
100 % C + 75 % K + 75 % P + Bio-F.	9.37d-f	0.467bc	20.06d	40.17b-d	115.0de
100 % C + 50 % K + 50 % P + Bio-F.	10.23a	0.367de	27.87b	40.47a	135.0a
100 % C + 25 % K + 25 % P + Bio-F.	9.40c-f	0.533ab	17.64e	40.00da-c	133.3ab
75 % C + 100 % K + 100 % P + Bio-F.	10.20a	0.333e	30.63a	39.47de	131.7ab
75 % C + 75 % K + 75 % P + Bio-F.	9.60bc	0.433cd	22.17c	40.10a-d	133.3ab
75 % C + 50 % K + 50 % P + Bio-F.	9.40c-f	0.433cd	21.71cd	39.90e	128.3b
75 % C + 25 % K + 25 % P + Bio-F.	9.30f	0.433cd	21.48c	40.37ab	131.7ab
50 % C + 100 % K + 100 % P + Bio-F.	9.57b-d	0.367de	26.08b	40.33a-c	131.7ab
50 % C + 75 % K + 75 % P + Bio-F.	9.57b-d	0.433cd	22.10c	40.40a-c	110.0e
50 % C + 50 % K + 50 % P + Bio-F.	9.53b-e	0.433cd	22.01c	40.17a-d	131.7ab
50 % C + 25 % K + 25 % P + Bio-F.	9.70b	0.533ab	18.20e	40.13a-d	121.7c
Third season: 2014					
Control	9.53b	0.500a	19.06d	39.90e	120.0d
100 % C + 100 % K + 100 % P + Bio-F.	9.77b	0.467ab	20.92c	40.40a	113.3d
100 % C + 75 % K + 75 % P + Bio-F.	9.53b	0.433a-c	22.00c	40.37ab	113.3d
100 % C + 50 % K + 50 % P + Bio-F.	11.07a	0.467ab	23.70b	40.30a-c	135.0bc
100 % C + 25 % K + 25 % P + Bio-F.	9.47b	0.367bc	25.80b	40.03de	116.7d
75 % C + 100 % K + 100 % P + Bio-F.	10.83a	0.367bc	29.51a	40.27a-c	145.0a
75 % C + 75 % K + 75 % P + Bio-F.	9.87b	0.500a	19.74e	40.13b-d	131.7c
75 % C + 50 % K + 50 % P + Bio-F.	9.60b	0.400a-c	24.00b	40.20a-d	135.0bc
75 % C + 25 % K + 25 % P + Bio-F.	9.60b	0.467ab	20.56cd	40.37ab	130.0c
50 % C + 100 % K + 100 % P + Bio-F.	9.60b	0.333c	28.83a	40.10c-e	140.0ab
50 % C + 75 % K + 75 % P + Bio-F.	9.70b	0.333c	29.13a	40.30a-c	131.7c
50 % C + 50 % K + 50 % P + Bio-F.	9.57b	0.400a-c	23.93bc	40.37ab	133.3bc
50 % C + 25 % K + 25 % P + Bio-F.	9.80b	0.467ab	20.99cd	40.00de	130.0c

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

*** 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:

It is obvious from data issued in Table (7) that the percentages of N, P, K, Ca and Mg in the leaves of fertilized trees were increased as a result of dressing with the different fertilization treatments used in this investigation. The significancy among the means of various treatments were variable in most cases of the three seasons, but the dominance in the first and second seasons was ascribed to fertilizing with 100 % compost + 50 % feldspar + 50 % rock phosphate + bio-fert. combined treatment, which followed by 75 % compost + 100 % feldspar + 100 % rock phosphate + bio-fert. combined one. In the 3^{rd} season, the opposite was the right, where the latter combination preceded the former one.

This may indicate the role of microorganisms of biofertilizers in decomposing organic matter and mineral rocks, consequently mobilizing K_2O and P_2O_5 plus other nutrients to be more available for plants (Subba-Rao, 1993). In this regard, Trivedi *et al*., (2012) reported that application of biocompost to Sardar and Allahabad Safeda guava soil recorded the maximum available N, K_2O and P_2O_5. incorporation of vermicompost resulted in the maximum N uptake and that of FYM resulted in the maximum P uptake and organic carbon content in the soil. Addition of biofertilizers recorded higher available P_2O_5 content in the soil. Similarly, were those results obtained by Ram *et al*., (2007) on guava cv. Allahabad Safeda, Rubee Lata *et al*., (2011) on guava cv. Red fleshed, Goswami and Shant Lal Misra (2012) on guava cv. Pant Prabhat, Akash Sharma Wali *et al*., (2013) on guava cv. Sardar and El-Iraqy (2014) on olive cv. Picual.

