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RESPONSE OF MAGHRABI BANANA TO DIFFERENT MIXTURES OF ORGANIC FERTILIZERS

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ABSTRACT

This investigation was carried out during 2004 and 2005 seasons in Oseim, Giza Governorate, Egypt, to study the effect of different mixtures from organic fertilizers [i.e. Banana Compost (BC), Cattel Manure (CM), El-Katamia Compost (KC), El-Eboor Compost (EC) and El-Neel Compost (NC)] on growth, yield, fruit quality and mineral contents of leaf and fruit of Maghrabi banana. The obtained results revealed that Banana compost mixture at the rate of 25% CM + EC + NC of enhanced plant growth (i.e. plant height, circumference, green leaves number, leaf area and number of suckers). Also, it increased fruit yield (i.e. bunch weight, number of hands per bunch and number of fingers/bunch), and improved fruit quality by increasing TSS% and decreasing total acidity percentage. Moreover, it increased fruit mineral content from (N-P-K-Ca-Cu). Leaf mineral content from (N-P-K-Ca-Mg-Na-Fe-Zn-Mn-Cu) was significantly affected the by different treatments during the two seasons of this study.

INTRODUCTION

Maghrabi banana (Musa sp.) is considered one of the important fruit crops grown in Egypt. Few decades ago, fertilization became one of the most important problems in banana production in Egypt, particularly after the High Dam construction which prevented the annual addition of mud which carried by waters from the Abyssianian mountains to the River Nile Valley of Egypt. Due to this factor, plants became in much need to macro and micro nutrients.

Organic manures which include compost and city garbage manure are applied to improve the nutritional status of the plant and maintain the fertility through its effect on physical and chemical properties of the soil, also addition of compost to soil increased contents of available phophorus and exchangeable potassium, (Abou-Baker & El-Magraby, 1994 and Attalah *et al*., 1997). Also, Vargas *et al*., (1998) found that composting of rejected bananas and raquits at the farm level is a rather simple process provided that soil from surrounding sites is employed as an inoculums of microbes. Such when plantations are supplied with organic matter in the form of household wastes, found that high yields are maintained for many years. Wilson *et al*. (1987) and Yao (1988).

Banana response to compost and other organic fertilizers were studied by many investigators.

Ismail and Badawi (1998) indicated that, most of the applied composts showed positive correlation between N,P and K uptake and the compost doses.

Smith (1998) reported that organic manure increased crop bunch and stem circumference,.

Doran *et al*., (2003) showed that application of Farmyard manure, farmyard manure + mineral fertilizer and 45 kg/ of compost / plant increased the nutrient contents of banana leaves.

Abd El-Naby (2000), Abd El-Naby & El-Sonbaty (2005) and Chezhiyan *et al*. (1999) mentioned that, banana compost and organic manure improved the vegetative growth, number of suckers and yield of banana plants.

Therefore, this investigation was carried out to study the effect of different mixtures from organic fertilizers, i.e. Banana Compost, El-Katamia Compost, El-Eboor Compost, El-Neel Compost and Cattel manure on vegetative growth, yield, fruit quality and some mineral contents of leaf and fruit Maghrabi banana grown in Oseim, Giza Governorate, Egypt.

MATERIALS AND METHODS

The present investigation was carried out during two successive seasons of 2004 and 2005 on Maghrabi banana, at a private orchard located at Oseim, Giza Governorate, Egypt. The banana planted in sandy clay loam soil. The mechanical and chemical analysis of the soil are presented in Table (1). The experiment was applied on the second and third ratoons of Maghrabi banana "Giant Cavendish" spaced at 3x3m, as they were uniform in growth vigour, The plants were under flood irrigation system and received the normal cultural practices usually applied in commercial orchards. Twenty-four plants were selected for the study.

Chemical analysis of organic manures are given in Table (2), according to the procedures which are outlined by Cottanie *et al*. (1982).

This experiment included eight treatments as shown in Table (3). Organic fertilizers were applied superficially and digged in the soil at the first week of January, in both seasons. Three suckers on each plant / treatment were chosen randomly as replicates in a randomized block design. Suckers were subjected to the following studies:

I-Vegetative growth measurements:

At the beginning of florescence emergence (August to September yearly), the following characters were determined:

a) Pseudostem length in cm. was measured from the soil surface up to the petiole of the last emerged leaf.
b) Circumference of pseudostem (cm) at the base (20 cm.), middle and top of pseudostem, then the average was delivered and recorded as a value for this trait.
c) Number of green leaves per plant were recorded.
d) Leaf length and width (cm.)of the 3rd full sized leaf were estimated, leaf area (m^2) was calculated as follows, length x width x 0.8. as noted by Murry (1960).
e) Number of emerged suckers per plant were recorded.

2- Yield and fruit physical and chemical properties:

- Bunch were harvested at the maturity stage in the beginning of January in both seasons, then bunch weight (kg), number of hands per bunch, number of fingers per bunch, finger weight (gm) and length (cm) were recorded.
- Total soluble solids (T.S.S. %) at ripe stage as a percentage were recorded by using hand refractometer.

