Reducing Inorganic N Partially in Zaghloul Date Palm Orchards by Using Humic Acid and Effective Microorganisms

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Abstract: Zaghloul date palms fertilized with N (1000 g N / palm/ year) via 100% inorganic N as well as through 25 to 75% inorganic besides humic acid and EM each at 50 to 200 ml/ palm/ year during 2012 and 2013 seasons. Area of pinnae and leaf, leaf content of N, P, K and Mg, yield and fruit quality in response to different N management treatments were investigated. Application of N via 50 to 75% inorganic plus 50 to 200 ml humic acid and EM significantly improved the area of pinnae and leaf, N, P, K and Mg in the leaves, yield as well as fruit quality and total counts of bacteria in the soil over the check treatment (using N via inorganic N at 100%) or when inorganic N was applied at 25%. A significant reduction on all characters was observed with reducing inorganic N from 50 to 25% even with the application of humic acid and EM each at 50 to 200 ml/ tree. The promotion was associated with increasing levels of both humic acid and EM. Increasing levels of both humic acid and EM from 100 to 200 ml/ tree had a slight effect. Using N as 50% inorganic + 100 ml humic acid + 100 ml EM/ palm gave the best results with regard to yield and fruit quality of Zaghloul date palms

[Faissal F. Ahmed; Hamdy I.M. Ibrahim and Mohamed Kh. Kamel. **Reducing Inorganic N Partially in Zaghloul Date Palm Orchards by Using Humic Acid and Effective Microorganisms.** *World Rural Observ* 2014;6(2):102-110]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). http://www.sciencepub.net/rural. 16

Key words: Humic acid, EM and Zaghloul date palms.

1. Introduction

Poor cropping of Zaghloul date palms grown under middle Egypt conditions is mainly attributed to unbalanced or malnutrition of N. Adjusting N nutrition was carried out by using organic and biofertilization. Organic forming has become recently a positive alternative to chemical N fertilizers. Organic fertilization with humic substances and biofertilization with EM (culture contains more than 60 microorganism strains such as photosynthesis bacteria, lactic acid, bacteria and yeast etc.) had essential roles in improving soil fertility, organic matter, activity of microflora , the availability of most nutrients, water retention and root development (**Yagodin , 1990 ; Higa and Wididana , 1991 and Kannaiyan , 2002**).

Previous studied showed that using organic biofertilizers especially humic substances caused a pronounced promotion on growth, yield and fruit quality of fruit crops (**Hamad, 2008; Al- Wasfy and El- Khawaga, 2008; Abd El- Salam *et al.*, 2009 ; Morsi, 2009; Ibrahiem- Zeinb, 2010; Mohamed, 2011, Saad *et al.*, 2011; Ahmed *et al.*, 2011; Abdelaal *et al.*, 2012; Mahmoud, 2012; Ahmed *et al.*, 2013 ; Mabrouk , 2013 and Ibrahiem and Gad El- Kareem, 2014**).

Using EM as a substitute of mineral N fertilizers partially was found by many authors to enhance growth and fruiting of fruit crops (**Badran and Mohamed, 2009; Roshdy *et al.*, 2011; Ahmed–Samah, 2011; Ibrahiem, 2012 and Refaai *et al.*, 2012**).

The target of this study was elucidating the possibility of using humic acid and EM as a partial replacement of mineral N fertilizer in Zaghloul date palm orchards.

2. Material and Methods

This investigation was carried out during 2012 and 2013 seasons in a private date palm orchard situated at West Samalout, Samalout district, Minia Governorate on thirty 20- years Zaghloul date palms (soft date palms cv). These palms produced through conventional propagation by off shoots. They are uniform in vigour, healthy and free from any damages, insects and diseases. The selected palms arte planted at 8 x 8 meters apart. The texture of the soil is sandy. Drip irrigation system using well water containing 100 ppm salinity was followed. Hand pollination was carried out as usual. Number of bunches per each palm was adjusted to ten bunches. Leaf bunch ratio was maintained at 8 : 1 . Analysis of the soil (according to **Wilde *et al.*, 1985**) are shown in Table (1).

All the selected palms received the normal horticultural practices that already applied in the orchards except those dealing with inorganic , organic and biofertilizaiton of N.

This study included the following ten treatments.

1- Application of the suitable N (1000 g N / palm) via 100 % inorganic N (2986 g ammonium nitrate / palm/ year).

