Effect of Replacement of Inorganic N Fertilizer Partially By Using Plant Compost and EM on Productivity of Sakkoti Date Palms

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Abstract: The effect of replacing 25 to 70% inorganic N partially by using 12.5 to 35% plant compost and 125 to 350 ml EM/ palm/ year on growth, palm nutritional status, flowering, fruit setting, yield, fruit quality and both nitrate and nitrite in the pulp of Sakkoti date palms was investigated during 2013 and 2014 seasons. Growth, flowering, fruit setting, yield and bunch weight were maximized with supplying the palms with N as 60% inorganic N + 20% plant compost + 200 ml EM/ palm/ year. Palm nutritional status, both physical and chemical characteristics of the fruits and nitrate and nitrite in the pulp were remarkably improved by replacing 70% of inorganic by 35% plant compost and 350 ml EM/ palm / year. Carrying out N fertilization in Sakkoti date palm orchards by replacing 40% of inorganic N by using 20% plant compost and 200 ml EM/ palm/ year was beneficial for producing an economical yield, improving fruit quality and reducing pollution with nitrate and nitrite in the pulp.
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1. Introduction

Poor yield of Sakkoti date palms grown under Aswan region is considered a problem. This is attributed to unbalancing N nutrition.

Organic farming agriculture is a unique production management system which promotes and enhances agro- eco system of health including bio diversity, biological cycles and soil biological activity. It has been systematically followed on a large scale in the developed countries including Egypt (**Dahama, 1999**). Clean cultivation is suggested to be one possibility to restore the natural conditions and it has become in the last few decades a positive alternative to chemical fertilizers.

The presence of N in excess promotes development of the above ground organs with relatively poor root growth and fruiting (**Mengel, 1984; Nijjar, 1985; Mengel and Kirkby, 1987; Miller *et al.,* 1990 and Yagodin, 1990**).

Effective microorganisms which is known as EM is a culture containing more than 60 microorganisms including lactic acid bacteria (*Lactobacillus plantary, lactobacillus casei* and *Streptocous lactis*), photosynthesis bacteria, yeast and algae, EM produces lactic acids (**Higa, 1989 and 1991; Higa and Kinjo, 1991; Higa and Wididana, 1991a and 1991 b; Kannaiyan, 2002 and Cabrera *et al.,* 2003**).

The promoting effect of organic N fertilization on fruiting of Sakkoti date palms was confirmed by the results of **Melouk *et al.,* (1999); Shaheen *et al.,* (2003) Mohamed and Ragab (2004); Mohamed and Gobara (2004); Mansour *et al.,* (2004); Gobara and Ahmed (2004); Saied (2011); Ahmed *et al.,* (2014a) and Omar (2015)** on different date palm cultivars.

These results regarding the promoting effect of EM on growth and yield was reported by **Ahmed – Samah (2011) and Ahmed *et al.,* (2014)** on different date palm cvs, **Badran and Mohamed (2009) and Ibrahiem and Gad El- Kareem (2014)** on different banana cvs. as well as **Roshdy *et al.,* (2011); Ibrahiem (2012) and Refaai and Ahmed (2013)** on different mango cultivars.

The target of this study was examining the effect of N (inorganic, and organic) at various proportions as well as plant compost and EM on vegetative growth characters, leaf mineral content, yield and fruit quality of Sakkoti date palms grown under Aswan conditions. Selecting the best proportion of inorganic, and organic of N besides the levels of EM that are responsible for obtaining an economical yield and reducing at the lower extent the pollution occurred by nitrite and nitrate is considered another target.

2. Material and Methods

This study was conducted in a private date palm orchard located at Edfu district, Aswan Governorate during the two consecutive Seasons of 2013 and 2014 in which 27 offshoots derived Sakkoti, dry date palms were selected for achieving this study. The palms were planted at 8 x 8 meters apart. The texture of the soil is silty clay. (Table 1).

