Effect of using plant compost and EM as partial replacement of inorganic N fertilizer on fruiting of barhy date palms

Mohamed A. El- Sayed [1]; Abbas, S. Abdalla [2]; Moawad M. Abd El- Hameed [1] and Hassan M.F. El- Naggar [2]

[1]Hort. Dept. Fac. of Agric. Minia Univ. Egypt.
[2]Tropical Fruits Res. Dept. Hort. Res. Instit. ARC, Giza, Egypt.
faissalfadel@yahoo.com

Abstract: During 2016 and 2017 seasons, Barhy date palms grown under Upper Egypt conditions were fertilized with N as 25 to 100% inorganic N plus 25 to 100% plant compost manure and Effective microorganisms (EM) at 50 to 200 ml/ palm. The scope of this study was examining the possibility of using plant compost and EM versus inorganic N fertilizer and their effects on growth, palm nutritional status, bunch weight, yield / palm and both physical and chemical characteristics of the fruits of Barhy date palms. Supplying Barhy date palms with the recommended N (1000 g N/ palm / year) through 50 to 75% inorganic N (ammonium nitrate) plus 25 to 50% plant compost manure with or without EM, at 50 to 100 ml / palm/ year materially was accompanied with improving all growth aspects, initial fruit setting %, fruit retention %, yield, bunch weight and fruit physical characteristics relative to the other N management treatments. Photosynthetic pigments, N, P, K, Mg and chemical fruit properties were gradually improved with reducing the percentages of inorganic N from 100 to 0.0% and at the same time increasing both percentages of plant compost from 0.0 to 100% and levels of EM from 0.0 to 200 ml / palm / year. In most cases, using inorganic N at percentage lower than 50% had an adverse effects on growth traits, yield and physical fruit characteristics. EM was substantially responsible for enhancing all the investigated parameter when used with organic and inorganic fertilization compared with using inorganic and organic N sources alone. For improving yield and fruit physical characteristics, it is suggested to fertilize Barhy date palms with N via 50% inorganic N plus 50% plant compost and 100 ml EM/ palm/ year. However, supplying the palms with N via 100% plant compost gave the better fruit chemical properties.

[Mohamed A. El- Sayed; Abbas, S. Abdalla; Moawad M. Abd El- Hameed and Hassan M.F. El- Naggar. **Effect of using plant compost and EM as partial replacement of inorganic N fertilizer on fruiting of barhy date palms.** *N Y Sci J* 2019;12(1):16-27]. ISSN 1554-0200 (print); ISSN 2375-723X (online). http://www.sciencepub.net/newyork. 3. doi:10.7537/marsnys120219.03.

Keywords: Barhy date palms, plant compost, EM, growth, palm nutritional status, inorganic N, yield, physical and chemical fruit characteristics.

1. Introduction

The problem of poor yield of Barhy date palms grown under Upper Egypt conditions is the over application of inorganic N fertilizers that causes more growth at the expense of fruiting. For adjusting the uptake of N by palms, it is necessary to use plant compost organic fertilizer and EM biofertilizer (**Devlin and Withdam, 1983**).

Application of organic fertilizers (**Dahama, 1999; Taiz and Zeigler, 2002, Srivastava *et al.*, 2002 and Cabrera *et al.*, 2003**) and EM (**Kannaiyan, 2002 and Irizar- Garza *et al.*, 2003**) is beneficial in improving organic matter in the soil, N fixation, availability of nutrients, biosynthesis of IAA, cytokinins and gibberellins, antibiotics, B vitamins, antioxidants and plant pigments, water retention and root development and reducing soil pH and soil salinity. They are responsible for enhancing the activity of microorganisms and enzymes.

Previous studies showed that using organic manures (**Morsi, 2009; Saied, 2011 and 2015; Omar, 2015; Abd El- Wahab, 2017; Boghdady, 2018 and Abd El- Kafy, 2018**) and EM (**Paschoal *et al.*, 1999; Roshdy *et al.*, 2011; Refaai, *et al.*, 2012; Ibrahim, 2012; Faraag, 2013; Hassan-Huda, 2014 and Abd El- Haleem- Sahar, 2015**) were very effective in improving growth aspects, nutritional status of the trees, yield and both physical and chemical characteristics of the fruits in different date palm, citrus and mango cvs.

The target of this study was examining the effect of using plant compost manure and effective microorganisms (EM) as partial replacement of inorganic N, fertilizer on fruiting of Barhy date palms grown under Upper Egypt conditions.

