J. Agric. Sci. Mansoura Univ., 34 (7): 8013 - 8025, 2009

INFLUENCE OF ORGANIC AND BIOFERTILIZATION ON GROWTH, YIELD AND FRUIT QUALITY OF WILLIAMS BANANA

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ABSTRACT

This investigation was conducted during two successive seasons (2005/2006 and 2006/2007) on the first and second ratoons of Williams banana plants grown in a sand clay loam soil under flood irrigation conditions in a banana orchard located at El-Kanater Research Station, Kalubia Governorate. The plants received recommended dose (RD) of mineral N only/or between its different rates (75, 50 and 0% N of RD) and organic N in the form of Nile Compost (NC) and Chicken Manure (CM) as well as Microbein bio-fertilizer (M).

The obtained results clarified that all used treatments were effective in improving growth, yield and fruit quality in comparison with 100 % N either in the form mineral (control) or in the form organic manure (Nile Compost or Chicken Manure) of Williams banana. It was also noticed that the combined treatment of 50 % mineral N + 50% N in the form of compost with Microbein biofertilizer gave best plant vegetative growth parameters (circumference and height of pseudostem, number of green leaves and leaf area) as well as leaf chemical content expressed as an increase in percentages of nitrogen, phosphorus and potassium. In addition, it noticed that the same combined treatment had the highest values of yield and its components such as bunch weight, number of hands/bunch, average hand weight and number of fingers/hand. Also, it noticed that the same combined treatment improved physical properties of fruits expressed as average finger weight, average finger length, average finger diameter and pulp (%) as well as chemical properties of fruits such as, increasing the percentages of TSS, reducing and total sugars while decreased the percentage of acidity.

In general, the results proved that using of 50 % mineral N + 50% N in the form of compost + Microbein biofertilizer are the most superior treatments for increasing vegetative growth, yield and its components as well as fruit quality of Williams banana. Hence, It could be concluded that, minimizing the use of chemical nitrogen fertilizer to half of recommended dose through addition of 50 % mineral N + 50% N in the form of compost with Microbein biofertilizer.

INTRODUCTION

Banana (Musa spp) is one of the most important and popular fruit crops in Egypt for its high nutritive value. Banana plays an important role in the economy of tropical and subtropical courtiers.

Banana plants need large amounts of fertilizers, especially nitrogen and potassium. Moreover, it draws nutrients elements from a very limited soil depth due to its shallow roots system (Saleh, 1996).

Fertilization is one of the most important cultural practices carried out during the growing season, especially nitrogen fertilization. Nitrogen is one of the major plant nutrients, being a part of protein, enzymes, amino acids, polypeptides and many other biochemical compounds in plant system. It is

required for the survival and growth of each plant cell (Mengel and Kirkby, 1987). In addition, N is a constituent of amino acids and proteins, its important effect lies in encouraging cell division and the development of meristeniatic tissue (Nijjar, 1985).

The major problems facing banana growers are the high costs of excessive manufactured fertilizers needed for banana plants. Besides, these chemical fertilizers are considered as air, soil and water polluting agents during their production and utilization. Consequently, it has drown the attention of researchers and banana growers to use organic and bio-fertilizers which are safe for human, animals and environment. The utilization of organic and bio-fertilizers is considered as a promising alternative for chemical fertilizers to avoid pollution and reduce the costs of mineral fertilizers.

Organic fertilization is another option for supplying nutrient elements to bananas, in addition to, the organic materials improves soil structure and reduce soil pH, resulting in better root growth and more efficient use of water and nutrients; provides slow release of nitrogen and other nutrients and increase the nutrient-holding properties of the soil, lowering the need for excessive applications of nitrogen fertilizer and hence decrease possible nitrate contamination of ground water (Nijjar, 1985 and Darwish *et al*., 1995). Biofertilizers are commonly called microbial inoculants which are capable of transforming important nutritional elements in the soil from non-usable to usable form by the crop plants through their biological processes. During the last decade, biofertilizers have been extensively used as an eco-friendly approach to minimize the use of chemical fertilizers, improve soil fertility status and for the enhancement of crop production by their biological activity in the rhizosphere (El-Haddad *et al*., 1993, Casale *et al*., 1995 and Ram Rao *et al*., 2007).