Pruning was performed to maintain leaf bunch ratio at 10: 1. The number of female spathes per palm was adjusted to 10 spathes for all the selected palms. Pollination of the experimental palms was uniformly

performed by inserting five male strands into the female spathe. Each selected palm received the common horticultural practices that are already applied in the orchard except those dealing with inorganic, organic and biofertilization of N as well as application of compost and EM

Table (1): Mechanical, physical and chemical analysis of the tested orchard soil:

Characters	values
Particle size distribution:	
Sand %	10.60
Silt %	58.00
Clay %	31.40
Texture grade	Silty clay
pH (1:2.5 extract)	8.00
E.C (1: 2.5 extract) (mmhos/ 1 cm/ 25°C)	0.91
Organic matter %	2.09
$CaCO_3$ %	1.22
Macronutrients values	
Total N %	0.11
P(ppm, Olsen method)	20.00
K (ppm, ammonium acetate)	419.00
Mg (ppm)	79.00
S (ppm)	6.90
B(ppm hot water extractable)	0.27
EDTA extractable micronutrients (ppm)	
Zn	1.31
Fe	11.00
Mn	10.18
Cu	1.60

This experiment included the following nine treatments from inorganic N (ammonium nitrate, 33.5% N) as well as plant compost and EM:

1- Application of the suitable N (1000 g/ palm/ year) as 100 % inorganic source ammonium nitrate (33.5 % N) (2985.0 g. ammonium nitrate / palm/ year).

2- Application of the suitable N through 75% inorganic source (2239 g. ammonium nitrate/ palm/ year) alone.

3- Application of the suitable N through 75% inorganic source (2239 g. ammonium nitrate/ palm/ year) + 12.5 % plant compost (2.0 % N) (6.25 kg / palm/ year) + 125 ml EM / palm/ year.

4- Application of the suitable N through 60% inorganic source (1791 g. ammonium nitrate/ palm/ year) alone .

5- Application of the suitable N through 60% inorganic source (1791 g. ammonium nitrate/ palm/ year) + 20% plant compost) 10 kg palm/ year) + 200 ml EM/ palm/ year.

6- Application of the suitable N through 45 % inorganic source (1343.3 g. ammonium nitrate/ palm/ year) alone.

7- Application of the suitable N through 45 % inorganic source (1343.3 g. ammonium nitrate/ palm/ year) + 275% plant compost (13.75 kg/ palm/ year) + 27.5 ml $E.M_1$ / palm/ year.

8- Application of the suitable N through 30 % inorganic source (895.5 g. ammonium nitrate/ palm/ year) + alone.

9- Application of the suitable N through 30 % inorganic source (895.5 g. ammonium nitrate/ palm/ year) + 35% plant compost (17.5 kg/ palm/ year) + 350 ml EM palm/ year).

Each treatment was replicated three times, one Sakkoti date palm per each. Inorganic N source was applied in the source of ammonium nitrate (33.5 % N). It was splitted into three equal batches and applied at the first week of March, May and July for the three consecutive seasons. Organic N fertilizers plant compost (2% N) (Table 2) was added once at the first week of Jan. during 2013 and 2014 seasons. The fresh EM (each ml contains 0.6×10^7 bacterial cells) at 125 to 350 ml / palm/ year was added once at the first week of March. Randomized complete block design was adopted.

Table (2): Analysis of the solid mature compost (analysis of company)

Parameters	Values
Cubic meter weight (kg.)	600.00
Moisture %	29.0
Organic matter %	30.7
Organic carbon %	31.25
pH (1 : 2.5 extract)	8.5
EC (ds/m) (1 : 2.5 extract)	6.5
C/N ratio	18.82
Total N %	1.66
Total P %	0.52
Total K %	1.12
Total Ca %	1.25
Total Mg %	1.21
Total Fe (ppm)	320.0
Total Mn (ppm)	45.0
Total Zn (ppm)	34.0
Total Cu (ppm)	42.0

Generally, the following measurements were determined during the two seasons of this study:

1- Some vegetative growth characters namely length, width and area of leaflet (cm^2) (**Ahmed and Morsy, 1999)** and leaf, (m^2) number of leaflets/ leaf,

total surface area per palm(m^2) as well as number of spines/ leaf and spine length (cm.).

2- Some plant pigments namely chlorophylls a & b and total chlorophylls (mg/ 100 g F.W) (**Von-Wettstein, 1957**)

3- Leaf chemical composition namely total carbohydrates %, leaf content of N, P, K, Mg and Ca (as percentage) and Fe, Zn, Mn and Cu (as ppm) and C/N. (**Peach and Tracey, 1968; Summer, 1985 and Wilde *et al.*, 1985)**

4- Flowering and fruit setting aspects namely girth (cm) and length (cm) of spathe, number of strands / spathe, strand length as well as number of flowers and fruits per strand, initial fruit setting % and fruit retention %.