2- Application of N as 75% inorganic N (2240 g ammonium nitrate / palm/ year) + 50 ml humic acid + 50 ml EM / palm.
3- Application of N as 75% inorganic N + 100 ml humic acid + 100 ml EM / palm.
4- Application of N as 75% inorganic N + 200 ml humic acid + 200 ml EM / palm.
5- Application of N as 50% inorganic N (1493 g ammonium nitrate / palm/ year) + 50 ml humic acid + 50 ml EM / palm.
6- Application of N as 50% inorganic N+ 100 ml/ humic acid + 100 ml EM/ palm.
7- Application of N as 50% inorganic N+ 200 ml/ humic acid + 200 ml EM/ palm.
8- Application of N as 25 % inorganic N (747 g ammonium nitrate / palm/ year) + 50 ml humic acid + 50 ml EM / palm.
9- Application of N as 25 % inorganic N+ 100 ml/ humic acid + 100 ml EM/ palm.
10- Application of N as 25 % inorganic N+ 200 ml/ humic acid + 200 ml EM/ palm.

Table (1): Analysis of the tested soil

Characters	Values
Sand %	80.0
Silt %	9.1
Clay %	10.9
Texture	Sandy
pH (1: 2.5 extract)	7.68
EC (1 : 2.5 extract) (ppm)	701
O.M. %	0.62
Total $CaCO_3$ %	3.1
Total N %	0.02
Available P (ppm)	1.9
Avajilable K (ppm)	70.5

Each treatment was replicated three times, one palm per each. Nitrogen was added to all the undertaken palms at fixed rate namely 1000 g N/ palm/ year) (**El- Assar, 2005**). Ammonium nitrate (33.5 % N) as a source of N was splitted into three equal batches at the first week of March, May and July. Humita 25 (25% humic acid) as a source of humic acid as well as EM (each ml contains 10^7 bacterial cells) were added once at growth start (last week of Feb.). Both were applied at three levels namely 50, 100 and 200 ml/ palm/ year. Randomized complete block design was used for carrying out statistical analysis of this study.

During both seasons, the following measurements were carried out:

1- Area of pinnae (cm^2) and leaf (**Ahmed and Morsy, 1999**).
2- Leaf content of N, P, K and Mg as percentage (**Piper, 1950; Summer, 1985 and Wilde *et al.*, 1985**).
3- Yield / palm (kg.) and bunch weight (kg.)
4- Physical and chemical characteristics of the fruits namely fruit weight (g.) and dimensions (length, width and thickness in cm) , flesh %, T.S.S. % , total acidity % (as g malic acid/ 100 ml juice), total fibre % and total soluble tannins % (**A.O.A.C., 2000**).
5- Total counts of bacteria (cfu/ 1.0 g soil) (**Cochran, 1950 and Abd El- Malek and Ischac, 1965**).

Statistical analysis of the obtained data was carried out and treatment means were compared using new L.S.D. at 5% (according to **Steel and Torrie , 1980**).

3.Results and Discussion

1- Area of pinnae and leaf and percentages of N, P, K and Mg in the leaves.

Data in Tables (2 & 3) clearly show that using the suitable N (1000 g N / palm) through 50 to 75% inorganic N plus 50 to 200 ml humic acid and EM/ palm significantly stimulated area of pinnae and leaf as well as percentages of N, P, K and Mg in the leaves rather than using inorganic N at 100% or at 25% with both humic acid + EM. Using N via 100% inorganic was significantly superior than using N as 25% inorganic plus humic acid and EM. The promotion was significantly associated with increasing levels of humic acid and EM from 50 to 200 ml/ palm. Increasing levels from 100 to 200 ml/ humic acid and EM failed significantly to promote growth and different nutrients. A significant reduction on these parameters was observed with using N as 25% inorganic + 50 ml/ humic acid and 50 ml EM/ palm. Using N as 75% inorganic N + 200 ml humic acid + 200 ml EM / palm gave the maximum values. The minimum values were recorded on the palms that received N as 25% inorganic N + 50 ml humic acid + 50 ml EM/ palm. These results were true during both seasons.

2-Bunch weight and yield per palm.