The goal target of this study is to evaluate the response of using some types of organic and bio-fertilizers with reducing the recommended doses of chemical fertilizers to achieve better growth, yield and fruit quality of Williams banana.

MATERIALS AND METHODS

This study was conducted during two successive seasons (2005/2006 and 2006/2007) on the first and second ratoons of Williams banana plants in a banana orchard located at El-Kanater Research Station, Kalubia Governorate, planted at 3.5 X 3.5 m apart grown in sand clay loam soil under flood irrigation conditions.

Thirty nine stools of each, containing three plants of Williams were chosen to evaluate the effect of some organic manures; i.e., Nile Compost (NC) and Chicken Manure (CM) as well as Microbein bio-fertilizers (M) on vegetative growth, leaf mineral content, yield and fruit quality of the tested banana cv.

The chemical and physical properties of the experimental soil, Nile Compost and Chicken Manure are shown in Table (1).

The experiment was set in a completely randomized blocks design with three replicates. Each replicate was represented by one stool, which

contains three plants for yielding in the current season and three ratoons for yielding in the following season.

Table (1): The physical and chemical properties of the soil, Nile Compost and Chicken Manure

Properties	Soil depth		Nile Compost	Chicken Manure
	0-30 cm	30-60 cm		
Sand (%)	63.17	61.54	-	-
Silt (%)	17.69	16.39	-	-
Clay (%)	19.14	22.07	-	-
Texture	Sandy clay loam		-	-
Weight of m^3 (kg)	-	-	450	520
Moisture content (%)	-	-	20-25	20.65
PH	7.7	7.6	8.2	8.8
EC (1:5) (ds /cm)	0.66	0.53	4.1	6.4
Organic carbon (%)	-	-	28.5	27
Organic matter (%)	-	-	52	47
N (%)	0.08	0.07	1.74	1.34
C/N ratio	-	-	16:01	21:01
P (%)	0.11	0.09	0.7	0.57
K (%)	0.54	0.49	1.2	0.93
Ca (ppm)	3.5	3.2	-	-
Mg (ppm)	15.5	15.1	-	-
Fe (ppm)	-	-	1025	3775
Mn (ppm)	-	-	115	33
Zn (ppm)	-	-	28	253

The normal technocultural practices used in the commercial banana orchards were applied to all Williams plants, except those dealing with nitrogen fertilization according to the recommendations of the National Program Banana Development.

The selected plants were treated by the recommended rate of actual nitrogen i.e. 500g/plant/year in the form of ammonium sulphate (20.6 % N) at fortnight intervals in 14 equal doses starting from the first week of April to the last week of October.

Organic manures (Nile Compost and Chicken Manure) were applied once in the soil at the last week of December of each season. While, the biofertilizer as Microbein contains Azotobacter and Azospirillum as nitrogen fixing bacteria were applied once at 150g/stool/year in the first week of April of each season in shallow trenches (30 cm length x 20 cm width x 10 cm depth) according to the recommendation of the productive unit of this biofertilizer. Irrigation was conducted after the addition of organic manures, chemical and biofertilizers in both seasons.

The experiment involved the following thirteen treatments as follows:
1) 100 %mineral N of recommended dose as (control)
2) 75 % mineral N + 25% N in the form of compost
3) 75 % mineral N + 25% N in the form of compost + Microbein
4) 50 % mineral N + 50% N in the form of compost
5) 50 % mineral N + 50% N in the form of compost + Microbein
6) 0% mineral N + 100% N in the form of compost
7) 0% mineral N + 100% N in the form of compost + Microbein
8) 75 % mineral N + 25% N in the form of Chicken Manure
9) 75 % mineral N + 25% N in the form of Chicken Manure + Microbein
10) 50% mineral N + 50% N in the form of Chicken Manure
11) 50% mineral N + 50% N in the form of Chicken Manure + Microbein
12) 0% mineral N + 100% N in the form of Chicken Manure
13) 0% mineral N + 100% N in the form of Chicken Manure + Microbein

The tested N responses of the banana plants to the treatments were evaluated through the following parameters:

1. Vegetative growth parameters:

After the inflorescences emergence (at the end of August in both seasons), vegetative growth parameters such as: Circumference and height of pseudostem (cm), number of green leaves and the third leaf area from the top of the plant (m^2) according to the following equation: Leaf area = length x width x 0.86 (Obiefuna and Ndubizu, 1979) were measured.