2. Materials and Methods

This study was conducted at El- Mataana Experimental Res. Station orchards Hort. Res. Instit., Agric. Res. Center, Esna district, Luxor governorate during two consecutive seasons of 2016 and 2017 in which 24 tissue culture derived off shoots of Barhy date palms were selected for achieving this study. The palms were planted at 6 x 7 meters apart (100

palms / fed.). The texture of soil is silty clay with water Table not less than two meters deep.

The selected palms were at the same age and uniform in vigour. These palms were 20 years old at the start of study, good physical conditions and free from insects, damages and diseases. The selected palms were irrigated through surface irrigation system. Pruning was performed to maintain leaf bunch ratio at 8:1 (according to **Dammas, 1998**). The number of female spathes per palm was adjusted to 8 spathes by removing excess earliest, latest and small bunches. Pollination of the experimental palms was uniformly performed to avoid residues of metaxenia.

The pollen grains viability was tested before carrying out pollination with acertoicarmine staining. One drop of 1.0% acetocarmine was dispersed. Pollens were microscopy examined. Colorless or unstained pollen grains were considered non- viable according to **Morerira and Gurgel (1944).**

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

Pollination was achieved by inserting five male strands into the female bunch using known high activity pollen source throughout 2-3 days after female spathe cracking. To prevent contamination of pollens, every bunch was bagged after inserting the male strands by paper bags which were tied at the ends using a piece of cotton for aeration. The bags were shaken lightly to ensure pollen distribution and were removed after four weeks (**Dammas, 1998**).

The results of orchard soil analysis according to Black ***et al,*** **(1965)** are given in Table (2).

Each selected Barhy date palm received the common horticultural practices that are already applied in the orchard except those dealing with inorganic, organic and biofertilization of N. These practices included the application of 1.0 kg mono calcium superphosphate (15.5% P_2O_5) and 1.0 kg potassium sulphate (48 % K_2O) per each palm/ year. Phosphate fertilizer was added once a year during the first week of January. Potassium fertilizer was added twice a year before bloom (1^{st} week of Mar.) and again after fruit setting (2^{nd} week of April). Other horticultural practices such as irrigation, pruning, spraying micronutrients and pest control management were carried out as usual.

This experiment included the following eight treatments from inorganic N (ammonium nitrate, 33.5 % N), plant compost manure (2.5 % N) and effective microorganisms (EM) arranged as follows:

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

2- Application of the suitable N as 75% inorganic N (2239 g ammonium nitrate / palm/ year) + 25% plant compost manure (10 kg / palm/ year).

3- Application of the suitable N as 50% inorganic N (1493g ammonium nitrate / palm/ year) + 50 % plant compost manure (20 kg / palm/ year).

4- Application of the suitable N as 25% inorganic N (747 g ammonium nitrate / palm/ year) + 75% plant compost manure (30 kg / palm/ year).

5- Application of the suitable N as 0.0 % inorganic N + 100 % plant compost manure (40 kg / palm/ year).

6- Application of the suitable N as 75% inorganic N (2239g ammonium nitrate / palm/ year) + 25% plant compost manure (10 kg / palm/ year) + 50 ml /palm/ year Effective microorganisms (EM) algae biofertilizer.

7- Application of the suitable N as 50% inorganic N (1493g ammonium nitrate / palm/ year) + 50 % plant compost manure (20 kg / palm/ year) + 100 ml /palm/ year Effective microorganisms (EM) biofertilizer.

8- Application of the suitable N as 25% inorganic N (747 g ammonium nitrate / palm/ year) + 75% plant compost manure (30 kg / palm/ year) + 200 ml /palm/ year Effective microorganisms (EM) biofertilizer.

Each treatment was replicated three times, one Barhy 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 two consecutive seasons. Organic N fertilizer namely plant compost manure (2.5% N) was added once at the first week of Jan. during 2016 and 2017 seasons. EM biofertilizer at 50 to 200 ml/ palm/ year was also added once at the first week of March. Ammonium nitrate was distributed around the canopy of each palm while organic and biofertilizer were applied in holes 10 cm depth and 50 cm apart around the canopy of each palm. All the selected palms (24 palm) received N at fixed rate namely 1000 g N/ palm/ year (**Saied, 2015**).

Analysis of plant compost manure are shown in Tables (2).