From the aforementioned results, it can be concluded that application of 100 % of recommended compost dose (40 kg/tree) + 50 % of recommended feldspar dose (600 g/tree) and 50 % of recommended rock phosphate dose (650 g/tree) alongwith biofertilizers (nitropeine, phosphoreine and potasseine at 120, 25 and 134 g/tree, respectively) to 6-years-old guava cv. "Etmani" tree under flood irrigation system may be one of the economic way for highly growth, production and fruit quality.

Table (7): Effect of fertilization treatments on mineral content of (*Psidium guajava* L.) "Etmani" cv. leaves under ordinary irrigation system during 2012, 2013 and 2014 seasons

Treatments	N (%)	P (%)	K (%)	Ca (%)	Mg (%)
First season: 2012					
Control	1.522h	0.122g	1.392i	1.754d	0.410gh
100 % C + 100 % K + 100 % P + Bio-F.	1.909e	0.202d	1.543c	1.764d	0.430g
100 % C + 75 % K + 75 % P + Bio-F.	1.632g	0.133fg	1.546bc	1.772cd	0.476f
100 % C + 50 % K + 50 % P + Bio-F.	2.248a	0.386a	1.574a	1.726e	0.411gh
100 % C + 25 % K + 25 % P + Bio-F.	1.531h	0.324b	1.521d	1.762d	0.414gh
75 % C + 100 % K + 100 % P + Bio-F.	2.252a	0.142f	1.480f	1.757d	0.903a
75 % C + 75 % K + 75 % P + Bio-F.	2.063c	0.223c	1.474fg	1.755d	0.825c
75 % C + 50 % K + 50 % P + Bio-F.	1.943de	0.372a	1.513de	1.728e	0.425gh
75 % C + 25 % K + 25 % P + Bio-F.	1.563h	0.194d	1.457gh	1.757d	0.506e
50 % C + 100 % K + 100 % P + Bio-F.	1.971d	0.125fg	1.563ab	1.762d	0.694d
50 % C + 75 % K + 75 % P + Bio-F.	1.550h	0.159e	1.502e	1.824a	0.494ef
50 % C + 50 % K + 50 % P + Bio-F.	1.850f	0.121g	1.332j	1.792b	0.405h
50 % C + 25 % K + 25 % P + Bio-F.	2.192b	0.334b	1.442h	1.787bc	0.725c
Second season: 2013					
Control	1.582h	0.188d	1.448c	1.707g	0.431f
100 % C + 100 % K + 100 % P + Bio-F.	1.775f	0.204d	1.643ab	1.751d	0.505e
100 % C + 75 % K + 75 % P + Bio-F.	1.985d	0.226cd	1.679a	1.727ef	0.361g
100 % C + 50 % K + 50 % P + Bio-F.	2.282a	0.555a	1.684a	1.736de	0.794a
100 % C + 25 % K + 25 % P + Bio-F.	2.279a	0.331bc	1.634ab	1.735de	0.415fg
75 % C + 100 % K + 100 % P + Bio-F.	2.113bc	0.242cd	1.580b	1.712fg	0.721b
75 % C + 75 % K + 75 % P + Bio-F.	2.163b	0.235cd	1.597b	1.900a	0.674bc
75 % C + 50 % K + 50 % P + Bio-F.	2.043cd	0.379b	1.631ab	1.851b	0.494ef
75 % C + 25 % K + 25 % P + Bio-F.	1.663g	0.202d	1.602b	1.821c	0.675bc
50 % C + 100 % K + 100 % P + Bio-F.	2.071c	0.129d	1.671a	1.829c	0.572d
50 % C + 75 % K + 75 % P + Bio-F.	2.104bc	0.166d	1.608b	1.825c	0.656c
50 % C + 50 % K + 50 % P + Bio-F.	1.905e	0.139d	1.448c	1.822c	0.722b
50 % C + 25 % K + 25 % P + Bio-F.	2.291a	0.352b	1.591b	1.854c	0.825a
Third season: 2014					
Control	1.593h	0.132h	1.470f	1.821c	0.400e
100 % C + 100 % K + 100 % P + Bio-F.	1.959f	0.211e	1.591e	1.829bc	0.498d
100 % C + 75 % K + 75 % P + Bio-F.	2.125d	0.162fg	1.694b	1.835bc	0.404e
100 % C + 50 % K + 50 % P + Bio-F.	2.386ab	0.212e	1.774a	1.855a	0.499d
100 % C + 25 % K + 25 % P + Bio-F.	1.719g	0.336b	1.660c	1.829bc	0.463de
75 % C + 100 % K + 100 % P + Bio-F.	1.977ef	0.158fg	1.631cd	1.822c	1.053a
75 % C + 75 % K + 75 % P + Bio-F.	2.334bc	0.252d	1.621d	1.839a-c	0.665bc
75 % C + 50 % K + 50 % P + Bio-F.	2.282c	0.307c	1.661c	1.838a-c	0.514d
75 % C + 25 % K + 25 % P + Bio-F.	1.752g	0.214e	1.579e	1.842ab	0.650bc
50 % C + 100 % K + 100 % P + Bio-F.	2.162d	0.164fg	1.642cd	1.791d	0.725b
50 % C + 75 % K + 75 % P + Bio-F.	1.752g	0.182f	1.480f	1.826bc	0.625c
50 % C + 50 % K + 50 % P + Bio-F.	2.025e	0.149gh	1.561e	1.835bc	0.727b
50 % C + 25 % K + 25 % P + Bio-F.	2.402a	0.369a	1.580e	1.855a	0.676bc