2. Leaf mineral content

After bunch shooting (in September in both seasons), leaf samples were taken from the third upper leaf from the top of the plant. Total nitrogen was calorimetrically determined according to the method described by Pregl (1945), Phosphorus was calorimetrically determined according to the method described by Jackson (1958) and Potassium was determined Flame photometrically according to the method advocated by (Piper, 1950) were determined:

3. Yield and its components:

At bunch maturation, average bunch weight (kg), number of hands/bunch, average hand weight (kg) and number of fingers/hand were determined.

4. Physical properties of fruits:

After the ripening of the fingers, average finger weight (g), average finger length (cm), average finger diameter (cm) and pulp percentage were determined.

5. Chemical properties of fruits:

Total soluble solids in the pulp (T.S.S. %) by a hand refractometer as well as titratable acidity as malic acid (g/100g) according to (A.O.A.C., 1995) were estimated. Percentages of reducing and total sugars according to (A.O.A.C., 1985) were determined.

Statistical analysis:

The complete randomized block design was adopted for the experiment. The statistical analysis of the present data was carried out according to Snedecor and Chocran (1982). Averages were compared using

the new L.S.D. values at 5% level. Percentages were transformed by a certain equation prior to the statistical analysis.

RESULTS AND DISCUSSION

1. Vegetative growth parameters:

Data in (Table 2) show that most of vegetative growth parameters (circumference and height of pseudostem, number of green leaves and leaf area) responded positively to the triple combination of 50 % mineral N + 50% N in the form of compost with Microbein biofertilizer as compared to control and the remaining treatments in both seasons.

This beneficial effect of organic manure may be due to increase the availability of most nutrients through growth period (Smith *et al*., 1994) and improve the physical structure of soil, enhance water retention during drought and increase drainage in wet condition (Taiz and Zeiger, 1998).

Table (2): Effect of organic fertilizer and biofertilizer on vegetative growth parameters of Williams banana plants during 2005/2006 and 2006/2007 seasons

Characteristics	Circumference of pseudostem (cm)		Height of pseudostem (cm)		Number of green leaves		Leaf area (m2)	
Season / Treatment	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Control	80.1	83.3	275.2	282.7	12.3	12.7	1.72	1.77
75 % RD + 25% NC	82.6	85.9	295.1	303.1	12.8	13.1	1.79	1.85
75 % RD + 25% NC + M	83.1	86.4	297.5	305.6	13.0	13.4	1.81	1.86
50 % RD + 50% NC	87.4	90.8	320.6	329.3	13.4	13.9	1.92	1.98
50 % RD + 50% NC + M	88.1	91.6	329.3	338.2	13.7	14.1	1.97	2.02
0% RD + 100% NC	76.3	79.3	264.6	271.8	12.2	12.5	1.63	1.67
0% RD + 100% NC + M	79.2	82.3	270.3	277.6	12.3	12.6	1.69	1.75
75 % RD + 25% CM	80.5	83.7	282.5	290.2	12.5	12.8	1.76	1.82
75 % RD + 25% CM + M	81.4	84.6	288.9	296.7	12.6	13.0	1.78	1.83
50% RD + 50% CM	85.3	88.7	310.8	319.2	13.1	13.6	1.88	1.94
50% RD + 50% CM + M	86.7	90.1	313.1	321.6	13.3	13.7	1.89	1.94
0% RD + 100% CM	75.1	78.1	260.9	268.0	12.1	12.4	1.59	1.63
0% RD + 100% CM + M	75.8	78.8	261.7	268.8	12.2	12.4	1.60	1.63
New L.S. D. (0.05) =	0.7	0.6	8.6	8.9	0.3	0.2	0.05	0.04

100 %mineral N of recommended dose as (control)
Recommended dose of mineral N (RD)
Nile compost (NC)
chicken manure (CM)
Microbein (M)

With respect to biofertilizers, Jagnow *et al*. (1991) reported that Azotobacter and Azospirillum biofertilizers produce adequate amounts of IAA and cytokinin which increase the surface area per unit root length and encourage root hair branching with an eventual increase in absorption of nutrients from the soil and thus promote plant growth.