Table (2): Analysis of the solid manure plant compost

Parameters	Values
Cubic meter weight (kg.)	600.0
Moisture %	29.0
Organic matter %	30.7
Organic carbon %	15.63
pH (1: 10)	8.5
EC (ds/ m)	6.5
C/N ratio	18.82
Total N %	2.5
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 Zu (ppm)	34.0
Total Cu (ppm)	42.0

This experiment was arranged in a randomized complete block design (RCBD). Each treatment was replicated three times, one palm per each replicate.

Generally, the following measurements were determined during the two investigated seasons.

Leaf morphology

Morphology of leaves was studied on the four full sized leaves/ palm (one leaf at each side). Measurements included number of leaflets/ leaf, leaflet length and width on 8 leaflets per each leaf. Leaflet area (cm $^{2)}$ was determined using, **Ahmed and Morsy (1999)** equation: Leaflet area (W x L) x 0.67 + 10.29, in which W and L are the maximum width and length of leaflet. Then leaf area (m^2) was calculated by multiplying the number of leaflets/ leaf by the area of leaflet. Number of spines per leaf as well as spine length (cm.) were also recorded.

Measurements of Plant pigments:

Plant pigments namely chlorophylls a & b and total carotenoids were determined as (mg/ 100 g. F.W.). Samples of five mature pinnae form the six month old leaf (1st week of August) were taken during the three seasons. The fresh pinnae were cut into small pieces and 0.2 g. weight from each sample was taken, homogenized and extracted by 25% acetone in the presence of little amount of Na_2CO_3 and silica quartz, then filtered through central glass funnel G_4. The residue was washed several times with acetone until the filtrate became colorless. The combined extract was completed to a known volume (20 ml) with acetone 85%. A portion of this extract was taken for the colorimetric determination of pigments. Acetone (85% v/v) was used as a blank (according to **Von- Wettstein, 1957 and Hiscox and isralstam, 1979**).

The optical density of the filtrate was determined using Carl- Zeis spectrophotometer at the wave length of 662 and 644 nm to determine chlorophylls a and b, respectively. Concentration of each pigment was calculated by using the following equations according to **Von- Wettstein, (1957)**.

Chl.a = (9.784 x E662)- (0.99 x E662) = mg/g F.W.

Chl.b = (21.462 x E644)- (4.64 x E644) = mg/g F.W.

Total carotenoids = (4.965 x E440- 0.268 (chlorophyll a+ chlorophyll b)

E= optical density at a given wave length.

The chlorophylls a and b were calculated as mg/ 100 g fresh weight of pinnae. Also, total chlorophylls was estimated (mg/ 100 g F.W.) by summation of chlorophylls a and b.

Percentages of N, P, K and Mg in the leaves.

To determine the percentages of N, P, K and Mg, one six – month old labeled leaf per palm was removed (at the first week of August annually). The medium four pinnae were taken (according to **Summer, 1985**).

The samples were washed several times with tap water and rinsed with distilled water and air-dried at 70^{o}C for 72 hrs. The dry materials were ground in a stainless steel mill and 0.2 grams of each sample was digested using concentrated sulfuric acid and 30% hydrogen peroxide. The concentrations of N, P, K and Mg in the dried pinnae were determined according to the following procedures that outlined by **Wilde *et al.*, (1985)**:-

1- Total nitrogen percentage was measured by the micro- kjeldahl methods (**Chapman and Pratt, 1975**).

2- Phosphorus percentage was determined colorimetrically (**Peach and Tracey, 1968**).

3- Potassium percentage was determined using flame photometer (**Piper, 1950**).

4- Percentage of Mg was determined using versenate method (**Wilde *et al.*, 1985**).

Percentage of initial fruit setting:

It was measured by dividing number of initial setted fruits by number of total flowers per bunch in the three labelled bunches (1st week of April) and multiplying the product by 100.

Percentage of fruit retention:

It was calculated by dividing number of retained fruits per bunch in the three selected bunches (1st week of September) by total number of flowers of bunch and multiplying the product by 100.

Yield, bunch weight and quality parameters:

Yield and bunch weight:

Bunches (ten) of Barhy date palms were picked at the optimum commercial harvesting time **(Dammas, 1998)** under Luxor Governorate conditions (last week August) in the two experimental seasons. The yield of each palm was recorded in terms of weight per palm (kg.) by multiplying the average bunch weight (kg.) by total number of bunches per palm (eight bunches).

