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Effect of some Different Sources of Organic Fertilizers in Presence of Bio-fertilizer on Growth and Yield of Banana cv. Grande Naine plants

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ABSTRACT

This study was undertaken during the two successive seasons of 2013 (first ratoon plants) and 2014 (second ratoon plants) on Grande Naine cultivar to increase growth, productivity and improving fruit quality of Banana cv. Grande Naine grown under sandy soil conditions at El-Khatatba region. The obtained results showed that all vegetative growth of Grande Naine banana plants i.e., pseudostem length, pseudostem circumference, green leaves number, leaf area and assimilation area/plant were greatly increased by the studied fertilization treatments as compared with control plants (T_1) in both seasons. However, the tallest pseudostem as well as the thickest pseudostem circumference were recorded by the treatment of recommended dose (RD)+compost (30ton/fed+humic+EM (T_8), followed in descending order by RD+compost (30ton/fed+compost tea+ EM application (T_9). Moreover, the highest number of green leaves/plant, the highest leaf area and assimilation area/plant were registered by T_9, followed by T_8. Moreover, T_8 showed to be the most effective treatment for producing the greatest values of bunch length, bunch circumference and bunch weight followed by T_9 treatment. Also, most tested fertilization treatments succeeded in improving fruit quality in both seasons. Furthermore, all tested fertilization treatments increased fruit total sugar content as well as leaf nitrogen, phosphorus and potassium contents, but they decreased fruit starch content as compared with control plants in the two seasons.

Key words: Banana cv. Grande Naine, chemical, organic, bio- fertilization, growth, leaf mineral content and fruit quality.

Introduction

One of goals of Egyptian Researcher is to increase the production of fruits to satisfy the requirements for local consumptions and export to foreign markets. The increase could be achieved in two ways: the first is the horizontal expansion by planting more lands, and the second is the vertical expansion by importing cultural practices such as fertilization to raise the production of the same area of land.

Banana is the common name for herbaceous plants of the genus Musa. It is well known that banana needs large amounts of fertilizers, especially potassium and nitrogen. So, the major problems facing banana growers are the high costs of excessive manufactured fertilizers needs for banana plants. Besides, these chemical fertilizers are considered as air, soil and water polluting agents during their production and utilization.

Consequently, it has drowned the attention of researchers and banana growers to use another sources of fertilizers which are safe for human, animal and environment. Thus, it is preferred to use these natural fertilizers to avoid pollution and to reduce the costs of chemical fertilizers (Palmer, 1971 and El-Mahmoudy, 1975).

Organic agriculture is an ecological management system that promotes and enhances biodiversity, biological cycles and soil biological activates. It is based on the minimal use of off–farm and chemical inputs and management practices that restore maintain and enhance ecological harmony. Therefore, a great attention has been payed to use the natural source of nutrition as an alternative to the mineral fertilization, but organic fruit growers have little experience with banana plants.

Organic fertilizers improve the physical, chemical and biological properties of nearly all soil types, adjusting soil PH, increasing soil solubility and production of the plants. Adding organic fertilizers not only increase the organic matter in the soil but also increase the available phosphorus and the exchangeable potassium, calcium, and the other micro-elements, through its effect on soil pH, encourages proliferation of soil microorganisms, increases microbial population and activity of microbial enzymes, viz. dehydrogenase, urease and nitrogenase (Abou-Hussein *et al.,* 2002).

Compost is a readily available fertilizer with beneficial effects on physical, chemical, biochemical and biological properties of the soils. Moreover, compost-based treatments can exert protective effects against plant diseases occurrence and/or stimulate an enhanced plant physiological status with improvements in quantity and quality of crop productions (Loredana *et al*., 2015).