These results agree with those reported by El-Demerdash, (1988), Smith (1998), Abd El-Naby and Gomaa (2000), Abd El-Moniem and Radwan (2003) and Hammam (2003). They indicated that length, diameter of banana pseudostem, number of green leaves and leaf area per plant was greatest with using of 50 % mineral nitrogen fertilizer substituted by biofertilizer mixtures.

2. Leaf mineral content

All of the leaf mineral content expressed as percentages of nitrogen, phosphorus and potassium increased significantly by the combined treatments of mineral nitrogen, organic manure and biofertilizer. The highest significant effects over the control and the remaining treatments in both seasons were due to triple combination of 50 % mineral N + 50% N in the form of compost with Microbein biofertilizer (Table, 3).

This pronounced effect of organic manures on leaf mineral content is due to their high content of N, P and K beside other nutrients. In addition, the marked effect of these organic fertilizers in reducing soil pH may be responsible for facilitating the availability of most nutrients (Smith *et al*., 1994).

Table (3): Effect of organic fertilizer and biofertilizer on Leaf mineral content of Williams banana plants during 2005/2006 and 2006/2007 seasons

Characteristics	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
Season / Treatment	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Control	2.09	2.17	0.22	0.25	2.32	2.42
75 % RD + 25% NC	2.16	2.25	0.23	0.27	2.40	2.49
75 % RD + 25% NC + M	2.18	2.28	0.24	0.28	2.42	2.53
50 % RD + 50% NC	2.30	2.41	0.26	0.31	2.55	2.65
50 % RD + 50% NC + M	2.33	2.43	0.28	0.32	2.59	2.71
0% RD + 100% NC	2.02	2.11	0.21	0.24	2.25	2.36
0% RD + 100% NC + M	2.07	2.16	0.21	0.25	2.30	2.39
75 % RD + 25% CM	2.13	2.20	0.23	0.26	2.36	2.45
75 % RD + 25% CM + M	2.16	2.24	0.23	0.27	2.40	2.48
50% RD + 50% CM	2.20	2.28	0.25	0.28	2.44	2.54
50% RD + 50% CM + M	2.22	2.32	0.26	0.30	2.46	2.57
0% RD + 100% CM	1.99	2.08	0.20	0.23	2.21	2.30
0% RD + 100% CM + M	2.00	2.10	0.21	0.24	2.22	2.32
New L.S. D. (0.05) =	0.03	0.01	0.02	0.01	0.04	0.05

100 %mineral N of recommended dose as (control)
Recommended dose of mineral N (RD)
Nile compost (NC)
chicken manure (CM)
Microbein (M)

As regard to Biogein and nitrobein, it is could be used as sources for fixing nitrogen in the soil. Several processes other than N_2 Fixation could account for these positive effects, including production of growth regulators, protection from root pathogens and modification of nutrient uptake by the plant (Techan, 1988).

These results are in harmony with those obtained by Umesh *et al*., (1988). They indicated that, nitrogen, phosphorus and potassium increased when banana plants were inoculated with biofertilizers.

3. Yield and its components:

Data in Table (4) show that triple combined treatment of 50 % mineral N + 50% N in the form of compost + Microbein biofertilizer had the highest values of yield and its components such as bunch weight, number of hands/bunch, average hand weight and number of fingers/hand as compared to control and the remaining treatments in both seasons.