Quality parameters:

Samples of fifty dates from the yield of each palm were taken randomly and the following physical and chemical characters were measured:

Physical characters:

Weights of fruit, seed and flesh (g.) were also estimated in a top pan balance of 0.01 g. sensitivity. Fruit dimensions (height, diameter) were recorded. Percentages of seeds and flesh were estimated by dividing weights of seeds and fresh by the whole weight of fruit and multiplying the product by 100. Edible (flesh weight) to non- edible portions (seed weight) was calculated.

Chemical characteristics:

Total soluble solids % (T.S.S. %):

The fruit fresh was well minced with an electric blender and past was squeezed and the total soluble solids % was determined by using hand refractometer (according to **A.O.A.C., 2000**).

Total, reducing and non – reducing sugars:

The percentages of total and reducing sugars were determined according to **Lane and Eynon (1965)** volumetric method that outlined in **A.O.A.C. (2000)**. Non- reducing sugars percentage was computed by calculating the differences between total and reducing sugars.

Total acidity %:

Twenty five grams of flesh were mixed with 100 ml distilled water in an electric blender, the extract was filtered and twenty ml of it were titrated against 0.1 N sodium hydroxide using phenolphthalein as an indicator according to **A.O.A.C., (2000).** Total acidity % was determined as g. malic acid per 100 g pulp **(AO.A.C. 2000**).

Tannins content:

The tannin content was determined using the Indigo Carmen indicator according to **Balbaa (1981).** Titration was carried out using 0.1 N potassium permanganate solutions. Tannins in fresh weight were calculated (as total tannins percentage) according to the following equation:

1 ml potassium permanganate (0.1 N) = 0.00416 g. tannins.

Crude fibers content:

Determination of crude fibers content was achieved using acetic acid glacial and nitric acid at 10: 1 solution according to the official methods described in **A.O.A.C., (2000)**.

Juice content of nitrate and nitrite (as ppm)

Both were determined by the addition of 2.5 ml 85% phosphoric acid to the neutral Griess reagent to produce Griess reaction. After mixing the solution, it was incubated at room temperature for 15 min then measured at 540 nm. Values of nitrate and nitrite (ppm) were calculated using the standard curve of NO_2 (**Ridnour Lisa *et al,* 2000**).

Statistical analysis:

All the obtained data during the course of this study during both seasons were collected, tabulated and statistically analyzed. The differences between treatment means were compared using new L.S.D. test according to **Snedecor and Cochran (1980); Steel and Torrie (1982) and Mead *et al,* (1993)**.

3. Results

Some vegetative growth aspects

Data in Table (3) show the effect of using plant compost and Effective microorganisms as partial replacement of inorganic N on pinnae and leaf area, number of pinnae per leaf, number of spines/ leaf and spine length of Barhy date palms during 2016 and 2017 seasons.

It is clear from the obtained data that varying N management treatments had significant differences on the area of pinnae and leaf, number of pinnae per leaf, number of spines/ leaf and spine length. Using N as 50 to 75 % inorganic N + 25 to 50% plant compost with or without the use of Effective microorganisms (EM) at 50 to 100 ml/ palm simulated significantly the five growth aspects relative to the use of N completely via plant compost or via inorganic N alone or when N was added as 25% inorganic N plus 75% compost and 200 ml EM/palm. The stimulative on these growth aspects was significantly associated with reducing the

percentages of inorganic N from 100 to 50 % and at the same increasing the percentages of plant compost from 0.0 to 50% and levels of EM from 0.0 to 100 ml palm. A significant reduction on these growth aspects was observed when percentages of inorganic N reached 25% regardless organic and biofertilization or when plant compost or inorganic N was applied as 100%. Using N as 25 to 75% inorganic N + 25 to 75% plant compost + 50 to 200 ml EM/ palm significantly enhanced these growth aspects compared to carrying out organic and inorganic fertilization without EM. Using N as 100% inorganic N was significantly superior the use of plant compost at 100% in enhancing all growth traits. The maximum values were recorded on the palms fertilized with N as 50% inorganic N + 50% plant compost + 100 ml EM/ palm. However, the lowest values were recorded on the palms that received N completely via compost. These results were true during both seasons.

Photosynthetic pigments and percentages of N, P K and Mg.

Data in Tables (4 to5) show the effect of using plant compost and Effective microorganisms as partial replacement of inorganic N on chlorophylls a & b, total chlorophylls, total carotenoids N, P, K, and Mg in the leaves of Barhy date palms during 2016 and 2017 seasons.