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

*** 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). 1) تحت نظام الرى بالغمر (الرى السطحى)

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

أجريت مجموعة من التجارب الحقلية بأحد البساتين الخاصة بمنطقة قليوب، محافظة القليوبية، مصر خلال ثلاث مواسم نمو متتالية هى: 2012، 2013، 2014 لدراسة استجابة أشجار الجوافة عمر (6) سنوات (صنف عتمانى) منزرعة فى تربة طينية طميية على مسافات 5 × 5 م وتروى بالغمر (رى سطحى) للتسميد بكمبوست المادة العضوية بمعدل كل، ¾ أو ½ الجرعة الموصى بها (40، 30، 20 كجم/شجرة، على الترتيب) + صخر الفلسبار بمعدل كل، ¾، ½ أو ¼ الجرعة الموصى بها (1200، 900، 600، 300 جم/شجرة، على الترتيب) + صخر الفوسفات بمعدل كل، ¾، ½ أو ¼ الجرعة الموصى بها (1300، 975، 650، 325 جم/شجرة، على الترتيب) + مخلوط الأسمدة الحيوية (نيتروبين + فوسفورين + بوتاسين بمعدل120، 25جم ، 134 س م/شجرة، على الترتيب) فى أثنى عشرة معاملة مشتركة، بجانب معاملة المقارنة (بدون تسميد إضافى).

أوضحت النتائج المتحصل عليها أن جميع معاملات التسميد المستخدمة بهذه الدراسة أحدثت تحسناً ملحوظاً فى متوسطات طول الفرع، عدد الأوراق/متر طولى من النمو الخضرى، مساحة الورقة وعدد البراعم الزهرية/متر طولى، وبفروق معنوية مختلفة عند مقارنتها بمتوسطات الكنترول فى سنوات الدراسة الثلاثة. ولقد تم أيضاً الحصول على إتجاه مشابه فيما يتعلق بعدد الثمار/متر طولى، وزن وطول وقطر الثمرة، حجم الثمرة، كمية المحصول/شجرة وسمك اللحم. لوحظ كذلك أن النسبة المئوية للمواد الصلبة الذائبة قد زادت فى ثمار الأشجار المسمدة، بينما انخفضت النسبة المئوية للحموضة فى معظم الحالات بالمواسم الثلاثة. لذا، كانت نسبة المواد الصلبة الذائبة/الحموضة فى ثمار الأشجار المعاملة أعلى منها فى ثمار الأشجار الغير معاملة مما أعطاها طعماً أكثر إستساغة. علاوة على ذلك، فقد زاد محتوى فيتامين (C) فى لحم الثمار، كما زادت صلابة الثمار. أيضاً فقد تحسن محتوى الأوراق من عناصر النتروجين، الفوسفور، البوتاسيوم، الكالسيوم والماغنسيوم نتيجة لإضافة التوليفات السمادية المستخدمة بهذا البحث. إلا أن أفضل المعاملات السمادية المستخدمة كانت من: 100 % كومبوست + 50 % صخر الفلسبار + 50 % صخر الفوسفات + مخلوط الأسمدة الحيوية والتى أعطت أعلى القيم فى معظم الحالات بالمواسم الثلاثة.