Data in Table (3) obviously reveal that using N as 50 to 75% inorganic plus 50 to 200 ml humic acid and 200 ml EM per palm was very effective in improving bunch weight and yield per palm comparing to using N as 100% inorganic or when N was added as 25% inorganic + 50 to 200 ml humic acid and EM per palm. There was a gradual promotion on bunch weight and yield with increasing levels of humic acid and EM from 0.0 to 200 ml/ palm. A slight and unsignificant promotion on bunch weight and yield was observed with increasing levels of humic acid and EM from 100 to 200 ml/ palm. Reducing percentages of inorganic N from 75% to 50% under the same levels of humic acid

and EM had meaningless promotion on bunch weight and yield. Using N as 100% inorganic significantly was superior than using N as 25% inorganic plus 50 to 200 ml/ palm in improving bunch weight and yield per palm. A significant reduction on both bunch weight and yield per palm was observed due to reducing percentages of inorganic N from 50 to 25% even with the application of both humic acid and EM. Economically point of view using N as 50% inorganic + 100 ml humic acid + 100 ml EM per palm was suggested to be beneficial for producing an acceptable yield and bunch weight. Under such promised treatment yield reached 128 kg & 130 kg while bunch weight was 12.8 and 13.0 kg during both seasons, respectively. The palms fertilized with N as 100% inorganic produced 120.0 & 119.0 kg per palm. Bunch weight in these palms reached 12.0 & 11.9 kg during 2012 & 2013 seasons, respectively. The percentages of increase on the yield due to using the best and recommended treatment over the check treatment reached 7.5 and 10.1 % during 2012 and 2013 seasons, respectively. These results were true during both seasons.

3- Fruit quality:

It is worth to mention from the data in Tables (4 to 6) that supplying Zaghloul date palms with N as 50 to 75% inorganic N + 50 to 200 ml humic acid or EM/ palm was significantly very effective in improving fruit quality in terms of increasing weight, length, width and thickness of fruit, flesh % , T.S.S. % and total and reducing sugars % and reducing total acidity % , total fibre % and total soluble tannins relatively to using N as 100% inorganic or when N was added as 25% inorganic + 50 to 200 ml humic acid or EM per palm. The promotion on fruit quality was significantly associated with increasing levels of humic acids and EM from 50 to 200 ml per palm. A slight effect on fruit quality was observed with increasing levels of humic acid and EM from 100 to 200 ml per palm. Using N as 100% inorganic significantly surpassed the application of N through 25% inorganic + 50 to 200 ml /palm humic acid and EM. Using N as 50 to inorganic N + 100 ml humic acid + 100 ml EM per palm gave the best results with regard to fruit quality. Unfavourable effects on fruit quality were observed on the palms that received N via 25% inorganic + 50 ml humic acid + 50 ml EM per palm. Similar results were declared during 2012 and 2013 seasons.

4-Total counts of bacteria in the soil

It is obvious from the data in Table (6) that amending the palms with N as 25 to 75% inorganic N + 50 to 200 ml humic acid and EM per palm resulted in great promotion on total counts of bacteria in the soil relatively to using N as 100% inorganic N. The promotion on the total counts of bacteria was in proportional to the reduction in the percentage of inorganic N from 100 to 25% and the increase in the levels of humic acid and EM from 50 to 200 ml / palm. The lowest values (31.0^6 and 31.7^6 cfu / 1.0 g soil)were recorded on the palms that fertilized with N as 100 % inorganic N during both seasons, respectively. Amending the palms with N as 25% inorganic N + 200 ml humic acid + 200 ml EM per palm effectively maximized the total counts of bacteria (41.1^6 and 43.1^6 cfu / 1.0 g soil) during both seasons, respectively.

Table (2): Effect of inorganic N , humic acid and EM on area of pinnae and leaf , percentages of N and P % of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Pinnae area (cm^2)		Leaf area (cm^2)		Leaf N %		Leaf P %	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	57.9	58.5	1.76	1.80	1.41	1.50	0.18	0.17
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	61.1	61.7	2.22	2.26	1.52	1.61	0.22	0.24
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	64.1	64.7	2.62	2.66	1.58	1.67	0.25	0.27
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	64.5	65.0	2.64	2.67	1.26	1.35	0.26	0.28
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	61.0	61.6	2.21	2.25	1.50	1.59	0.21	0.23
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	64.1	64.7	2.61	2.65	1.57	1.66	0.24	0.26
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	64.5	65.0	2.63	2.66	1.58	1.67	0.25	0.27
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	51.1	51.9	1.00	1.04	1.25	1.34	0.11	0.12
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	54.1	55.0	1.39	1.44	1.31	1.40	0.14	0.15
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	54.3	55.1	1.40	1.45	1.32	1.41	0.15	0.16
New L.S.D. at 5%	2.8	2.7	0.31	0.29	0.05	0.06	0.03	0.03