Table (4): Effect of organic fertilizer and biofertilizer on yield and its components of Williams banana plants during 2005/2006 and 2006/2007 seasons

Characteristics	Average bunch weight (kg)		Number of hands/bunch		Average hand weight (kg)		Number of fingers/hand	
Season / Treatment	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	23.83	25.12	11.0	11.5	1.81	1.97	17.7	18.5
75 % RD + 25% NC	25.54	26.96	11.4	12.0	1.89	2.05	18.3	19.2
75 % RD + 25% NC + M	25.76	27.21	11.4	12.1	1.91	2.06	18.5	19.3
50 % RD + 50% NC	28.05	29.68	12.0	12.6	2.01	2.19	19.1	19.8
50 % RD + 50% NC + M	29.26	30.99	12.3	12.9	2.06	2.23	19.2	20.0
0% RD + 100% NC	22.95	24.17	10.8	11.4	1.76	1.90	17.1	17.9
0% RD + 100% NC + M	23.61	24.88	11.0	11.4	1.79	1.94	17.5	18.2
75 % RD + 25% CM	24.96	26.35	11.3	11.7	1.85	1.99	18.0	18.7
75 % RD + 25% CM + M	25.19	26.59	11.4	11.9	1.86	2.01	18.3	19.1
50% RD + 50% CM	26.64	28.15	11.5	12.1	1.97	2.13	18.6	19.5
50% RD + 50% CM + M	27.22	28.78	11.8	12.2	1.98	2.15	18.8	19.6
0% RD + 100% CM	22.35	23.52	10.5	11.1	1.75	1.87	16.8	17.3
0% RD + 100% CM + M	22.79	23.99	10.7	11.2	1.76	1.89	16.9	17.5
New L.S. D. (0.05) =	1.19	1.28	0.3	0.2	0.05	0.04	0.1	0.2

100 %mineral N of recommended dose as (control)
Recommended dose of mineral N (RD)
Nile compost (NC)
chicken manure (CM)
Microbein (M)

The effect of chemical and organic fertilizers plus the biofertilizer on bunch length, bunch weight and number of fingers / hand could be attributed to its role in increasing amino acids content, which considered as a constituent of proteins and other compounds that share in the development of new tissues (Smith 1998 and Tiwary *et al*., 1999). In addition, This pronounced effect of organic fertilizers and the biofertilizer on yield and its components may be due to increase cell division and enlargement and consequently increased vegetative growth which is reflected on increasing the yield and its components as finally result from the physiological processes, Abd El-Naby (2000) and Geetha and Nair (2000). In addition, biofertilizer increased the contents of growth regulators such as IAA and cytokinins that stimulated plant growth (Li *et al*., 1998).

The increase of yield was largely because of the cumulative effect of vigorous plant growth characters. This improved growth parameter, which in turn resulted in higher bunch weight, number of fingers/ hands, higher weight of hand and harvest index.

In this respect, Dhanapal *et al*. (1978) reported that Azospirillum biofertilizer produces bio-active substances which reflected on enhancing uptake level of nutrients such as N and auxins which may divert the photo assimilates to the developing flower bud and helped in the conversions of flowers to more femaleness to produce higher number of fingers, which in turn also increase yield.

These results agree with those reported by Dhanapal *et al*. (1978), Jeeva *et al*. (1988), Abd El-Moniem and Radwan (2003), Gogoi *et al*. (2004), Mai *et al*. (2005), who found that number of hands per bunch, number of fingers per hand, bunch weight, and yield of banana plants increased with 50 % of recommended dose of N plus Azospirillum.

4. Physical properties of fruits:

Data in Table (5) revealed that triple combined treatment of 50 % mineral N + 50% N in the form of compost + Microbein biofertilizer had the highest significant effect on physical properties of fruits expressed average finger weight, average finger length, average finger diameter and pulp (%) as compared to control and the remaining treatments in both seasons.

The positive effect on physical properties of fruits may be due to the increase in growth parameters and the increase in the availability of nutrients, resulting from biofertilizer and organic manures application (Abd El-Naby 2000).

These results are in agreement with those obtained by Gogoi *et al*. (2004), Mai *et al*. (2005). They indicated that physical properties of fruits increased with 50% recommended dose of N plus Azospirillum on banana plants.