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Compost tea in modern terminology means compost extract brewed with microbial food source, humic, fulvic acids and catalyst amendments to promote the growth and multiplication of microbes in the tea (Steve, 2009).Compost tea is a liquid extract produced by diluting compost with water. Anecdotal evidence suggests these teas may be effective against pathogens associated with foliar and fruit diseases. These organisms may work by inducing plant resistance, inhibiting pathogen growth, or outcompeting the pathogens. Some compost teas apparently contain large numbers of beneficial microbes that compete for space on leaves and fruits, denying pathogens space to colonize. Benefits described to the use of humic acid and related products to increase nutrient uptake, tolerance to drought and temperature extremes, activity of beneficial soil microorganisms, and availability of soil nutrients particularly in alkaline soils and low organic matter (Russo and Berlyn, 1990). Also, humic materials may increase root growth in a similar manner to auxins (Tatini, *et al*., 1991).These water extractable components include active microorganisms, primarily bacteria, fungi and some protozoa, mineral nutrients and organic acids and other microbial by products.

Chemical fertilization is an important and limiting factor for growth and production of banana plants because plants remove large amounts of nutrients from the soil. Among these nutrients, nitrogen, phosphorus and potassium are considered the prime nutrients for growth of plants. Sandy soils are considered recently, as the main area for agricultural extinction, under such conditions, it is necessary to use the improved irrigation fertilization (fertigation) by adding the dissolved nutrients through a drip (trickle) irrigation system (Ibrahim, 2003). For growth and fruit production, bananas require high amounts of nutrients which are often supplied only in part by the soil. These nutrients have to be enriched with organic and bio fertilizers in order to maintain soil fertility and to permit the continuous production of high yields (Gowen, 1995). Several investigators reported that combined application of organic with bio fertilizers or with inorganic fertilizers increased soil N, P and K availability and decreased soil PH compared with the treatments with inorganic fertilizers alone of banana plants (Athani and Hulamani (2000); El- Shammaa (2001); Suresh and Hasan (2001); Hammam *et al.,* (2003); Abd El-Moniem and Radwan (2003); Gogoi *et al*., (2004); Abd El-Moniem *et al.,* (2008); Mohamed *et al.,* (2010), Barakat *et al.,* (2011) and Vazquez-Ovando *and Andrino-Lopez* (2012)).

Humic acid (polymeric polyhydroxy acid) is the most significant component of organic substances in aquatic systems. Humic acid is highly beneficial to both plant and soil; it is important for increasing microbial activity, it is considered as a plant growth bio-stimulant and an effective soil enhancer; it promotes nutrient uptake as chelating agent and improves vegetative characteristics, nutritional status and leaf pigments (Eissa *et al*., 2007 and Ismail *et al*., 2007).

Bio-fertilization is considered an important tool to enhance the yield and fruit quality of fruit trees and it becomes, as positive alternative to chemical fertilizers. It is safe for human and environmental and using them was accompanied with reducing the great pollution occurred on our environment as well as for producing organic foods for export. (Abdelaal *et al.,* 2010). Effective Microorganisms EM preparation contains milk bacteria (*Lactobacillus casei*, *Streptococcus lactis*), photosynthetic bacteria (*Rhodopseudomonas palustrus*, *Rhodobacter space*), yeast (*Saccharomyces albus*, *Candida utilis*), actinomycetes (*Streptomyces albus*, *S. griseus*) and moulds (*Aspergillus oryzae* and *Mucom hiemalis*).

Therefore, the present study is undertaken to evaluate the usefulness of supplementing some sources of organic fertilizers in presence of bio-fertilizer with the recommended chemical fertilizers doses on growth, productivity and chemical constituents of banana cv. Grande Naine plant grown under sandy soil conditions.

Materials and Methods

This work was carried out at the sandy soil of El-Khatatba region, Minofia Governorate, Egypt, through the two successive seasons 2013 (first ratoon plants) and 2014 (second ratoon plants) of Grande Naine cultivar, Giant Cavendish AAA sub-group. Mother plants were planted at 3.0×3.5 m. apart in March 2012 and three suckers were selected per each hole and the others were removed. The chemical and mechanical properties of the used soil are presented in Table (1).

Table 1: Soil characteristics of banana plantation at the start of the experiment.