T1-2

Total acidity (%) was estimated as malic acid according to A.O.A.C. (1995).

Table (3): Organic fertilizers added during two seasons of the study:

Treatment	Organic fertilizers (kg/plant/year)									
	CM		BC		KC		EC		NC	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
CM	40.00	32.00	-	-	-	-	-	-	-	-
CM + BC	20.00	16.00	22.86	25.00	-	-	-	-	-	-
CM + BC + KC	13.33	10.66	15.23	16.66	2.96	3.14	-	-	-	-
CM + BC + EC	13.33	10.66	15.23	16.66	-	-	6.06	6.66	-	-
CM + BC + NC	13.33	10.66	15.23	16.66	-	-	-	-	3.98	2.67
CM + BC + KC + EC	10.00	8.00	11.43	12.50	2.22	2.35	4.55	5.00	-	-
CM + BC + KC + NC	10.00	8.00	11.43	12.50	2.22	2.35	-	-	2.99	2.00
CM + BC + EC + NC	10.00	8.00	11.43	12.50	-	-	4.55	5.00	2.99	2.00

CM: Cattle Manure BC: Banana compost KC: El-Katamia Compost
EC: El-Eboor Compost NC: El-Neel Compost.

3- Mineral content of leaves and fruits:

Leaf samples were taken from the third upper leaf in descending leaves from the top of the plant after bunch shooting in September of each season. Each sample was of 10x10 cm from the middle part of the blade leaf as recommended by Hewitt (1955) and adopted by Abou-Aziz *et al*., (1993). The fruit samples were taken from ripe pulp.

Leaf and fruit samples were washed with tap water and then with distilled water to remove the dust and any chemical spray resides. After washing, they were dried in electric oven at 60-70°C until constant weight. The dried material was ground in an electric mill. 0.2 gram of the ground material was digested using a mixture of perchloric acid: sulphoric acid 1:10 (v/v) according to Jackson (1967) and the clear digest was quantitatively transferred to 100ml volumetric flask.

In this solution, the following nutrients were determined. Total nitrogen was determined in ground material by semi-micro kjeldahl methods as recommended by Bremmer (1965), phosphorous was colorimetrically determined using the molybdenum blow method according Chapman and Pratt (1961) Potassium was determined by the flamephotometer according to Jackson (1958).

Iron, zinc, manganese and copper were estimated by using Atomic Absorption Spectrophotometer Jaril-Ash 850.

The results were subjected to statistical analysis according to Snedecor & Cochran (1980) and the differences between the means were compared at 5% level using Duncan's multiple range test, Duncan (1955).

RESULTS AND DISCUSSION

1- Vegetative growth:

Data in Tables (4 and 5) clearly show that pseudostem length and circumference for Maghrabi banana were significantly affected by different treatments in both seasons.

Maghrabi banana plants received (CM + BC + EC + NC) produced the highest pseudostem length compared with other treatments in both seasons. The values were 308.3 cm in the first season and 338.3 cm in the second one. The lowest values were recorded by cattel manure treatment (control) in both seasons.

Also pseudostem circumference was significantly affected by different mixture organic fertilizers treatments in both seasons.

Maghrabi banana plants received (CM + BC + KC + NC) and (CM + BC + EC + NC) in the first season gave the highest values, it recorded 84.33 and 83.00 cm, respectively, while in the second season, (CM + BC + EC + NC) treatment recorded the highest values (85.67 cm) of pseudostem circumference compared with different treatments.

Data presented in Tables (4 and 5) also show that number of green leaves per plant, leaf length (cm) leaf width (cm) and leaf area (m^2) were significantly affected by different mixtures organic fertilizers during both seasons of study.

Table (4): Effect of different organic fertilizers on growth responses of 'Maghrabi" banana cv. During 2004 season.

Treatment	Pseudostem length (cm)	Pseudostem circumference (cm)	Green leaves number	leaf length (cm)	leaf width (cm)	leaf area (m^2)	Number of suckers
CM	236.0c	66.67e	9.67d	198.33e	60.33bc	0.957c	1.33c
CM + BC	243.0c	69.33de	10.33cd	222.70cd	60.67bc	1.081c	2.00bc
CM + BC + KC	259.7b	76.00bcd	11.33bcd	240.0ab	66.33b	1.274b	2.67ab
CM + BC + EC	267.7b	77.67abc	11.67abc	237.70abc	57.67c	1.097bc	2.33bc
CM + BC + NC	265.0b	74.33cde	11.67bcd	225.30bcd	62.00bc	1.117bc	2.33bc
CM + BC + KC + EC	235.0c	70.33cde	9.67d	219.00d	59.00bc	1.034c	1.33c
CM + BC + KC + NC	295.0a	84.33a	12.33ab	227.30bcd	62.33bc	1.133bc	2.33bc
CM + BC + EC + NC	308.3a	83.00ab	13.33a	246.70a	76.67a	1.513a	3.67a

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattle manure BC: Banana Compost KC: El-Katamia Compost
EC: El-Eboor Compost NC: El-Neel Compost

Table (5): Effect of different organic fertilizers on growth responses of 'Maghrabi" banana cv. during 2005 season.