Table (3): Effect of inorganic N , humic acid and EM on percentages of K and Mg in the leaves, bunch weight and yield per palm of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Leaf K %		Leaf Mg %		Bunch weight (kg.)		Yield/ palm (kg.)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	0.98	1.05	0.49	0.50	12.0	11.9	120.0	119.0
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	1.06	1.13	0.56	0.57	12.5	12.6	125.0	126.0
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	1.12	1.20	0.61	0.63	12.9	13.1	129.0	131.0
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	1.13	1.21	0.62	0.64	13.0	13.2	130.0	132.0
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	1.05	1.12	0.55	0.55	12.4	12.5	124.0	125.0
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	1.11	1.18	0.60	0.61	12.8	13.0	128.0	130.0
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	1.12	1.19	0.61	0.62	12.9	13.1	129.0	131.0
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	0.87	0.95	0.40	0.41	11.1	11 .0	111.0	110.0
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	0.92	0.99	0.44	0.47	11.5	11.5	115.0	115.0
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	0.93	1.00	0.4 5	0.48	11.6	11.6	116.0	116.0
New L.S.D. at 5%	0.04	0.04	0.03	0.04	0.4	0.4	2.5	3.0

Table (4): Effect of inorganic N, humic acid and EM on some physical characters of the fruits of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Av. Fruit weight (g.)		Fruit length (cm.)		Fruit width (cm)		Fruit thickness (cm)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	16.4	16.6	4.9	5.0	2.7	2.7	1.11	1.09
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	19.6	20.0	5.0	5.1	2.9	3.0	1.23	1.20
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	22.3	22.7	5.2	5.3	3.1	3.2	1.35	1.30
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	22.6	23.0	5.3	5.4	3.2	3.3	1.36	1.34
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	19.4	20.0	4.9	5.0	2.8	3.0	1.22	1.19
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	22.2	22.6	5.1	5.2	3.0	3.1	1.34	1.29
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	22.5	22.9	5.2	5.3	3.1	3.2	1.35	1.33
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	15.0	15.5	4.4	4.5	2.4	2.4	0.88	0.88
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	15.6	16.1	4.6	4.7	2.5	2.5	0.99	0.99
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	15.7	16.2	4.7	4.8	2.5	2.5	1.00	1.00
New L.S.D. at 5%	0.5	0.4	0.2	0.2	0.2	0.2	0.11	0.09

Table (5): Effect of inorganic N , humic acid and EM on the percentage of flesh , T.S.S. as well as total and reducing sugars in the fruits of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Flesh %		T.S.S. %		Total sugars %		Reducing sugars %	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	89.0	89.5	42.5	43.1	37.8	38.0	25.1	25.2
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	90.0	90.5	44.0	44.9	38.3	38.5	25.8	25.9
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	91.0	91.4	44.5	46.3	39.9	41.1	26.9	27.0
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	91.9	92.3	44.7	46.5	40.0	40.2	27.0	27.1
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	89.9	90.3	44.8	44.8	38.2	38.5	25.7	25.8
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	90.9	91.3	44.3	46.2	39.8	40.0	26.8	26.9
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	91.8	92.2	45.2	46.4	39.9	41.1	26.9	27.0
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	88.0	88.2	40.0	41.0	36.0	36.3	24.0	24.1
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	88.5	88.6	41.3	42.5	36.5	36.9	24.4	24.5
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	88.6	88.9	41.5	42.8	36.6	37.0	24.5	24.6
New L.S.D. at 5%	0.3	0.3	0.7	0.8	0.4	0.3	0.3	0.3