5- Yield per palm expressed in weight (kg.) and bunch weight (kg.) (**Hulme, 1971**).

6- Some physical characters of the fruits namely weight, volume, height and diameter and thickness of fruit, length and weight % of seed, flesh % and flesh / seed of fruit.

7- Some chemical characteristics of the fruits namely T.S.S. %, total, reducing and non- reducing sugars %, **(A.O.A.C., 2000)** total acidity %, **(A.O.A.C., 2000),** crude fibre % and total soluble tannins(**Balbaa, 1981**)..

8- Nitrate and nitrite content in the pulp (ppm) (**Ridnour- Lisa, *et al.*, 2000**).

Thereafter, the obtained data during the two seasons were collected, tabulated and subjected to the proper statistical analysis of variance method reported by **Mead *et al.* (1993)**. The differences between treatment means were differentiated using new L.S.D. at 5% parameter.

3. Results

1-Some vegetative growth characters

It is clear form the data in Tables (3 & 4) that the ten vegetative growth traits namely length, width and area of leaflet and leaf, number of leaflets/ leaf, total surface area of palm, number of spines per leaf and spine length were significantly affected by application of the suitable N (1000 g N/ palm/ year) via 60 to 75% inorganic N + 12.5 to 20% plant compost besides using EM_1 at 125 to 200 ml/ palm/ year relative to using N via inorganic N at 30 to 75 % without the use of organic and biofertilization or when inorganic N percentages were lowered than 60% even with the application of plant compost at 27.5 to 35% and EM at 275 to 350ml / palm/ year. The promotion on these growth characters was significantly associated with reducing percentages of inorganic N from 75 to 60% and at the same increasing percentages of plant compost from 12.5 to 20% and EM from 125 to 200 ml/ palm/ year. A significant reduction on these growth characters was observed when inorganic N percentages were lowered to 30 to 45% out of the suitable N even with the application of any one of the two biostimulants (compost and EM). Using N completely via inorganic N was superior than using inorganic N at 30% even with the application of plant, compost and EM in enhancing these growth characters. The maximum values were recorded on the palms that fertilized with N via 60% inorganic + 20% plant compost + using EM_1 at 200 ml / palm/ year. However, using N via 30% inorganic alone gave the lowest values. Similar results were announced during both seasons.

2- Plant pigments:

Plant pigments namely chlorophylls a & b and total chlorophylls in the leaves gradually tended to promote with reducing the percentages of inorganic N source from 100 to 30% and at the same time increasing the levels of plant compost from 12.5 to 35% and EM from 0.0 to 350 ml / palm/ year. Using N via 100% inorganic without organic and biofertilization was favourable than using N via inorganic N at 30 to 75 % alone. The maximum values of plant pigments were observed on the palms that received N as 30% inorganic + 35% plant compost + 350 ml EM_1/ palm/ year while, the lowest values were observed on the palms that received N via inorganic N at 30 % alone. These results were true during both seasons. (Table 5).

3-Leaf chemical composition

Varying N management treatments had significant effect on total carbohydrates, C/N, leaf content of N, P, K, Mg, Ca, Zn, Fe, Mn and Cu. The maximum values of total carbohydrates were recorded on the palms that received N as 30% inorganic + 35% plant compost + 350 ml EM_1 palm/ year. Fertilization with inorganic N at 100% alone gave the minimum values. The highest values of N, P, K, Mg, Ca, Zn, Fe, Mn and Cu were observed on the palms that fertilized with N as 30% inorganic + 35% plant compost + EM_1 at 350 ml/ palm/ year. Fertilizing the palms with N through inorganic N at 100% gave the lowest values of these nutrients. These results were true during both seasons (Tables 6 & 7).