Treatment	Pseudostem length (cm)	Pseudostem circumference (cm)	Green leaves number	leaf length (cm)	leaf width (cm)	leaf area (m^2)	Number of suckers
CM	260.0f	62.67c	10.33d	216.67e	69.00d	1.196d	2.33ab
CM + BC	283.3df	71.00b	13.33ab	240.00d	72.33cd	1.389c	3.33a
CM + BC + KC	294.3cd	73.67b	11.33cd	271.00ab	81.33a	1.763a	2.33ab
CM + BC + EC	310.0bc	72.33b	12.67abc	272.00ab	73.00cd	1.588b	1.33b
CM + BC + NC	291.7de	72.33b	10.33d	275.67a	81.00ab	1.786a	2.67ab
CM + BC + KC + EC	276.7e	70.67bc	10.67d	260.00bc	79.00ab	1.643b	3.67a
CM + BC + KC + NC	311.7b	75.00b	11.67bcd	251.67cd	76.67bc	1.544b	2.67ab
CM + BC + EC + NC	338.3a	85.67a	13.67a	273.33ab	83.00a	1.815a	2.67ab

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El_Neel Compost.

[CM + BC + EC + NC] treatment produced the highest number of green leaves per plant in the two seasons of study, since they were 13.33 and 13.67 leaves per plant in the first and second seasons, respectively compared with control.

Maghrabi banana plants fertilized by (CM + BC + EC + NC) showed the longest leaf in both seasons of study, since they were 246.70cm and 273.33cm in the first and second seasons, respectively. As well as the greatest leaf width was recorded by plants received treatment (CM + BC + EC + NC) it was 76.67 cm in the first season and 83.00 cm in the second one.

Maghrabi banana plants fertilized by (CM + BC + EC + NC) recorded the highest leaf area in both seasons, since it was 1.513m^2 in the first season and 1.815m^2 in the second one.

Concerning the total number of suckers per plant (Tables, 4 and 5) indicated that (CM + BC + EC + NC) mixture recorded the highest number of suckers per plant (3.67) in the first season, while in the second season, total suckers number per plant was not significantly affected with different treatments compared with control.

These results are in agreement with those obtained by Smith *et al*., (1994) who found that the effect of organic manure may be due to increasing the availability of most nutrients through growth period, and Taiz & Zeiger (1998) noted that it improve the physical structure of soil, enhancing water retention during drought and increasing drainage in wet condition. The improving effect of using organic manure was reported by the results of Smith (1998), Ray & Yadav (1996), Abd El-Naby (2000), Abd El-Naby & Gomaa (2000), Abd El-Naby *et al*. (2004), Abd El-Naby and El-Sonbaty (2005) and Kamel (2002).

2- Yield and fruit physical and chemical properties:

Data in Tables (6 and 7) show that bunch weight, number of hands/bunch, number of fingers/bunch, finger weigh, finger length, total soluble solids percentage and total acidity percentage were significantly affected by different treatments.

The highest bunch weight was recorded by plants received (CM + BC + EC + NC) treatment it recorded 27.92 and 27.03 kg in the first and second seasons, respectively. Meanwhile, the lowest bunch weight was recorded due to control treatment during two seasons of the study.

Data in Tables (6 and 7) also revealed that the highest number of hands/bunch was recorded by plants fertilized by (CM + BC + EC + NC), (CM + BC + KC + EC) and (CM + BC + NC) mixtures as compared with those the control in the first and second seasons.

The highest number of fingers/bunch was obtained by plants fertilized by (CM + BC + EC + NC) mixtures it recorded 199.0 fingers/bunch, in the first season, while in the second season, (CM + BC + EC + NC), (CM + BC + KC + EC) and (CM + BC + NC) mixtures were recorded the highest value (215.3, 212.0 and 211.7, respectively).

The least number of fingers/bunch was recorded by plants treated by cattel manure (control) in both seasons of study.

These results are in harmony with those obtained by Smith (1998) Abd El-Naby (2000), Abd El-Naby & Gomaa (2000), Tirkey *et al*. (2002) and Abd El-Naby & El-Sonbaty (2005).

Results in Tables (6 and 7) show that finger weight was significantly affected by different fertilizer treatments. The highest finger weight was recorded by plants supplied by cattle manure (control) and (CM + BC), since it were 148.1 and 144.6 gm, respectively in the first season, while in the second season both (CM + BC + KC + NC) and (CM + BC + EC + NC) mixtures were recorded the highest finger weight, since it was 126.8gm and 125.5 gm, respectively.

Table (6): Yield and fruit quality of "Maghrabi" banana fruits as affected by different organic fertilizers during 2004 season.