Table (6): Effect of inorganic N , humic acid and EM on the percentages of total acidity, total fibre and total soluble tannins and total counts of bacteria (cfu 1.0 g /soil) of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Total acidity %		Total fibre %		Total soluble tannins %		Total counts of bacteria (cfu / 1.0g)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	0.200	0.195	0.85	0.90	0.78	0.76	31.0^6	31.7^6
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	0.182	0.177	0.70	0.75	0.63	0.61	32.0^6	32.8^6
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	0.170	0.165	0.51	0.56	0.44	0.42	34.1^6	35.0^6
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	0.168	0.163	0.49	0.54	0.42	0.40	34.0^6	35.2^6
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	0.183	0.178	0.71	0.76	0.64	0.62	37.1^6	38.1^6
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	0.171	0.166	0.52	0.57	0.45	0.43	38.4^6	39.4^6
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	0.169	0.164	0.51	0.56	0.44	0.42	38.3^6	39.5^6
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	0.250	0.244	0.97	1.02	0.46	0.88	39.9^6	41.9^6
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	0.235	0.231	0.92	0.97	0.85	0.82	41.0^6	43.0^6
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	0.230	0.225	0.91	0.96	0.84	0.81	41.1^6	43.1^6
New L.S.D. at 5%	0.011	0.012	0.03	0.04	0.04	0.04	-	-

4. Discussion

The beneficial effects of humic acid and EM, on enhancing soil organic matter, availability of nutrients, water retention, microflroa activity and root development as well as their important roles in reducing soil pH and salinity (**Yagodin, 1990 and Kannaiyan, 2002**) could result in enhancing soil fertility and the uptake of most nutrients which reflect in stimulating growth, nutritional status of the palms, yield and fruit quality.

These results regarding the effect of humic acid on growth and fruiting of Zaghloul date palms are in concordance with those obtained by **Mabrouk**, **(2013); Ahmed *et al.*, (2013) and Ibrahiem and Gad El-Kareem, (2014).**

The results of **Roshdy *et al.*, (2011); Refaai *et al.*, (2012) and Ibrahiem (2012)** emphasized the importance of EM on growth and fruiting in different fruit crops.

Conclusion:

Supplying Zaghloul date palms with N (1000 g N/ palm / year) as 50% inorganic N + 100 ml humic acid + 100 ml EM per palm is recommended for promoting yield and fruit quality.

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Table2): Effect of inorganic N , humic acid and EM on area of pinnae and leaf , percentages of N and P % of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Pinnae area (cm^2)		Leaf area (cm^2)		Leaf N %		Leaf P %	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	57.9	58.5	1.76	1.80	1.41	1.50	0.18	0.17
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	61.1	61.7	2.22	2.26	1.52	1.61	0.22	0.24
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	64.1	64.7	2.62	2.66	1.58	1.67	0.25	0.27
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	64.5	65.0	2.64	2.67	1.26	1.35	0.26	0.28
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	61.0	61.6	2.21	2.25	1.50	1.59	0.21	0.23
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	64.1	64.7	2.61	2.65	1.57	1.66	0.24	0.26
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	64.5	65.0	2.63	2.66	1.58	1.67	0.25	0.27
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	51.1	51.9	1.00	1.04	1.25	1.34	0.11	0.12
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	54.1	55.0	1.39	1.44	1.31	1.40	0.14	0.15
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	54.3	55.1	1.40	1.45	1.32	1.41	0.15	0.16
New L.S.D. at 5%	2.8	2.7	0.31	0.29	0.05	0.06	0.03	0.03

Table (3): Effect of inorganic N , humic acid and EM on percentages of K and Mg in the leaves, bunch weight and yield per palm of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Leaf K %		Leaf Mg %		Bunch weight (kg.)		Yield/ palm (kg.)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	0.98	1.05	0.49	0.50	12.0	11.9	120.0	119.0
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	1.06	1.13	0.56	0.57	12.5	12.6	125.0	126.0
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	1.12	1.20	0.61	0.63	12.9	13.1	129.0	131.0
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	1.13	1.21	0.62	0.64	13.0	13.2	130.0	132.0
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	1.05	1.12	0.55	0.55	12.4	12.5	124.0	125.0
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	1.11	1.18	0.60	0.61	12.8	13.0	128.0	130.0
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	1.12	1.19	0.61	0.62	12.9	13.1	129.0	131.0
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	0.87	0.95	0.40	0.41	11.1	11 .0	111.0	110.0
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	0.92	0.99	0.44	0.47	11.5	11.5	115.0	115.0
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	0.93	1.00	0.4 5	0.48	11.6	11.6	116.0	116.0
New L.S.D. at 5%	0.04	0.04	0.03	0.04	0.4	0.4	2.5	3.0