Properties	Clay %	Silt %	Fine sand %	Coarse sand %	Texture	PH	EC	Ca CO_3 %	Na mg/L	K mg/L	Ca mg/L	Mg mg/L	HCO_3 mg/L	Cl mg/L	SO_4 mg/L
Value	8.00	6.00	30.50	55.50	Sandy	8.2	0.84	0.63	1.91	0.10	1.24	0.86	2.01	1.53	0.63

The experimental plants received all the agricultural practices usually used in banana plantation, except for the purpose of this study**.** The main source of water supply was well water under drip irrigation.

Organic fertilizer treatments:

- Organic manure (compost) at the rate of 20 and 30 tons/fed were added in early December of both seasons. Two trenches (100×50×50 cm) were excavated on the two side of the hole, and then the given amount of compost as a part of surface soil was mixed together and added to the chuck holes followed by irrigation.

- Humic acid was added as soil drench three times at the rate of 15cm^3 per hole, just before irrigation at one month interval, starting at March 1st.
- Compost tea was added as soil drench three times at the rate of 15 liters per hole at one month interval, starting at March 1st.

Table 2: Chemical analysis of the organic manure (compost)

Parameter	M^3 weight	Moisture %	Organic matter %	pH (1:10)	EC (ds/m)	C/N ratio	Total N %	Total P %	Total K %	Total Ca %	Total Mg %	Total Fe (ppm)	Total Mn (ppm)	Total Zn (ppm)	Total Cu (ppm)
Value	790 kg	30	35.6	8.9	3.4	17.6	1.5	0.6	1.32	1.92	0.90	1012	116	28	18.3

Compost tea preparation:

Compost tea (compost extract) was extracted by soaking 10 kg of plant mature compost with 100 liter water + 100 cm Molasses for 7 days in a special unit, attached to air pump and the aerator provides continuous flow of air bubblers to extract compost tea until completion of the fermentation process and extract color becomes light Brown (Fayek *et al.,* 2014). The chemical properties of compost tea are shown in Table (3).

Table 3: Chemical analysis of the organic compost tea

Parameter	Organic matter %	pH (1:10)	EC (ds/m)	Total N %	Total P %	Total K %	Total Ca %	Total Mg %	Total Fe (ppm)	Total Mn (ppm)	Total Zn (ppm)	Total Cu (ppm)
Compost tea Composition	45	7.44	2.33	1.15	0.92	1.25	1.95	0.79	1978	457	148	32

Bio-fertilizers treatments:

Effective Microorganisms (EM) preparation was added as soil drench three times at the rate of 10cm^3 per hole at one month interval, starting at March 1st, which supplied by Department of Microbiology, Agric. Res. Inst., Giza was used in this study as biological activators.

Chemical fertilizer treatments:

Chemical fertilizers doses were added through drip irrigation system during the two seasons of this study. The plants were received chemical fertilizers at the recommended doses of NPK (800, 100, 1000 N, P_2O_5 and K_2O actual Kg/fed) in the forms (ammonium nitrate 33.5 N%, phosphoric acid 80% (P_2O_5)and potassium sulphate 48% (K_2O) (National campaign for improving banana productivity in Egypt, 2014).

The experiment consisted of nine treatments as follows:

1- T_1: Control (recommended dose of chemical fertilizer: Rd)
2- T_2: Rd + 20 ton compost+ EM
3- T_3: Rd + 30 ton compost + EM
4- T_4: Rd + humic acid + EM
5- T_5: Rd + compost tea + EM
6- T_6: Rd + 20 ton compost+ humic + EM
7- T_7: Rd + 20 ton compost + compost tea + EM
8- T_8: Rd + 30 ton compost + humic + EM
9- T_9: Rd + 30 ton compost + compost tea + EM

Recorded data

Vegetative growth:

Morphological measurements were taken at bunch shooting stage via the following parameters: pseudostem height (cm.), pseudostem circumference (cm.), number of green leaves per plant, leaf length (cm), leaf width (cm) then leaf area (m^2) of the third full sized leaf (from the top) was calculated using the equation=leaf length (cm)×leaf width (cm)×0.8 (Murry, 1960) and assimilation area per plant (m^2) was determined using the equation = leaf area × number of green leaves (Ibrahim, 1993).