Table (5): Effect of organic fertilizer and biofertilizer on physical properties of Williams banana fruits during 2005/2006 and 2006/2007 seasons

Characteristics	Average finger weight (g)		Average finger length (cm)		Average finger diameter (cm)		Pulp (%)	
Season / Treatment	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Control	98.8	106.6	18.1	19.5	3.1	3.2	66.4	71.7
75 % RD + 25% NC	100.4	108.2	18.7	20.3	3.2	3.4	68.8	74.3
75 % RD + 25% NC + M	100.5	108.5	18.7	20.4	3.2	3.5	68.8	74.6
50 % RD + 50% NC	103.3	111.5	19.7	21.4	3.4	3.7	72.4	78.2
50 % RD + 50% NC + M	105.8	114.2	20.1	21.7	3.5	3.9	73.9	79.8
0% RD + 100% NC	98.1	105.9	17.7	19.2	3.1	3.0	65.2	70.4
0% RD + 100% NC+ M	98.4	106.5	18.1	19.3	3.1	3.0	66.4	71.5
75 % RD + 25% CM	99.2	106.7	18.6	20.1	3.2	3.2	68.4	73.8
75 % RD + 25% CM + M	99.2	107.0	18.7	20.3	3.2	3.3	68.8	74.1
50% RD + 50% CM	103.2	110.7	18.9	20.5	3.3	3.6	69.4	75.1
50% RD + 50% CM + M	103.3	111.1	19.3	20.8	3.4	3.6	70.9	76.5
0% RD + 100% CM	97.6	105.2	17.3	18.6	3.0	2.9	63.4	68.4
0% RD + 100% CM + M	97.9	105.6	17.6	18.9	3.0	3.0	64.6	69.7
New L.S. D. (0.05) =	2.5	2.4	0.3	0.2	0.1	0.2	1.4	1.3

100 %mineral N of recommended dose as (control)
Recommended dose of mineral N (RD)
Nile compost (NC)
chicken manure (CM)
Microbein (M)

5. Chemical properties of fruits:

The presented data in Table (6) show that triple combined treatment of 50 % mineral N + 50% N in the form of compost + Microbein biofertilizer improved chemical properties of fruits. However, it increased the percentages of TSS, reducing and total sugars and decreased the percentage of acidity as compared to control and the remaining treatments in both seasons.

The effect of the used organic and biofertilizer on increasing the TSS, reducing and total sugars and decreasing the percentage of acidity in the pulp of fingers could be due to their beneficial effect on the total leaf area of the plant which is reflected in more carbohydrates production through photosynthesis process that reflected on improved chemical properties of fruits (Tiwary *et al*., 1998; Mansour 1998; Tachibana and Yahata 1998; El-Kobbia 1999; Joo *et al*., 1999; Abd El-Naby 2000 and Magda Mostafa 2002).

These results agreed with those obtained by Umesh *et al*. (1988) indicated that Azospirillum biofertlizer inoculation coupled with 50% N resulted in the most pronounced increase in amount of total soluble solids as well as reducing sugars content of Cavendish banana.

Table (6): Effect of organic fertilizer and biofertilizer on chemical properties of Williams banana fruits during 2005/2006 and 2006/2007 seasons

Characteristics	TSS (%)		Acidity (%)		Reducing sugars (%)		Total sugars (%)	
Season / Treatment	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Control	18.7	19.2	0.29	0.32	7.47	8.07	16.9	17.2
75 % RD + 25% NC	19.3	19.9	0.28	0.30	7.72	8.33	17.4	17.9
75 % RD + 25% NC + M	19.5	20.1	0.27	0.29	7.80	8.43	17.6	18.1
50 % RD + 50% NC	20.6	21.2	0.26	0.27	8.21	8.87	18.5	18.9
50 % RD + 50% NC + M	20.9	21.5	0.24	0.26	8.34	9.00	18.7	19.2
0% RD + 100% NC	18.0	18.5	0.31	0.34	7.23	7.80	16.4	16.8
0% RD + 100% NC + M	18.5	19.1	0.30	0.32	7.39	7.99	16.7	17.0
75 % RD + 25% CM	19.0	19.6	0.29	0.31	7.60	8.20	17.2	17.6
75 % RD + 25% CM + M	19.3	19.8	0.29	0.30	7.72	8.31	17.4	17.7
50% RD + 50% CM	19.6	20.2	0.27	0.28	7.84	8.47	17.7	18.1
50% RD + 50% CM + M	19.8	20.5	0.26	0.27	7.93	8.55	17.9	18.2
0% RD + 100% CM	17.7	18.1	0.32	0.36	7.10	7.67	16.1	16.2
0% RD + 100% CM + M	17.8	18.4	0.31	0.35	7.14	7.72	16.2	16.4
New L.S. D. (0.05) =	0.3	0.2	0.02	0.01	0.12	0.11	0.3	0.2