It is obvious from the obtained data that fertilizing Barhy date palms with N as 25 to 75% inorganic N + 25 to 100% plant compost + 50 to 200 ml EM / palm significantly enhanced photosynthetic pigments (chlorophylls a & b, total chlorophylls and total carotenoids) and nutrients namely N, P, K and Mg relative to carrying out inorganic fertilization alone. The stimulation on these leaf chemical components was significantly related to reducing the percentages of inorganic N from 100 to 0.0 % and at the same time increasing the percentages of plant compost from 100to 0.0 % and levels of EM from 0.0 to 200 ml / palm. Using EM at 50 to 200 ml / palm significantly enhanced these leaf component compared to using inorganic and organic fertilization without EM. Using plant compost at 100% of N significantly enhanced these leaf chemical component relative to use of inorganic N at 100%. The maximum values were recorded on the palms received N as 25% inorganic N + 75% plant compost + 200 ml EM / palm. The palms received the whole N via inorganic source alone gave the lowest values. Similar trend was noticed during both seasons.

The percentages of initial fruit setting and fruit retention

Data in Table (6) show the effect of using plant compost and Effective microorganisms as partial replacement of inorganic N on the percentages of initial fruit setting and fruit retention of Barhy date palms during 2016 and 2017 seasons.

It is noticed from the obtained data that subjecting Barhy date palms with N via 50 to 75% inorganic N + 25 to 50% plant compost either alone or in combined with 50 to 100 ml EM/ palm significantly improved both initial fruit setting and fruit retention compared with the use of N as 100% inorganic or plant compost or when N was added via 25% inorganic regardless organic and biofertilization. Using N via inorganic N at 100% was significantly superior than using it completely via plant compost. A significant reduction on such two parameters was observed when percentages of inorganic N was reduced from 50 to 25% regardless organic and biofertilization. There was a gradual and significant promotion on initial fruit setting and fruit retention with reducing the percentages of inorganic N from 100 to 50% and at the same time increasing percentages of plant compost from 0.0 to 50% and levels of EM from 0.0 to 100 ml/ palm. A significant promotion was observed on such two parameters when EM at 50 to 200 ml / palm was added to the mixture of inorganic and organic fertilization relative to the use of organic and inorganic fertilization alone.

The maximum values (38.0 & 38.9 %) of initial fruit retting were received on the palms that received N as 50 % inorganic N + 50% plant compost + 100 ml EM / palm during both seasons, respectively. The same previous treatment gave 27.0 & 28.9 % fruit retention during both seasons, respectively. The minimum values of initial fruit setting (29.0 & 28.9 %) and fruit retention (19.0 & 18.9) were appeared in the palms that supplied with N completely via plant compost during both seasons, respectively. Palms treated with N completely via inorganic N form gave 32.4 & 33.0% initial fruit setting and 22.9 & 23.0% fruit retention during both seasons, respectively. These results were true during both seasons.

The yield / palm

Yield/ palm of Barhy date palms during 2015 and 2016 seasons as affected with the application of N via inorganic, organic and EM is shown in Table (6).

Yield/ palm was significantly improved in response to amending the palms with N via 50 to 75% inorganic N + 25 to 50% plant compost and 50 to 100 ml EM relative to the application of inorganic N or plant compost each at 100% of N or when N was added via 25% inorganic N regardless organic and biofertilization. There was a progressive and significant promotion on the yield/ palm with reducing the percentages of inorganic N from 100 to 50 % and at the same time increasing the percentages

of plant compost from 0.0 to 50% and levels of EM from 0.0 to 100 ml / palm. A significant reduction on the yield was observed when the percentages of inorganic N was reduced from 50 to 25% regardless the application of organic and biofertilizers. Using inorganic N at 100% was significantly superior than using plant compost at 100% in improving the yield. Using EM at 50 to 200 ml/ palm besides inorganic and organic N was significantly necessary for improving the yield relative to the use of inorganic and organic fertilization alone. The maximum yield (223.2 & 224.0 kg) was presented in the palms that received N as 50% inorganic N + 50% plant compost + 100 ml/ palm during both seasons, respectively. The lowest yield (168.8 & 168.0 kg) was received on the palms that received N as 100% plant compost. The palms received N as 100% inorganic N gave yield/ palm reached 192.0 & 191.2 kg during both seasons, respectively. The percentages of increment on the yield produced from the use of N as 50%, inorganic N + 50 plant compost + 100 ml EM/ palm over the palms treated with N as 100% inorganic N alone reached 16.3 and 17.2 during both seasons, respectively. These results were true during both seasons.