Bunch characteristics:

Bunch length and circumference (cm), bunch weight (kg) and number of fingers/hand were counted and recorded.

Finger parameters (physical and chemical):

Finger weight (g), finger length and diameter (cm), pulp weight (g), peel weight (g), pulp /peel ratio, total soluble solids (%), total sugars (%), starch (%), titratable acidity (%) and T.S.S / acidity ratio were estimated from samples of ripened fruits (yellow color 6) which taken from the middle portion (5th and 6th) of two hands

for each bunch. Total sugar, starch and titratable acidity were determined according to A.O.A.C (1995). T.S.S were estimated by hand refractometer as Brix.

Yield was calculated according to the following equation:

Yield = Bunch weight (kg) × Number of plant (1200 plants)/ fed.

Leaf mineral contents of N, P and K were determined as follows:

Samples of leaves were taken from the third upper leaf in the descending foliar succession of the plant at bunch shooting as recommended by (Hewitt, 1955). Total nitrogen was determined by using micro-kjeldehl method as described by (Pregl, 1945). Phosphorus was estimated according to (Evenhuis and Dewaored, 1980). Potassium was determined photometrically as described by (Brown and Lilleland, 1946).

Statistical analysis:

The obtained data in both seasons were statistically analyzed using analysis of variance method as a simple experiment in randomized complete block design. However, LSD at 0.05 was used to differentiate between means according to Snedecor and Cochran (1980).

Results and Discussion

Effect of some different sources of organic fertilizers in presence of bio-fertilizer on vegetative growth of banana cv. Grande Naine plants.

Data in Table (4) revealed that all vegetative growth of Grande Naine banana plants i.e., pseudostem height, pseudostem circumference, green leaves number, leaf area and assimilation area/plant were greatly increased by the studied fertilization treatments as compared with control plants (T_1) in both seasons. However, the tallest pseudostem (301.67 and 300.00cm) as well as the thickest pseudostem circumference (90.00 and 88.33cm) were recorded by the treatment of RD+ compost: 30ton/fed+humic+ EM (T_8), followed in descending order by the treatment of RD+ compost: 30ton/fed compost tea+ EM (T_9). However, the differences between the above-mentioned two treatments did not reach to the level of significant in most cases in the two seasons.

Moreover, the highest number of green leaves /plant (12.67 and 12.33), the highest leaf area (2.42 and 2.36 m^2) and assimilation area/plant (30.66 and 29.10m^2) were registered by T_9 treatment, followed in most cases by T_8 treatment which gave (12.00 and 12.33 leaves), (2.33 and 2.34) and (27.96 and 28.85) in the first and second seasons, respectively. On contrary, the lowest values of these parameters were gained by control plants (T_1) which scored (230.67 and 226.33 leaves), (74.33 and 69.33), (10.00 and 10.33), (1.51 and 1.38) and (15.10 and 14.25) in the first and second seasons, respectively. Irrespective control treatment, the lowest values of the studied vegetative parameters were registered by T_5 in both seasons of this study. The remained treatments occupied an intermediate position between the aforementioned treatments in both seasons.

Table 4: Effect of some different fertilizer treatments on vegetative growth of Grande Naine banana plants during 2013 and 2014 seasons.