Treatment	Bunch weight (Kg)	No. of hands/ bunch	No. of fingers/ bunch	Finger weight (gm)	Finger length (cm)	TSS %	Acidity %
CM	14.21d	7.33c	96.0f	148.1a	17.33b	12.47d	0.155a
CM + BC	20.81b	9.00b	144.0e	144.6ab	18.50b	13.30c	0.130ab
CM + BC + KC	21.15b	9.33b	156.0d	135.6c	20.67a	16.03a	0.108ab
CM + BC + EC	19.19c	10.33a	171.3c	112.0e	17.67b	14.47b	0.134ab
CM + BC + NC	21.16b	10.33a	174.7bc	121.1d	18.50b	16.30a	0.138ab
CM + BC + KC + EC	21.34b	10.67a	177.0b	120.6d	20.67a	16.40a	0.124ab
CM + BC + KC + NC	18.93c	9.00b	155.3d	121.9d	20.67a	16.20a	0.092b
CM + BC + EC + NC	27.92a	10.67a	199.0a	140.3bc	21.17a	16.53a	0.096b

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El-Neel Compost

Table (7): Yield and fruit quality of "Maghrabi" banana fruits as affected by different organic fertilizers during 2005 season.

Treatment	Bunch weight (Kg)	No. of hands/ bunch	No. of Fingers/ bunch	Finger weight (gm)	Finger length (cm)	TSS %	Acidity %
CM	17.91e	9.33d	166.7c	107.5e	16.77c	14.53e	0.142a
CM + BC	20.70d	10.00bcd	170.0c	121.8bc	20.10b	15.60d	0.108ab
CM + BC + KC	20.91d	10.33bc	177.7b	117.7c	20.33b	16.47c	0.114ab
CM + BC + EC	20.49d	9.67cd	172.3bc	118.9c	19.67b	15.27d	0.109ab
CM + BC + NC	23.75b	12.00a	211.7a	112.2d	21.83a	16.33c	0.122ab
CM + BC + KC + EC	23.40b	11.67a	212.0a	110.4de	20.67ab	16.70c	0.117ab
CM + BC + KC + NC	21.80c	10.67b	172.0bc	126.8a	21.67a	17.20b	0.106ab
CM + BC + EC + NC	27.03a	11.67a	215.3a	125.5ab	21.67a	18.33a	0.086b

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El_Neel Compost.

As for finger length, it was significantly affected by different fertilizers since (CM + BC + EC + NC), (CM + BC + KC + NC) and (CM + BC + KC + EC), mixtures gave the largest finger length 21.17, 20.67 and 20.67 cm, respectively in the 1st season, while it recorded 21.67, 21.67 and 20.67 cm, respectively in the 2nd season.

These results are generally in agreement with those found by Gubbuk *et al*. (1993), Chezhiyan *et al*. (1999), Abd El-Naby & El-Sonbaty (2005) and Kamel (2002).

Data presented in Tables (6 and 7) show that all treatments significantly affected TSS% in fruit juice in both seasons as compared with those of the control.

The highest TSS% was obtained by fertilization with (CM + BC + EC + NC), (CM + BC + KC + EC), (CM + BC + NC), (CM + BC + KC + NC) and (CM + BC + KC) mixtures, since it was 16.53, 16.40, 16.30, 16.20 and 16.03%, respectively during the first season, while in the second season (CM + BC + EC + NC) mixtures gave the highest TSS% (18.33%).

The lowest TSS% in fruit was recorded by plants received cattel manure (control) during two seasons of the study.

Acidity percentage in fruit was significantly affected by the treatments. The lowest total acidity % was recorded when plants were fertilized with (CM + BC + EC + NC) in both seasons as it recorded 0.096 and 0.086%, respectively.

These results are supported by those reported by Abd El-Naby and Gomaa (2000), Kamel (2002) Caussiol & Joyce (2004) and Abd El-Naby and El-Sonbaty (2005).

3- Leaf mineral content:

Data in Tables (8 and 9) clearly indicated that mixture organic fertilizers significantly affected leaf N, P, K, Ca, Mg, Na, Fe, Zn, Mn and Cu contents in both seasons.

Table (8): Effect of different organic fertilizers on leaf mineral content at bunch shooting stage of "Maghrabi" banana cv. during 2004 season.