4- Flowering and fruit setting aspects:

Data in Tables (8 & 9) clearly show that girth and length of spathe, number of strands/ spathe, strand length, number of flowers and fruits/ strand as well as percentages of initial fruit setting and fruit retention % were significantly affected by using N via 60 to 75% inorganic N, 12.5 to 20% plant compost plus application of EM, at 125 to 200 ml/ palm/ year relative to using N via inorganic N alone or when inorganic N percentages were lowered than 60% even with the application of any one of the two biostimulants. The lowest values were recorded on the palms that supplied with N via 30% inorganic +

unfertilization with plant compost and EM_1. Supplying the palms with N through 60% inorganic + 20% plant compost + 200 ml EM/ palm/ year effectively maximized these parameters. These results were true during both seasons.

5- Yield / palm and bunch weight:

It is clear from the data in Table (10) that yield per palm and bunch weight were significantly improved in response to application of N via 60 to 75% inorganic + 12.5 to 20% plant compost + EM_1, at 125 to 200 ml/ palm/ year comparing with using inorganic N fertilization alone or when inorganic N was applied at percentages lower than 60% even with the application of 27.5 to 35% plant compost and EM_1 at 275 to 350 ml/ palm/ year. The promotion on both yield and bunch weight was significantly associated with reducing percentages of inorganic N from 100 to 60% and at the same time increasing percentages of plant compost from 0.0 to 20% and EM levels from 0.0 to 200 ml/ palm/ year. The best results with regard to yield and bunch weight were observed due to using N via 60% inorganic + 20 % plant compost + 200 ml EM_1/ palm/ year. Such promised treatment produced yields reached 109 and 112 kg per palm/ year during 2013 and 2014 seasons, respectively. The lowest yield (80 and 82.0 kg/ palm) was presented in the palms that supplied with N via 30% inorganic N + unfertilization with plant compost and EM during the two seasons, respectively. These results were true during both seasons.

6- Fruit quality:

Data in Tables (10 to 14) clearly show that an obvious promotion on fruit quality was observed in terms of increasing weight, volume, height and diameter of fruit, flesh %, flesh / seed, T.S.S. %, total, reducing and non – reducing sugars and decreasing weight % and length of seed, crude fibre %, total soluble tannins as well as nitrite and nitrate in the pulp with reducing percentages of inorganic N from 100 to 30% and at the same time increasing percentages of plant compost from 0.0 to 35% and EM levels from 0.00 to 350 ml/ palm/ year. The best results with regard to fruit quality were obtained due to fertilizing the palms with N via 30% inorganic + 35% plant compost + EM. at 350 ml/ palm/ year. Unfavourable effects on fruit quality were observed on the palms that fertilized with N through 30% inorganic N source alone. These results were true during both seasons.

Table (3): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some vegetative growth characters of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Leaflet length (cm.)		Leaflet width (cm.)		Leaflet area (cm)		Leaf length (m)		Leaf width (m)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	44.09	44.20	3.25	3.40	106.3	111.0	4.9	4.9	0.55	0.50
2- Using N via 75% inorganic N alone	43.11	43.23	3.11	3.26	100.1	104.7	4.8	4.8	0.50	0.45
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	45.13	45.25	3.41	3.56	113.4	118.2	5.0	5.0	0.59	0.53
4-Uing N via 60 % inorganic N alone	42.11	42.22	2.93	3.08	93.0	97.4	4.7	4.8	0.45	0.40
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	46.12	46.25	3.62	3.77	122.1	127.1	5.1	5.2	0.64	0.58
6-Uing N via 45 % inorganic N alone	40.11	40.22	2.74	2.90	83.9	88.4	4.2	4.2	0.35	0.30
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	41.0	41.12	2.81	2.96	87.5	91.8	4.5	4.5	0.40	0.35
8-Uing N via 30 % inorganic N alone	38.11	38.25	2.55	2.71	75.4	79.7	3.9	4.0	0.27	0.19
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	39.00	39.11	2.63	2.79	79.0	83.4	4.2	4.2	0.30	0.24
New .S.D. at 5 %	0.37	0.40	0.04	0.04	1.9	2.0	0.2	0.2	0.05	0.05