Parameters / Treatments	Pseudostem height (cm)		Pseudostem circumference (cm)		No. of green leaves\plant		Leaf area (m^2)		Assimilation area/plant (m^2)	
	1st	2nd	1st	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.
T_1: Control (RD)	230.67	226.33	74.33	69.33	10.00	10.33	1.51	1.38	15.10	14.25
T_2: Rd+ compost (20 ton/fed.)+ EM	282.67	279.67	84.33	75.33	11.00	10.67	1.90	1.83	20.90	19.52
T_3: Rd+ compost (30 ton/fed.)+ EM	297.67	297.00	87.00	82.00	11.67	11.67	2.35	2.24	27.42	26.34
T_4: Rd+ humic acid+ EM	271.00	271.00	80.67	76.00	11.67	11.33	1.89	1.84	22.05	20.84
T_5: Rd+ compost tea+ EM	260.33	256.67	78.67	74.00	11.33	11.00	1.66	1.67	18.80	18.37
T_6: Rd+ compost (20 ton/fed.)+ humic+ EM	298.67	296.00	83.33	81.00	12.33	11.67	2.40	2.32	29.59	27.07
T_7: Rd+ compost (20 ton/fed.)+ compost tea+ EM	275.67	287.67	82.00	78.00	11.33	11.00	2.05	1.97	23.22	21.67
T_8: Rd+ compost (30 ton/fed.)+ humic+ EM	301.67	300.00	90.00	88.33	12.00	12.33	2.33	2.34	27.96	28.85
T_9: Rd+ compost (30 ton/fed.)+ compost tea+ EM	301.67	298.33	88.67	86.67	12.67	12.33	2.42	2.36	30.66	29.10
LSD at 0.05 level	6.73	5.82	3.87	4.69	1.14	1.43	0.231	0.198	2.91	3.42

These results are confirmed by those obtained by Abd EL-Naby (2000), EL-Shammaa (2001), Abd EL-Naby and El Sonbaty (2005), Suresh and Hasan (2001) and Baiea *et al.,* (2015) on banana, EL-Gioushy and Baiea (2015) on apricot trees and Baker *et al.,* (2003), Abd EL-Naby *et al.,* (2004), Rivera-Cruz *et al.,* (2010) and Sharaf *et al.,* (2011) on orange trees.

Effect of some different sources of organic fertilizers in presence of bio-fertilizer on yield of banana cv. Grande Naine plants.

Data presented in Table (5) indicated that T_8 treatment showed to be the most effective treatment for producing the greatest values of bunch length (126.33 and 123.67 cm) and bunch circumference (127.67 and 126.67cm), followed by T_9 which scored (125.00 and. 122.33cm) and (125.33 and 125.00cm) in the first and second seasons, respectively. The differences between T_8 and T_9 were not significant in the two assigned seasons. Moreover, the heaviest bunch was gained by T_9 treatment (34.41 and 31.37 kg), followed by T_8 treatment (33.88 and 29.76 kg), with non significant differences between them in the two seasons. Furthermore, the highest yield/fed (41.29 and 37.64ton) was recorded by T_9 treatment, followed by T_8 treatment which scored (40.65 and 35.71 ton) in the first and second seasons, respectively. On the reverse, the lowest values of these parameters were recorded by control plants (T_1), followed in ascending order by T_5 treatment in the two seasons. The rest treatments came in-between the aforementioned treatments in both seasons.

The obtained results regarding banana yield were supported by the findings of many investigators of Abd EL-Naby and Gomaa (2000), EL-kholy (2004), Barakat *et al.,* (2011), Vazquez-Ovando and Andrino-Lopez (2012) and Baiea *et al.,* (2015) on banana, Dhewar and Waghmare (2009) and Roussos (2011) on orange trees, Abou El-khashab (2003) on olive trees and EL-Gioushy and Baiea (2015) on apricot trees.

Table 5. Effect of some different fertilizer treatments on yield parameters of Grande Naine banana plants during 2013 and 2014 seasons.