100 %mineral N of recommended dose as (control)
Recommended dose of mineral N (RD)
Nile compost (NC)
chicken manure (CM)
Microbein (M)

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تأثير التسميد العضوى والحيوى على النمو والمحصول وجودة الثمار فى الموز الويليامز

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أجرى هذا البحث خلال موسمى ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ على الخلفتين الأولى والثانية لنباتات الموز صنف الويليامز النامية فى تربة طميية تحت ظروف الرى السطحى بمزرعة الموز التابعة لمحطة بحوث القناطر - محافظة القليوبية. اشتملت التجربة على ١٣ معاملة واعتبرت المعاملة التى أضيف اليها النتيروجين المعدنى الموصى به (كنترول) وباقى المعاملات أضيف إليها نيتروجين معدنى بمعدل (٧٥ ، ٥٠ ، صفر%) من الجرعة الموصى بها لكل نبات فى توليفات مختلفة مع الكومبوست أو سبلة الدواجن (نيتروجين عضوى) بالاضافة إلى الميكروبين (مخصب حيوى).

أظهرت النتائج أن كل المعاملات المستخدمة كانت فعالة فى تحسين النمو والمحصول وجودة الثمار فى الموز الويليامز مقارنة باضافة ١٠٠ % نيتروجين سواء فى صورة معدنية (كنترول) أو فى صورة عضوية (كومبوست أو سبلة الدواجن). وقد لوحظ أن المعاملة المشتركة والمتكونة من ٥٠% من النيتروجين المعدنى الموصى بها + ٥٠% من النيتروجين العضوى فى صورة كمبوست + المخصب الحيوى فى صورة ميكروبين أدت إلى تحسين قياسات النمو الخضرى والمتمثلة فى محيط وطول الساق الكاذبة، عدد الأوراق، مساحة الورقة بالإضافة إلى ذلك فقد ازداد المحتوى المعدنى للأوراق (النسبة المئوية لكل من النيتروجين والفوسفور والبوتاسيوم) وكذلك أدت نفس المعاملة المشتركة إلى زيادة فى التركيب المحصولى متمثلا فى وزن السوباطة، عدد الكفوف لكل سوباطة، متوسط وزن الكف، عدد الأصابع لكل كف. كما لوحظ أيضا أن نفس المعاملة المشتركة أدت إلى تحسين الصفات الطبيعية للثمار والمشتملة على متوسط وزن الاصبع، طول وعرض الاصبع، النسبة المئوية للب بالنسبة للاصبع وكذلك الصفات الكيماوية للثمار متمثلة فى زيادة النسبة المئوية للمواد الصلبة الذائبة الكلية، السكريات المختزلة والكلية مع إنخفاض فى النسبة المئوية للحموضة.

وبصفة عامة فقد أوضحت النتائج أن استخدام ٥٠% من كمية السماد النيتروجينى المعدنى + ٥٠% فى صورة سماد نيتروجينى عضوى (كمبوست) + المخصب الحيوى (ميكروبين) قد تفوقت على باقى المعاملات فيما يتعلق بزيادة النمو الخضرى وكمية المحصول وتحسين صفات الجودة لثمار الموز الويليامز. وهذا يوضح أن استخدام٥٠% فى صورة سماد نيتروجينى عضوى (كمبوست) بالاضافة إلى المخصب الحيوى (ميكروبين) يمكن أن يوفر حوالى٥٠% من كمية السماد النيتروجينى المعدنى.