Table (4): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some vegetative growth characters of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	No. of leaflets / leaf		Leaf area $(m)^2$		Total surface area / palm (m^2)		No. of spines / leaf		Spine length (cm)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	177.0	178.9	1.88	1.99	150.4	159.2	24.0	21.0	15.0	14.9
2- Using N via 75% inorganic N alone	174.0	176.0	1.81	1.84	144.8	147.2	23.0	20.0	14.0	13.9
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	181.0	183.0	2.05	2.16	164.0	172.8	25.0	22.0	16.4	16.3
4-Uing N via 60 % inorganic N alone	171.9	174.0	1.60	1.69	128.0	135.2	21.9	18.7	13.0	12.9
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	184.0	186.0	2.25	2.36	180.0	188.8	26.3	23.2	17.1	17.0
6-Uing N via 45 % inorganic N alone	166.0	168.0	1.39	1.49	111.2	119.2	19.0	15.9	12.0	11.9
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	168.9	171.5	1.48	1.57	118.4	125.6	20.5	17.0	12.9	12.8
8-Uing N via 30 % inorganic N alone	160.9	163.0	1.21	1.30	96.8	104.0	16.0	13.0	10.5	10.4
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	163.0	165.0	1.29	1.38	103.2	110.4	17.9	14.6	11.3	11.4
New .S.D. at 5 %	2.2	2.9	0.05	0.04	4.1	3.9	1.0	1.0	0.5	0.5

Table (5): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some leaf pigments and percentages of total carbohydrates and N in the leaves of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Chlorophyll a (mg / 100 g F.W.)		Chlorophyll b (mg / 100 g F.W.)		Total Chlorophylls (mg / 100 g F.W.)		Total carbohydrates %		Leaf N %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	14.1	13.6	4.9	5.0	19.0	18.6	11.5	11.9	2.10	2.17
2- Using N via 75% inorganic N alone	13.3	12.8	4.4	4.5	17.7	17.3	12.0	12.4	1.99	2.06
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	15.0	14.6	5.5	5.6	20.5	20.2	14.3	14.7	2.20	2.27
4-Uing N via 60 % inorganic N alone	12.7	12.2	4.1	4.1	16.8	16.3	12.5	12.9	1.89	1.96
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	15.8	15.3	6.0	6.1	21.8	21.4	15.0	15.5	2.30	2.37
6-Uing N via 45 % inorganic N alone	12.1	11.6	3.6	3.7	15.7	15.3	13.1	13.5	1.80	1.87
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	16.7	16.2	6.3	6.4	23.0	22.6	15.6	16.0	2.40	2.47
8-Uing N via 30 % inorganic N alone	11.1	10.6	3.1	3.2	14.2	13.8	13.7	14.1	1.70	1.77
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	17.5	17.0	7.0	7.1	24.5	24.1	16.2	16.6	2.49	2.56
New .S.D. at 5 %	0.6	0.6	0.3	0.3	0.7	0.7	0.4	0.4	0.06	0.05

Table (6): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on the percentages of P& K & Mg, Ca and Fe (as ppm) of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Leaf P %		Leaf K %		Leaf Mg %		Leaf Ca %		Leaf Fe (ppm)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	0.11	0.10	1.11	1.20	0.55	0.50	1.99	2.0	58.3	60.0
2- Using N via 75% inorganic N alone	0.14	0.14	1.16	1.25	0.60	0.55	2.10	2.11	62.3	64.0
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	0.27	0.27	1.42	1.51	0.81	0.76	2.50	2.51	83.0	84.8
4-Uing N via 60 % inorganic N alone	0.17	0.17	1.22	1.31	0.66	0.61	2.18	2.20	66.1	68.0
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	0.29	0.30	1.50	1.59	0.86	0.81	2.58	2.59	88.0	89.9
6-Uing N via 45 % inorganic N alone	0.20	0.19	1.30	1.39	0.72	0.67	2.26	2.26	74.1	76.0
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	0.31	0.31	1.56	1.65	0.90	0.84	2.69	2.70	92.0	93.8
8-Uing N via 30 % inorganic N alone	0.23	0.23	1.36	1.45	0.76	0.71	2.39	2.40	78.2	80.0
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	0.34	0.35	1.62	1.71	0.96	0.90	2.81	2.83	97.0	97.3
New .S.D. at 5 %	0.02	0.02	0.05	0.04	0.04	0.04	0.07	0.07	3.0	2.8