Parameters / Treatments	Bunch length (cm)		Bunch circumference (cm)		Bunch weight (kg)		Yield/fedan (ton)	
	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.
T_1 Control (RD)	92.67	88.67	94.00	93.00	19.35	16.36	23.22	19.63
T_2: Rd+ compost (20 ton/Fed.)+ EM	114.00	111.33	116.67	115.33	23.79	21.17	28.54	25.40
T_3: Rd+ compost (30 ton/Fed.)+ EM	120.00	115.33	120.00	118.33	24.84	23.79	29.80	28.54
T_4: Rd+ humic acid+ EM	116.33	114.00	118.33	114.67	21.70	22.05	26.04	26.46
T_5: Rd+ compost tea+ EM	105.00	104.67	105.67	110.33	20.33	21.30	24.39	25.56
T_6: Rd+ compost (20 ton/Fed.)+ humic+ EM	125.67	120.33	124.67	124.00	30.95	30.11	37.14	36.13
T_7: Rd+ compost (20 ton/Fed.)+ compost tea+ EM	114.00	112.67	115.00	116.67	26.14	21.17	31.36	25.40
T_8: Rd+ compost (30 ton/Fed.)+ humic+ EM	126.33	123.67	127.67	126.67	33.88	29.76	40.65	35.71
T_9: Rd+ compost (30 ton/Fed.)+ compost tea+ EM	125.00	122.33	125.33	125.00	34.41	31.37	41.29	37.64
LSD at 0.05 level	4.291	4.874	5.394	4.851	3.372	3.775	3.709	4.153

Effect of some different sources of organic fertilizers in presence of bio-fertilizer on quality of banana cv. Grande Naine plants.

Data presented in Tables (6&7) revealed that all studied fertilization treatments succeeded in improving fruit quality of banana cv. Grande Naine when compared with control treatment in the two seasons. However, the highest values of hand weight (2.03 and 2.06 Kg), fingers number/hand (18.67 and 18.67), finger length (18.23 and 18.05 cm) and finger weight (109.00 and 110.33 g) were scored by T_8-fertilized plants in the first and second seasons, respectively followed in descending order by T_9-fertilized plants which recorded (2.02 and 1.91 Kg), (18.67 and 17.67), (18.02 and 17.95 cm) and (108.00 and 108.00 g) in the first and second seasons, respectively. Whereas, the highest values of finger diameter were gained by T_9-fertilized plants as it recorded (3.86 and 3.78 cm), followed in descending order by T_8-fertilized plants which registered (3.70 and 3.81 cm) as an average of both seasons. The differences between the abovementioned two treatments did not reach to the level of significance in both seasons. Moreover, the treatments of T_6 and T_7 gave high significant increments in these parameters when compared with the other treatments in both seasons.

In addition, the highest pulp weight (79.67 and 79.67 g) and fruit T.SS content (22.21 and 22.05 %) were recorded by T_8 plants, while the lowest fruit total acidity content (0.31 and 0.34%) was obtained by T_9 plants in the first and second seasons, respectively. Furthermore, the highest values of peel weight (39.10 g) was gained by T_9 plants, followed in descending order by T_5 plants as it gave 38.48 g, whereas the highest values of pulp/peel ratio were gained by T_6 plants as it recorded 2.39, followed by T_8 plants which scored 2.25. This trend was true only in the first season, while in the second one, the picture was changed, where T_6 plants showed producing the highest value of peel weight as it scored 39.75 g, followed in descending order by T_5 plants which recorded 39.25 g, whereas the highest values of pulp/peel ratio were recorded by T_8 plants as it gave 2.15, followed by T_9 plants which scored 1.92. However, the differences between the aforementioned treatments were so small to reach the level of significant in the two seasons. Additionally, the highest values of fruit TSS/acidity were gained by T_9 plants as it scored 71.60 and 65.40, followed in descending order by T_8 plants which recorded 67.48 and 63.12, with no significant differences between them in the first and second seasons, respectively.

These results are confirmed with those obtained by Gomaa and Abd EL-Naby (2000), Abd EL-Naby and El Sonbaty (2005), Suresh and Hasan (2001), Vazquez-Ovando and Andrino-Lopez (2012) and Baiea *et al.,* (2015) on banana, Mansour and Shaaban (2007) on orange trees, Abd-Rabou (2006) on avocado and mango seedlings and Mohamedy and Ahmed (2009) on mandarin.