Treatment	N %	P %	K %	Ca %	Mg %	Na %	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
CM	1.86bc	0.24bc	3.02c	0.92bc	0.46bcd	0.126a	382.7c	28.23a	166.0cd	9.83c
CM + BC	1.60d	0.43a	3.12c	1.15ab	0.60a	0.032b	491.3ab	18.83cd	249.0ab	21.33b
CM + BC + KC	1.63cd	0.23bc	3.27c	1.24a	0.65a	0.020b	416.0bc	18.32d	265.7a	9.83c
CM + BC + EC	1.81bcd	0.24bc	3.65bc	1.05ab	0.43cd	0.018b	409.3bc	20.00cd	269.7a	9.67c
CM + BC + NC	1.99b	0.20c	3.59bc	1.03ab	0.43cd	0.023b	420.7bc	23.17bc	238.ab	10.00c
CM + BC + KC + EC	1.99b	0.20c	4.13ab	1.02ab	0.52abc	0.024b	411.7bc	17.67d	136.3d	9.67c
CM + BC + KC + NC	1.92b	0.27b	4.15ab	0.74c	0.34d	0.023b	411.7bc	26.33ab	202.3bc	18.17b
CM + BC + EC + NC	2.33a	0.20c	4.55a	1.27a	0.58ab	0.024b	544.3a	19.00cd	165.0cd	27.83a

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El-Neel Compost.

Table (9): Effect of different organic fertilizers on leaf mineral content at bunch shooting stage of "Maghrabi" banana cv. during 2005 season.

Treatment	N %	P %	K %	Ca %	Mg %	Na %	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
CM	1.80f	0.21d	3.06g	1.09f	0.34g	0.380a	201.0f	41.33de	105.3h	10.50e
CM + BC	1.85f	0.36b	3.65f	1.21e	0.44f	0.227c	220.3e	35.00e	136.0g	23.33ab
CM + BC + KC	2.12d	0.33bc	4.23d	1.45c	0.54e	0.233c	227.7e	64.67b	250.0e	24.00ab
CM + BC + EC	2.02e	0.24c	3.87e	1.17e	0.60d	0.307b	222.7e	50.67c	179.0f	14.67de
CM + BC + NC	2.18cd	0.34bc	4.47c	1.35d	0.64d	0.150de	281.3d	74.67a	343.3c	12.00de
CM + BC + KC + EC	2.25c	0.44a	4.60bc	1.78a	0.83b	0.193cd	306.7c	48.00cd	317.0d	25.43a
CM + BC + KC + NC	2.44a	0.32bc	4.75ab	1.68b	0.73c	0.160de	328.7b	51.00c	359.7b	16.33cd
CM + BC + EC + NC	2.36b	0.34bc	4.91a	1.78a	0.91a	0.137e	358.3a	63.00b	375.7a	20.33bc

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El-Neel Compost.

The highest nitrogen, potassium, calcium and magnesium percentages in the leaves were recorded by plants fertilized with (CM + BC + EC + NC) in the first season, while, in the second season plants fertilized by (CM + BC + KC + NC) increased N content in the leaves.

Concerning Fe, Zn, Mn and Cu contents in the leaves, results indicated that, the highest Fe and Cu in leaves were recorded by plants received (CM + BC + EC + NC) since it was 358.3 and 20.33 ppm, in the first season respectively.

On the other hand, cattel manure (control) gave the highest Zn in leaves during the first season.

In the second season, plants treated by (CM + BC + EC + NC) treatment gave the highest K, Ca and Mg in leaves. Also this treatment increased Fe and Mn content in leaves compared with control.

Concerning sodium percentage in the leaves, results in Tables (8 and 9) revealed that all treatments in this study decreased Na content in the leaves compared with cattle manure treatment (control) during two seasons of the study.

The same trend was obtained by Attalah *et al*. (1997), Ismail and Badawi (1998) who found that, most of the applied composts showed positive correlation between N, P and K uptake and the compost doses, Abd El-Naby & Gomaa (2000) and Doran *et al*., (2003) who showed that application of farmyard manure fertilizers and 45kg compost /plant increased the nutrient contents of banana leaves.

4- Fruit mineral content:

Data in Tables (10 and 11) suggested that different treatments significantly affected fruit mineral content.

The highest nitrogen, potassium and calcium percentage in fruits were recorded from plants fertilized by (CM + BC + EC + NC) compared to control during both seasons.

Table (10): Fruit mineral content at ripening stage of "Maghrabi" banana cv. as affected by different organic fertilizers during 2004 season.

Treatment	N %	P %	K %	Ca %	Mg %	Na %	Fe (ppm)	Zn (ppm)	Mn (ppm)
CM	0.88e	0.24bc	2.75e	0.107e	0.012a	22.77e	6.53g	5.50e	3.37e
CM + BC	1.36bc	0.25abc	2.97cd	0.127de	0.008a	34.63d	8.43f	7.43c	5.90bc
CM + BC + KC	1.07cd	0.25abc	3.43b	0.157cde	0.008a	23.37e	15.37c	7.27c	4.60d
CM + BC + EC	0.73e	0.22bc	2.91d	0.117de	0.041a	32.40d	8.10f	5.63e	4.40d
CM + BC + NC	1.24bcd	0.21c	3.08c	0.167bcd	0.007a	60.43a	11.40d	11.50a	3.53e
CM + BC + KC + EC	1.03d	0.30a	2.66e	0.217ab	0.008a	41.87c	10.67e	7.43c	5.67c
CM + BC + KC + NC	1.68a	0.25abc	3.49b	0.193bc	0.006a	43.50c	16.10b	6.50d	6.37b
CM + BC + EC + NC	1.40ab	0.27ab	4.02a	0.270a	0.006a	53.23b	22.40a	8.43b	7.20a

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El-Neel Compost.