Table (7): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on the leaf content of Zn, Mn and Cu (as ppm) and CN/ in the leaves of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Leaf Zn (ppm)		Leaf Mn (ppm)		Leaf Cu (ppm)		C/N	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	60.0	59.3	59.0	58.2	1.11	1.08	5.5	5.5
2- Using N via 75% inorganic N alone	63.3	62.7	62.2	61.7	1.10	1.10	6.0	6.0
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	78.3	77.7	77.4	76.6	1.10	1.10	6.5	6.5
4-Uing N via 60 % inorganic N alone	68.0	67.3	67.1	66.3	1.10	1.11	6.6	6.6
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	84.0	83.7	83.0	82.8	1.11	1.11	6.5	6.5
6-Uing N via 45 % inorganic N alone	71.2	70.5	70.2	69.6	1.11	1.12	7.3	7.2
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	87.5	86.8	86.4	85.8	1.11	1.11	6.5	6.5
8-Uing N via 30 % inorganic N alone	75.0	74.5	74.0	73.5	1.12	1.11	8.1	8.0
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	91.9	91.4	90.9	90.4	1.11	1.11	6.5	6.5
New .S.D. at 5 %	2.9	3.0	3.0	3.0	NS	NS	0.4	0.4

Table (8): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some flowering aspects of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Spathe girth (cm)		Spathe length (cm)		No. of strands / spathe		Strand length (cm.)	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	27.7	28.0	61.2	61.6	77.0	77.9	36.0	36.9
2- Using N via 75% inorganic N alone	26.6	26.9	60.1	60.5	74.8	75.7	35.0	36.0
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	28.8	29.1	62.3	62.7	79.9	80.8	37.0	37.8
4-Uing N via 60 % inorganic N alone	25.5	25.8	59.0	59.5	71.9	72.9	34.0	34.9
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	29.8	30.1	64.0	64.5	82.3	83.4	37.8	38.7
6-Uing N via 45 % inorganic N alone	23.3	23.6	54.9	55.4	66.0	67.1	32.0	33.0
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	24.5	24.8	57.0	57.5	69.0	70.0	32.7	33.8
8-Uing N via 30 % inorganic N alone	21.0	21.3	52.5	52.8	61.0	62.1	30.0	30.7
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	22.2	22.5	53.7	54.0	64.0	65.1	30.7	31.5
New .S.D. at 5 %	1.0	1.0	1.0	0.9	2.0	2.0	0.5	0.5

Table (9): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some flowering and fruit setting aspects of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	No. of flowers / strand		No. of fruits / strand		Initial fruit setting %		Fruit retention %	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	78.0	79.1	61.0	63.0	78.2	79.6	73.2	74.6
2- Using N via 75% inorganic N alone	75.0	76.2	57.0	59.0	76.0	77.4	70.9	72.5
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	81.0	82.1	65.0	67.0	80.2	81.6	75.0	76.7
4-Uing N via 60 % inorganic N alone	71.9	73.0	53.0	55.0	73.7	75.3	68.8	70.4
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	83.0	84.0	69.0	74.0	83.1	88.1	78.2	83.1
6-Uing N via 45 % inorganic N alone	66.0	67.0	47.0	49.0	71.2	73.1	66.3	68.1
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	69.0	70.0	50.0	52.0	72.5	74.3	67.5	69.4
8-Uing N via 30 % inorganic N alone	60.0	61.0	40.0	42.0	66.7	68.9	61.7	64.0
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	63.0	64.0	44.0	46.0	69.88	71.9	64.9	66.9
New .S.D. at 5 %	2.0	2.0	2.0	2.0	1.9	2.0	0.6	0.6

Table (10): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on yield / palm, bunch weight as well as weight and volume of fruit of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Yield/ palm (kg.)		Bunch weight (g.)		Fruit weight (g.)		Fruit volume (cm^3)	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	99.0	101.0	9.9	10.1	9.92	10.00	10.22	10.31
2- Using N via 75% inorganic N alone	96.0	99.0	9.6	9.9	9.70	9.80	10.00	10.10
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	105.0	109.0	10.5	10.9	10.10	10.19	10.41	10.40
4-Uing N via 60 % inorganic N alone	93.0	95.0	9.3	9.5	9.50	9.60	9.80	9.91
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	109.0	112.0	10.9	11.2	10.26	10.36	10.51	10.67
6-Uing N via 45 % inorganic N alone	86.0	89.0	8.6	8.9	9.30	9.40	9.61	9.70
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	89.0	92.0	8.9	9.2	10.50	10.60	10.80	10.92
8-Uing N via 30 % inorganic N alone	80.0	82.0	8.0	8.2	9.11	9.20	9.42	9.51
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	83.0	86.0	8.3	8.6	10.66	10.76	11.00	11.08
New .S.D. at 5 %	2.5	2.2	0.3	0.3	0.15	0.15	0.16	0.16