Table 6. Effect of some different fertilizer treatments on fruit quality of Grande Naine banana plants during 2013 and 2014 seasons.

Parameters / Treatments	Hand weight (kg)		Fingers number\hand		Finger length (cm)		Finger diameter (cm)		Finger weight (g)	
	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.
T_1 Control (RD)	1.49	1.22	16.00	14.00	14.47	13.92	3.38	3.39	93.33	87.33
T_2: Rd+ compost (20 ton/Fed.)+ EM	1.63	1.58	16.33	16.00	16.20	16.03	3.70	3.56	100.00	98.67
T_3: Rd+ compost (30 ton/Fed.)+ EM	1.70	1.81	16.33	17.33	18.01	17.92	3.73	3.71	104.00	104.33
T_4: Rd+ humic acid+ EM	1.58	1.49	16.00	15.67	15.73	15.73	3.58	3.33	99.00	95.33
T_5: Rd+ compost tea+ EM	1.52	1.40	15.33	15.00	15.55	15.35	3.43	3.47	99.33	93.00
T_6: Rd+ compost (20 ton/Fed.)+ humic+ EM	1.96	1.88	18.00	17.67	17.83	17.49	3.75	3.69	108.67	106.33
T_7: Rd+ compost (20 ton/Fed.)+ compost tea+ EM	1.70	1.57	16.67	15.67	16.80	16.63	3.71	3.58	101.67	100.00
T_8: Rd+ compost (30 ton/Fed.)+ humic+ EM	2.03	2.06	18.67	18.67	18.23	18.05	3.70	3.81	109.00	110.33
T_9: Rd+ compost (30 ton/Fed.)+ compost tea+ EM	2.02	1.91	18.67	17.67	18.02	17.95	3.86	3.78	108.00	108.00
LSD at 0.05 level	0.21	0.28	1.28	1.81	1.22	1.14	0.14	0.17	3.14	3.87

Table 7: Effect of some different fertilizer treatments on fruit quality of Grande Naine banana plants during 2013 and 2014 seasons.

Parameters / Treatments	Pulp weight (g)		Peel weight (g)		pulp\peel ratio		TSS (%)		Total acidity (%)		Fruit TSS\Acidity	
	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.
T_1 Control (RD)	56.33	54.00	35.07	36.40	1.61	1.48	18.93	19.57	0.44	0.42	43.02	46.59
T_2: Rd+ compost (20 ton/Fed.)+ EM	62.00	60.33	34.09	36.31	1.82	1.66	20.59	20.71	0.42	0.39	49.02	53.10
T_3: Rd+ compost (30 ton/Fed.)+ EM	77.33	67.00	34.52	37.17	2.24	1.80	21.76	21.90	0.38	0.37	57.26	59.18
T_4: Rd+ humic acid+ EM	61.33	57.33	35.08	38.35	1.75	1.49	20.39	20.24	0.40	0.40	50.97	50.60
T_5: Rd+ compost tea+ EM	61.67	55.67	38.48	39.25	1.60	1.42	20.28	20.16	0.42	0.40	48.28	50.40
T_6: Rd+ compost (20 ton/Fed.)+ humic+ EM	79.67	71.00	33.40	39.75	2.39	1.79	21.92	21.82	0.35	0.35	62.62	62.34
T_7: Rd+ compost (20 ton/Fed.)+ compost tea+ EM	63.00	63.33	33.40	35.43	1.89	1.79	20.92	20.99	0.41	0.38	51.02	55.23
T_8: Rd+ compost (30 ton/Fed.)+ humic+ EM	79.67	79.67	35.46	37.13	2.25	2.15	22.21	22.05	0.33	0.35	67.30	63.00
T_9: Rd+ compost (30 ton/Fed.)+ compost tea+ EM	79.33	74.33	39.10	38.82	2.03	1.92	22.13	21.96	0.31	0.34	71.38	64.58
LSD at 0.05 level	3.34	3.23	1.66	1.81	0.126	0.095	0.248	0.191	0.028	0.030	5.01	4.69

Effect of some different sources of organic fertilizers in presence of bio-fertilizer on chemical composition of banana cv. Grande Naine plants.