Table (11): Fruit mineral content at ripening stage of "Maghrabi" banana cv. as affected by different organic fertilizers during 2005 season.

Treatment	N %	P %	K %	Ca %	Mg %	Na %	Fe (ppm)	Zn (ppm)	Mn (ppm)
CM	0.84f	0.074a	1.55f	0.107e	0.011a	21.87e	3.43a	1.097f	0.343d
CM + BC	0.92e	0.072a	1.74d	0.173cd	0.008a	23.13de	2.44cd	1.327d	0.550b
CM + BC + KC	1.21c	0.082a	1.69de	0.230b	0.008a	33.63b	2.88b	1.240e	0.437c
CM + BC + EC	0.93e	0.074a	1.68de	0.123de	0.013a	25.00cd	2.44cd	1.160f	0.443c
CM + BC + NC	1.10d	0.083a	1.64e	0.313a	0.008a	36.23a	2.56c	0.917g	0.527b
CM + BC + KC + EC	1.18c	0.088a	1.84c	0.190bc	0.010a	32.63b	2.22d	1.433c	0.417c
CM + BC + KC + NC	1.28b	0.085a	2.21b	0.230b	0.005a	27.07c	2.84b	1.630b	0.537b
CM + BC + EC + NC	1.37a	0.091a	2.33a	0.333a	0.006a	36.50a	2.66bc	1.763a	0.630a

*** Means within each column with the same letter are not significantly different at 5% level.**
CM: Cattel manure BC: Banana Compost
KC: El-Katamia Compost EC: El-Eboor Compost NC: El-Neel Compost.

Phosphorus content in fruits was affected significantly in the first season only, the highest average of P% in fruit, was produced with (CM + BC + KC + EC) mixture.

No significant differences were observed between the used organic fertilizer mixtures on fruit Na% content in the two seasons.

In general, there are marked increases in Fe, Zn, Mn and Cu in fruits content with all organic mixtures compared with cattle manure (control). The highest average of fruits Zn and Cu content were produced from plants supplied by (CM + BC + EC + NC) in the first season, on the other hand, the control gave the highest fruit Zn content in the second season.

Fruit iron content was increased by using (CM + BC + NC) compared with cattle manure (control) in two seasons of study.

The obtained results are somewhat in line with the findings of Gubbuk *et al*., (1991), Alvarez *et al*., (1993), Smith (1994), Ismail and Badawi (1998), Abd El-Naby *et al*., (2004) and Abd El-Naby & El-Sonbaty (2005).

From the abovementioned results it could be concluded that banana compost mixture with other organic fertilizers source for fertilizing Maghrabi banana plants improved vegetative growth, leaf and fruit mineral contents, yield and fruit quality.

REFERENCES

Abd El-Naby, S.K.M. (2000). Effect of banana compost as organic manure on growth, nutrients status, yield and fruit quality of Maghrabi banana. Assiut J. of Agric. Sci. Vol. 13, No. 3: 101-114.

Abd-El-Naby, S.K.M. and A.M. Gomaa (2000). Growth, nutritional status, yield and fruit quality of Maghrabi banana as affected by some organic manures and biofertilizer. Minufiya J. Agric. Res. Vol. 25 No. 4: 1113-1129.

Abd El-Naby, S.K.M., E.A.A. Abd El-Moneim and A.S.E. Abd-Allah (2004). Effect of source and date of organic manure application on growth, yield, fruit quality and mineral content of Washington navel orange trees grown in sandy soil. Minufiya J. Agric. Res. Vol. 29 No. 2: 515-540.

Abd El-Naby, S.K.M. and M.R. El-Sonbaty (2005). Effect of partial replacement of Chemical fertilizers by organic manures in banana production and fruit quality. Assiut J. Agric. Sci. Vol. 36. No. 2.107-122.

Abou-Aziz, A.B.; A.M.M. Abd El-Kader; M.R. El-Sonbaty and M.M.M. Saad (1993). Effect of different levels of (K-MAG) compound fertilizer on vegetative growth, yield, fruit quality and some leaf-nutrient contents of Maghrabi banana cultivar. Assiut J. of Agric. Sci. Vol. 24, No:1, 345-357.

Abou-Baker, M.A. and S. El-Magraby (1994). Sugar beet response to city garbage compost and mineral fertilizer application. Annals Agric. Sci. Moshtohor, 32(3): 1310.

Alvarez, C.E.; A.E. Carracedo; E. Iglesias and M.C. Martinez (1993). Pineapples cultivated by conventional and organic method in a soil from a banana plantation. A comparative study of soil fertility, plant nutrition and yield. Biolo. Agric. And Hort. 9(2) 161-171 (c.f. Hort. Abst. 0144-8765).