Table (11): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some physical characters of the fruits of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Fruit height (cm)		Fruit diameter (cm)		Seed length (cm)		Seed weight %	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	4.82	4.90	2.36	2.37	2.79	2.70	6.66	6.64
2- Using N via 75% inorganic N alone	4.70	4.79	2.26	2.26	2.84	2.75	6.74	6.72
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	4.95	5.04	2.45	2.46	2.70	2.60	6.40	6.38
4-Uing N via 60 % inorganic N alone	4.55	4.64	2.15	2.14	2.90	2.80	6.80	6.79
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	5.09	5.18	2.25	2.56	2.60	2.50	6.31	6.29
6-Uing N via 45 % inorganic N alone	4.40	4.50	2.05	2.06	2.94	2.84	6.89	6.87
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	5.22	5.32	2.65	2.66	2.51	2.41	6.22	6.20
8-Uing N via 30 % inorganic N alone	4.25	4.34	1.95	1.96	2.99	2.87	7.00	6.99
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	5.39	5.52	2.79	2.80	2.41	2.31	6.18	6.17
New .S.D. at 5 %	0.11	0.11	0.09	0.08	0.03	0.03	0.03	0.04

Table (12): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some physical and chemical characteristics of the fruits of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Flesh weight %		Flesh / seed		T.S.S. %		Total sugars %	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	93.34	93.36	14.02	14.06	70.6	71.0	64.1	65.0
2- Using N via 75% inorganic N alone	93.26	93.38	13.84	15.94	69.8	70.2	63.3	64.2
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	93.60	93.62	14.63	14.67	71.7	72.1	65.2	66.1
4-Uing N via 60 % inorganic N alone	93.20	93.21	13.71	13.79	69.0	69.5	62.7	63.6
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	93.69	93.71	14.85	14.90	73.0	73.4	66.3	67.2
6-Uing N via 45 % inorganic N alone	93.11	93.13	13.51	13.56	68.3	68.7	61.7	62.6
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	93.78	93.80	15.08	15.13	73.6	74.0	67.5	68.5
8-Uing N via 30 % inorganic N alone	93.00	93.01	13.29	13.31	67.5	68.0	61.0	61.9
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	93.82	93.83	15.18	15.21	74.3	75.0	68.7	69.7
New .S.D. at 5 %	0.05	0.05	0.07	0.06	0.4	0.4	0.3	0.3

Table (13): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some chemical characteristics of the fruits of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Reducing sugars %		Non-reducing sugars %		Total acidity %		Crude fibre %	
	2013	2014	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	13.6	14.0	50.5	51.0	0.225	0.221	1.30	1.23
2- Using N via 75% inorganic N alone	13.0	13.5	50.3	50.7	0.246	0.242	1.39	1.32
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	14.5	15.0	50.7	51.1	0.205	0.200	1.23	1.16
4-Uing N via 60 % inorganic N alone	12.5	13.0	50.2	50.6	0.268	0.163	1.45	1.38
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	14.9	15.4	51.4	51.8	0.185	0.181	1.16	1.09
6-Uing N via 45 % inorganic N alone	11.8	12.3	49.9	50.3	0.290	0.285	1.50	1.43
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	15.6	16.1	51.9	52.4	0.166	0.161	1.00	0.90
8-Uing N via 30 % inorganic N alone	11.1	11.5	49.9	50.4	0.311	0.305	1.60	1.52
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	16.4	16.8	52.3	52.9	0.147	0.142	0.90	0.80
New .S.D. at 5 %	0.4	0.4	0.3	0.3	0.020	0.019	0.03	0.03

Table (14): Effect of replacing inorganic N fertilizer partially by application of plant compost and EM on some chemical characteristics of the fruits of Sakkoti date palms during 2013 & 2014 seasons.