Data in Table (8) pointed out that all tested fertilization treatments statistically increased fruit total sugar content as compared with control treatments in the two seasons, especially T_8 plants which scored 18.47 and 18.16 %, followed by T_9 and T_6 treatments as an average of both seasons as they gave the exact values, whereas the highest fruit starch content was gained by T_1 plants "control" which scored 2.13 and 2.10%, followed in descending order by T_5 plants which scored 2.07 and 2.03%, in the first and second seasons, respectively. On contrary, the lowest fruit starch content was recorded by T_8 plants as it scored (1.48 and 1.50%), followed in ascending order by T_9 plants which registered (1.54 and 1.61%) in the first and second seasons, respectively. Moreover, the treatment of T_9 showed to be the most effective one for inducing the greatest values of leaf nitrogen and potassium contents in the two seasons. Whereas, the highest leaf phosphorus content was scored by T_1 and T_6 plants as an average of both seasons.

The obtained results go on line with those obtained by Abd EL-Naby and Gomaa (2000), EL-Shammaa (2001), EL-kholy (2004), Suresh and Hasan (2001) and Baiea *et al.,* (2015) on banana, Tayeh *et al.,* (2003),

Rivera-Cruz *et al.,* (2010) and Sharaf *et al.,* (2011) on orange trees and EL-Gioushy and Baiea (2015) on apricot trees.

Table 8: Effect of some different fertilizer treatments on chemical composition of Grande Naine banana plants during 2013 and 2014 seasons.

Parameters / Treatments	Fruit total sugar content (%)		Fruit starch content (%)		Leaf N content (%)		Leaf P content (%)		Leaf K content (%)	
	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.	1st S.	2nd S.
T_1 Control (RD)	16.33	16.02	2.13	2.10	2.77	2.70	0.23	0.24	3.72	3.63
T_2: Rd+ compost (20ton/Fed.)+ EM	16.68	16.82	1.89	1.93	2.97	3.00	0.24	0.22	4.01	3.80
T_3: Rd+ compost (30 ton/Fed.)+ EM	17.38	17.93	1.61	1.59	3.07	3.01	0.23	0.23	3.92	3.97
T_4: Rd+ humic acid+ EM	16.49	16.23	1.93	1.95	3.00	2.96	0.24	0.22	3.89	3.86
T_5: Rd+ compost tea+ EM	16.23	16.09	2.07	2.03	3.00	2.91	0.23	0.22	3.78	3.75
T_6: Rd+ compost (20 ton/Fed.)+ humic+ EM	17.98	18.27	1.62	1.63	3.20	3.15	0.23	0.24	4.09	4.06
T_7: Rd+ compost (20 ton/Fed.)+ compost tea+ EM	17.01	17.49	1.77	1.77	3.06	3.06	0.22	0.21	3.98	3.92
T_8: Rd+ compost (30 ton/Fed.)+ humic+ EM	18.47	18.16	1.48	1.50	2.99	3.03	0.24	0.22	4.03	4.01
T_9: Rd+ compost (30 ton/Fed.)+ compost tea+ EM	18.27	17.98	1.54	1.61	3.23	3.17	0.20	0.22	4.14	4.12
LSD at 0.05 level	0.319	0.229	0.059	0.043	0.076	0.067	0.015	0.200	0.080	0.082

Optimum values %of (N: 2.6-4.0, P: 0.2-0.25 and K: 3.0-4.0) (Lahav, E. and D.W. Turner, 1983)

Conclusively, from the obtained results it could be recommended that fertilizing banana plants cv. Grande Naine with the treatment of recommended dose of chemical fertilizers +compost (30ton/fed)+humic at 15cm^3/hole+EM at 10cm^3/hole) to produce the greatest yield and quality.

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