Association of Official Agricultural Chemists (1995). Official Methods of Analysis. A.O.A.C. 15th Ed. Published by A.O.A.C. Washington, D.C. (U.S.A.).pp.1-32.

Attalah, M.Z.; M.H.H. El-Deeb; N.Z. Younan and N.S. Ghora (1997). Response of eight sugar beet varieties to city garbage compost in combination with chemical fertilizer. J. Agric. Sci. Mansoura Univ., 22(3): 941-958.

Bremmer, J.M. (1965). Total nitrogen. In: Methods of Soil Analysis (part 2). Black,C.A. (Ed) pp. 1149-78. American Society of Agronomy, Madison, USA.

Caussiol, L.P. and D.C. Joyce (2004). Characteristics of banana fruit from nearby organic versus conventional plantations: A case study. J. of Hort. Sci and Biotechnology 79(5): 678-682.

Chapman, H.D. and P.F. Pratt (1961). Methods of Analysis for Soils, Plants and Waters. Div. of Agric. Sci., Univ. of Califormia, U.S.A.

Chezhiyan, N.; P. Balasubramani; C.V. Harris and M. Ananthan (1999). Effect of inorganic and biofertilizers on growth and yield of hill banana var. Virupakshi. South Indian Horticulture, 47(1-6): 161.

Cottanie, A.; M. Verloo; L. Kiekens; G. Velghe and R. Camerlynch (1982). Chemical Analysis of Plant and Soils. Lab. Anal. Agroch. State Univ. Ghent. Blegium.pp.33-53.

Doran, I.; B. Sen and Z. Kaya (2003). The effect of compost prepared from waste material of banana plants on the nutrient contents of banana leaves. J. of Environmental Biology, 24; 4, 437-444.

Duncan, D.B. (1955). Multiple range and multiple F. Testes. Biometrics, 11: 1-24.

Gubbuk, H.; S. Bahce and N. Kasha (1991). The effect of different application rates of nitrogen and farmyard manure on the nutrient concentration in leaves of banana cultivars Cavendish and Basrai. Bahce, 20: 1-2, 33-39. (c.f. Hort. Abst. 89-1995).

Gubbuk, H.; S. Paydas and N. Kaska (1993). Effect of different nitrogen and farmyard manure levels on the stem and finger growth and the duration of fruit development of Cavendish and Basrai banana clones. Doga/Turk-Tarim-CV-Ormoncilik Fakultesi, 17(1): 239-253 (c.f. Hort. Abst. 960116).

Hewitt, C.W. (1955). Leaf anlaysis as a guide to the nutrition of banana Emp. J. Exp. Agric., 23: 11-16 (c.f. Hort. Abst. 31, 4346).

Ismail, A.E. and M.A. Badawi (1998). Role of certain composted plant or animal residues in the control of Rotylenchulus reniformis on cowpea. Pakistan J. of Nematology, 16: 2, 127-136.

Jackson, M.L. (1958). Soil Chemical Analysis. P. 498. Constable Ltd. Co., London.

Jackson, M.L. (1967). Soil chemical analysis. p. 331 Prentice Hall Inc. Englewoofd Cliffs, N.J.

Kamel, A.B. (2002). Physiological studies on biofertilization of banana Plants CV. Williams. Ph.D. Thesis. Fac. Agric. Minia Univ., Egypt.

Murry, D.B. (1960). The effect of deficient of major nutrients on growth and leaf analysis of the banana. Trop. Agric. Trin. 37: 97-106.

Ray, P.K. and J.P. Yadav (1996). Effect of combined use of organic manures and chemical fertilizers on growth and productivity of banana. Ann. of Agric. Res. 17(4): 366-369 (c.f. CAB. Abst. 0970-3179).

Smith, B.L. (1994). Nutrition of young tissue cultured banana plants. Inligtings-bulletin. Inst. Vir. Tropen. Subtropiese Gewase 262, 12 (c.f. Hort. Abst. 9403-0964).

Smith B.L. (1998). Micro-organisms in soil benefit growth and yield of bananas. Neltropika-Bull. No. 299, 22-25. (c.f. CAB Abst. 9803-09816).

Smith, W.H.; K.L. Campbell; W.D. Graham and A.B. Bottcher (1994). Beneficial uses of composts in Florida. Proc. of the Second Confernce, April, 247-253 U.S.A. (c.f. CAB Abst. 9619-00912).

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods. 6th Edition, Iowa State, Univ. Pres, Ames, Iowa, U.S.A.

Tirkey, T.; S. Agrawal and S.D. Pandey (2002). Effect of organic manures on growth, maturity and yield of banana Cv. Dwarf Cavendish. South Indian Hort. 50: 1-3, 19-24 (c.f. CAB Abst. 0038-3473).

Taiz, L. and E. Zeiger (1998). Plant physiology, Chapter, 5. Mineral nutrition. P. 113, Second (ed). Sinauer Associats, Inc.

Vargas, R.; S. Laprade and M. Barquero (1998). Compositing of rejected banana and raquits. Corbana, 23:49, 29-50.