وعليه، يمكن التوصية بتسميد أشجار الجوافة، عمر (6) سنوات (صنف عتمانى) المروية بالغمر بتوليفة من كومبوست المادة العضوية (40 كجم/شجرة) + صخر الفلسبار (600 جم/شجرة) + صخر الفوسفات (650 جم/شجرة) + مخلوط الأسمدة الحيوية للحصول على أفضل نمو خضرى، أعلى إنتاج وأفضل جودة للثمار بأقل تكلفة تجارية.

Table (4): Effect of fertilization treatments on some vegetative growth traits and No. flower buds of (*Psidium guajava* L.) "Etmani" cv. tree under ordinary irrigation system during 2012, 2013 and 2014 seasons.

Treatments	Shoot length (cm)			No. of leaves/lm			Leaf area (cm^2)			No. flower buds/lm		
	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
Control	15.30e	17.23bc	16.97f	60.32g	53.83g	55.40f	30.89ef	33.73f	33.97de	32.83bc	28.25e	29.66h
100 % C + 100 % K + 100 % P + Bio-F.	16.33ab	18.13a	18.03ab	65.55f	62.69f	63.96e	33.17c-e	35.39ef	35.96d	32.29b	32.73c	33.64fg
100 % C + 75 % K + 75 % P + Bio-F.	15.73c-e	17.23bc	17.57b-e	93.94c	90.15c	89.00b	33.94b-d	47.03b	50.38ab	31.80c-e	35.58a	35.85cd
100 % C + 50 % K + 50 % P + Bio-F.	16.53a	18.00a	17.50c-e	106.90a	97.90ab	68.14de	48.07a	49.24b	51.49ab	36.05a	35.79a	37.90a
100 % C + 25 % K + 25 % P + Bio-F.	16.20a-c	17.40bc	17.73a-e	100.70b	97.43ab	96.19a	30.76f	39.68c	40.16c	31.41de	31.23d	33.11g
75 % C + 100 % K + 100 % P + Bio-F.	16.10a-c	17.67ab	17.87a-d	93.60c	73.78d	74.09c	46.52a	48.64b	51.79ab	32.92bc	34.87ab	37.21ab
75 % C + 75 % K + 75 % P + Bio-F.	15.83b-d	17.47bc	17.93a-d	76.85d	69.10e	70.19cd	35.19bc	37.84cd	38.33c	32.21b-e	33.33c	35.75cd
75 % C + 50 % K + 50 % P + Bio-F.	15.47de	16.93c	17.33ef	97.66b	99.07a	97.94a	48.66a	51.53a	52.36a	32.33b-d	35.64a	37.92a
75 % C + 25 % K + 25 % P + Bio-F.	16.40a	17.30bc	17.47d-f	73.04e	71.92d	72.80c	36.17b	47.66b	32.12e	31.03de	32.73c	35.27de
50 % C + 100 % K + 100 % P + Bio-F.	16.53a	17.70ab	18.17a	65.29f	64.59f	63.85e	33.60cd	38.24cd	39.21c	31.85c-e	33.72c	33.77fg
50 % C + 75 % K + 75 % P + Bio-F.	16.37ab	17.47bc	18.00a-c	91.46c	89.13c	87.24b	35.35bc	36.85de	38.31c	30.96de	33.40c	34.64ef
50 % C + 50 % K + 50 % P + Bio-F.	16.10a-c	17.20bc	17.60b-e	98.37b	95.21b	93.98a	48.14a	46.95b	50.97ab	32.09b-e	33.95bc	36.75bc
50 % C + 25 % K + 25 % P + Bio-F.	15.53de	17.30bc	17.47d-f	76.24de	96.93ab	97.75a	32.06d-f	30.89g	49.60b	30.86e	33.40c	35.09de

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