Inorganic & organic of N and EM_1 treatments	Total soluble tannins %		Nitrite in flesh (ppm)		Nitrate in flesh (ppm)	
	2013	2014	2013	2014	2013	2014
1-Uing N via 100 % inorganic N alone	0.55	0.59	5.10	5.40	5.90	5.83
2- Using N via 75% inorganic N alone	0.60	0.64	4.55	4.86	5.50	5.43
3- Using N via 75% inorganic N + 20 % plant compost + 125 ml EM_1 / palm / year	0.50	0.55	2.11	2.41	3.11	3.04
4-Uing N via 60 % inorganic N alone	0.65	0.69	3.90	4.20	4.90	4.83
5-Using N via 60% inorganic N + 200 % plant compost + 200 ml EM_1 / palm / year	0.45	0.50	1.71	1.99	2.60	2.53
6-Uing N via 45 % inorganic N alone	0.69	0.73	3.30	3.60	4.39	4.32
7-Using N via 45% inorganic N + 27.5 % plant compost + 275 ml EM_1 / palm / year	0.40	0.44	1.30	1.60	2.10	2.03
8-Uing N via 30 % inorganic N alone	0.74	0.78	3.11	3.41	4.11	4.03
9-Using N via 30% inorganic N + 35 % plant compost + 350 ml EM_1 / palm / year	0.35	0.36	0.90	1.20	1.97	1.88
New .S.D. at 5 %	0.03	0.03	0.11	0.11	0.13	0.13

4. Discussion

The previous promoting action on growth and fruiting of Sakkoti date palms was mainly attributed Fe the essential roles of EM(effective microorganisms (**Higa, 1989, Higa and Wididana, 1991a, and Wani and lee 1995)**, and organic fertilizers (**Vercesi, 2000 and Bonanzinga *et al.,* 2001**) in reducing expenses of mineral N, air, soil, water and plant pollution; soil born pathogens, problems of salinity, soil pH, leaching process and soil erosion and enhancing the production of growth promoting substances i.e. IAA, GA_3 and cytokinins, root development, nutrients availability and uptake, soil organic matter and microbial activity, soil aggregation and aeration, permeability of soil, water holding capacity, nutrient transport, photosynthesis process, fixation of N, photosynthesis, water use efficiency, vitamins B, solubility of most nutrients, soil workability, resistance to drought buffering property of the soil, formation of heavy metal complexes, breaking of hazard chemicals, biosynthesis of estrate, formation of hummus, tolerance to draught and temperature extremes, the release of various nutrients, oxidation of sulphur complexes and converting insoluble sulphur to soluble one.

The promoting effect of organic N fertilization on fruiting of Sakkoti date palms was confirmed by the results of **Melouk *et al.,* (1999); Shaheen *et al.,* (2003), Mohamed and Ragab (2004); Mohamed and Gobara (2004); Mansour *et al.,* (2004); Gobara and Ahmed (2004); Saied (2011); Ahmed *et al.,* (2014a) and Omar (2015)** on different date palm cultivars.

These results regarding the promoting effect of EM on growth and yield are in harmony with those obtained by **Ahmed – Samah (2011) and Ahmed *et al.,* (2014)** on different date palm cvs, **Badran and Mohamed (2009) and Ibrahiem and Gad El-Kareem (2014)** on different banana cvs. as well as **Roshdy *et al.,* (2011); Ibrahiem (2012) and Refaai and Ahmed (2013)** on different mango cultivars.

Conclusion:

According to the obtained data under the experimental and resembling conditions, it is advised to fertilize mature Sakkoti date palms with the suitable N (1000 g palm/ year) through 60% inorganic N (1791 g ammonium nitrate, 33.5 % N) at the first week of March, May and July besides 20% plant compost (20 kg/ palm/ year) applied once at the first week of Jan. and Effective microorganisms (EM) at 200 ml / palm/ year once at the first week of March for improving yield qantitatively and qualitiatively and at the same time reducing fruit nitrite and nitrate pollution. Under such recommendation, it is possible for replacing 40% of mineral N fertilizers by 20% plant compost and 200 ml/ EM / palm/ year.

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