Wilson, G.F.; R. Swennen; E. de. Langhe and E. De. Langhe (1987). Effect of mulch and fertilizater on yield and longevity of a medium and giant plantation and a banana cultivar. Proceedings of the third meeting for plantain and banana research, Ivary Coast 27-31 May, 1985, 1987, 109-111. (c.f. CAB Absat. 1987-1989).

Yao N. (1988). Survey of cropping systems including plantains on small holdings in the Ivory coast fruits. Paris 43:3, 149-159 (c.f. Hort. Abst. 90039-4418).

إستجابة الموز المغربى لمخاليط مختلفة من الأسمدة العضوية

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أجرى هذا البحث خلال موسمي ٢٠٠٤، ٢٠٠٥ فى مزرعة خاصة بمركز أوسيم محافظة الجيزة، بهدف دراسة تأثير مخاليط أسمدة عضوية مختلفة [كمبوست الموز - السماد البلدي – كمبوست القطاميه (ناتج مخلفات المدن) – كمبوست العبور (ناتج مخلفات الفاكهة والخضر لسوق العبور) – كمبوست النيل (ناتج مخلفات نباتية)] على النمو الخضري والمحصول وجوده الثمار ومحتوى الأوراق والثمار من العناصر الغذائية للموز المغربي.

وقد أظهرت أهم النتائج المتحصل عليها ما يلي:

- أعطت معاملة خلط كمبوست الموز + السماد البلدي + كمبوست العبور + كمبوست النيل بنسبة ٢٥% لكل منهما أفضل صفات في النمو الخضري المتمثل في طول ومحيط الساق الكاذبة وعدد الأوراق الخضراء ومساحة الورقة وعدد الخلفات، وأوضحت المعاملة أيضاً تحسن في كمية المحصول (وزن السباطة – عدد الكفوف في السباطة – عدد الأصابع الكلية في السباطة) وكذلك زيادة النسبة المئوية للمواد الصلبة الذائبة وانخفاض الحموضة الكلية للثمار، كما أدت المعاملة إلى زيادة محتوى الثمار من العناصر الغذائية (نيتروجين – فوسفور – بوتاسيوم – كالسيوم – نحاس).
- كما تأثر محتوى الأوراق من العناصر (نيتروجين – فوسفور – بوتاسيوم – كالسيوم – ماغنسيوم – صوديوم – حديد – زنك – منجنيز – نحاس) تأثرا معنوياً بمختلف معاملات التسميد العضوي خلال موسمي الدراسة.

Table (1): Physical and chemical properties of the studied orchard soil:

Sample	Season	Particle size distribution				PH (1:2.5)	EC (dsm-1) (1:2.5)	O.M. (%)	Total N%	Available macronutrients (mg./100g)					Available micronutrients (mg./100g)			
		Sand (%)	Silt (%)	Clay (%)	Texture					P	K	Ca	Mg	Na	Fe	Mn	Zn	Cu
Soil	2004	51	26	23	Sandy clay loam	8.21	0.35	2.00	0.09	1.80	43.24	582	142	24.8	1.61	1.80	0.34	0.28

Table (2): Chemical analysis of different organic fertilizers before applying to the plants.

Sample	Season	PH (1:2.5)	EC (dsm-1) (1:2.5)	O.M. (%)	Total N%	Macronutrients (mg./100g)					Micronutrients (mg./100g)			
						P	K	Ca	Mg	Na	Fe	Mn	Zn	Cu
Cattle Manure	2004	9.14	1.95	5.10	0.4	2.40	614.0	648.6	262	130.2	40.4	28.90	5.0	5.0
	2005	9.10	1.90	5.40	0.5	2.20	614.5	657.0	266	133.4	40.0	26.95	5.3	5.0
El-Neel Compost	2004	8.4	7.3	48.45	1.34	43.58	141.9	598.0	106	215	10.28	4.4	8.80	1.2
	2005	8.3	7.5	60.00	2.00	45.80	126.0	611.0	114	220	12.40	5.6	10.21	1.9
El-Eboor Compost	2004	8.3	4.5	41.65	0.88	95.94	70.0	723.0	88	241.8	83.9	21.0	105.5	6.9
	2005	8.3	4.1	40.00	0.80	93.35	66.0	625.0	85	240.0	80.1	19.0	102.0	6.7
El-Katamia Compost	2004	8.7	7.5	50.49	1.8	42.12	286.0	564.0	123.3	297.6	26.8	22.3	33.30	8.0
	2005	8.0	6.0	51.20	1.7	40.00	286.6	510.0	125.0	295.0	25.2	20.0	31.40	7.2
Banana Compost	2004	6.4	19.0	36.4	0.35	20.50	312.0	864.6	467	309.0	24.60	51.8	19.93	3.8
	2005	6.0	17.0	34.0	0.32	21.78	311.4	856.0	471	305.0	23.95	50.2	19.00	3.5