Table4): Effect of inorganic N, humic acid and EM on some physical characters of the fruits of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Av. Fruit weight (g.)		Fruit length (cm.)		Fruit width (cm)		Fruit thickness (cm)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	16.4	16.6	4.9	5.0	2.7	2.7	1.11	1.09
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	19.6	20.0	5.0	5.1	2.9	3.0	1.23	1.20
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	22.3	22.7	5.2	5.3	3.1	3.2	1.35	1.30
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	22.6	23.0	5.3	5.4	3.2	3.3	1.36	1.34
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	19.4	20.0	4.9	5.0	2.8	3.0	1.22	1.19
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	22.2	22.6	5.1	5.2	3.0	3.1	1.34	1.29
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	22.5	22.9	5.2	5.3	3.1	3.2	1.35	1.33
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	15.0	15.5	4.4	4.5	2.4	2.4	0.88	0.88
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	15.6	16.1	4.6	4.7	2.5	2.5	0.99	0.99
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	15.7	16.2	4.7	4.8	2.5	2.5	1.00	1.00
New L.S.D. at 5%	0.5	0.4	0.2	0.2	0.2	0.2	0.11	0.09

Table (5): Effect of inorganic N , humic acid and EM on the percentage of flesh , T.S.S. as well as total and reducing sugars in the fruits of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Flesh %		T.S.S. %		Total sugars %		Reducing sugars %	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	89.0	89.5	42.5	43.1	37.8	38.0	25.1	25.2
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	90.0	90.5	44.0	44.9	38.3	38.5	25.8	25.9
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	91.0	91.4	44.5	46.3	39.9	41.1	26.9	27.0
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	91.9	92.3	44.7	46.5	40.0	40.2	27.0	27.1
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	89.9	90.3	44.8	44.8	38.2	38.5	25.7	25.8
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	90.9	91.3	44.3	46.2	39.8	40.0	26.8	26.9
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	91.8	92.2	45.2	46.4	39.9	41.1	26.9	27.0
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	88.0	88.2	40.0	41.0	36.0	36.3	24.0	24.1
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	88.5	88.6	41.3	42.5	36.5	36.9	24.4	24.5
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	88.6	88.9	41.5	42.8	36.6	37.0	24.5	24.6
New L.S.D. at 5%	0.3	0.3	0.7	0.8	0.4	0.3	0.3	0.3

Table (6): Effect of inorganic N , humic acid and EM on the percentages of total acidity, total fibre and total soluble tannins and total counts of bacteria (cfu 1.0 g /soil) of Zaghloul date palms during 2012 and 2013 seasons.

Treatment	Total acidity %		Total fibre %		Total soluble tannins %		Total counts of bacteria (cfu / 1.0g)	
	2012	2013	2012	2013	2012	2013	2012	2013
N as 100 % mineral N	0.200	0.195	0.85	0.90	0.78	0.76	31.0^6	31.7^6
N as 75% mineral N + 50 ml/ humic + 50 ml EM / palm	0.182	0.177	0.70	0.75	0.63	0.61	32.0^6	32.8^6
N as 75% mineral N + 100 ml/ humic + 100 ml EM / palm	0.170	0.165	0.51	0.56	0.44	0.42	34.1^6	35.0^6
N as 75% mineral N + 200 ml/ humic +200 ml EM / palm	0.168	0.163	0.49	0.54	0.42	0.40	34.0^6	35.2^6
N as 50% mineral N + 50 ml/ humic + 50 ml EM / palm	0.183	0.178	0.71	0.76	0.64	0.62	37.1^6	38.1^6
N as 50% mineral N + 100 ml/ humic + 100 ml EM / palm	0.171	0.166	0.52	0.57	0.45	0.43	38.4^6	39.4^6
N as 50% mineral N +200 ml/ humic + 200 ml EM / palm	0.169	0.164	0.51	0.56	0.44	0.42	38.3^6	39.5^6
N as 25 % mineral N + 50 ml/ humic + 50 ml EM / palm	0.250	0.244	0.97	1.02	0.46	0.88	39.9^6	41.9^6
N as 25 % mineral N +100 ml/ humic + 100 ml EM / palm	0.235	0.231	0.92	0.97	0.85	0.82	41.0^6	43.0^6
N as 25 % mineral N +200 ml/ humic +200 ml EM / palm	0.230	0.225	0.91	0.96	0.84	0.81	41.1^6	43.1^6
New L.S.D. at 5%	0.011	0.012	0.03	0.04	0.04	0.04	-	-

6/13/2014