Average bunch weight;

Data in Table (6) show the effect of using plant compost and Effective microorganisms as partial replacement of inorganic N on average bunch weight of Barhy date palms during 2016 and 2017 seasons.

It is evident from the obtained data that supplying Barhy date palms with N as 50 to 75% inorganic N + 25 to 50% plant compost with or without the use of EM at 50 to 100 ml/ palm significantly improved average bunch weight relative to the application of N completely as inorganic or plant compost as well as using N at 25% inorganic N regardless organic and biofertilization. The promotion on average bunch weight was significantly related to the reduction on the percentages of inorganic N from 100 to 50 % and at the same time increasing the percentages of plant compost from 0.0 to 50% and levels of EM from 0.0 to 100 ml / palm. Using EM at 50 to 200 ml/ palm besides organic and inorganic fertilization was significantly favourable than fertilization with plant compost and inorganic N alone. A significant reduction on average bunch weight was observed when inorganic N percentage reached 25% regardless the use of organic and biofertilization of N. The maximum bunch weight (27.9 & 28.0 kg) was recorded on the palms fertilized with N as 50 % inorganic N plus 50% plant compost and 100 ml EM/ palm during both seasons, respectively. The palms received N completely via inorganic N gave 24 & 23.9 kg bunch weight during both seasons, respectively. The lowest values (21.1 & 21.0 kg) of bunch weight was detected on the palms that received N as 100% plant compost. Similar trend was noticed during both seasons.

Some physical and chemical characteristics of the fruits

Data presented in Tables (7 to 9) show the effect of using plant compost and Effective microorganisms as partial replacement of inorganic N on weight, diameter and height of fruit, flesh/ seed and percentages of seed and flesh weights, T.S.S., reducing, total and non reducing sugars, titratable acidity, total crude fibre and total soluble tannins and fruit content of nitrate and nitrite (ppm) in the fruits of Barhy date palms during 2016 and 2017 seasons.

Physical characteristics of the fruits.

It is clear from the obtained data that supplying Barhy date palms with N via 50 to 75% inorganic N plus 25 to 50% plant compost + EM at 50 to 100 ml/ palm significantly was very effective in improving fruit characteristics in terms of increasing fruit weight and dimensions (diameter & height), fruit flesh weight % and flesh / seeds and reducing fruit seed weight % relative to the use of inorganic N or plant compost each at 100% of N as well as when inorganic N was added at 25% regardless organic and biofertilization. The promotion on fruit characteristics was significantly in proportional to the reduction on the percentage of inorganic N from 100 to 50% and at the same time increasing both percentages of plant compost from 0.0 to 50 % and levels of EM from 0.0 to 100ml / plant. The promotion was significantly depended on using EM at 50 to 200 ml/ palm besides organic and inorganic fertilization relative to the use of inorganic and organic fertilization alone. The application of N as 100% inorganic was significantly superior than using N as 100% plant compost. Adverse effects on fruit characteristics were noticed when inorganic N percentages was reduced from 50 to 25% regardless organic and biofertilizaiton. The best results were obtained when the palms were fertilized with N as 50% inorganic + 50% plant compost + 100 ml / EM / palm. The palms received N as 100% plant compost produced poorer fruit physical characteristics. These results were true during both seasons.

Chemical fruit characteristics

A significant promotion on chemical fruit characteristics was observed due fertilizing Barhy date palms with N as 25 to 75% inorganic N, 25 to 100% plant compost and EM at 50 to 200 ml/ palm relative to the use of N as 100% inorganic N. This promotion was appeared in terms of increasing T.S.S. and total, reducing and non- reducing and decreasing titratable acidity, total crude fibre, total soluble tannins and both nitrate and nitrite in the

fruit. There was a gradual and significant promotion on chemical fruit characteristics with reducing the percentages of inorganic N from 100 to 0.0 % and at the same time increasing percentages of plant compost from 0.0 to 100% and levels of EM from 0.0 to 200 ml/ palm. Using EM at 50 to 200 ml/ palm besides inorganic and organic fertilization significantly was responsible for promoting chemical fruit characteristics than using inorganic N plus plant compost alone. The best results were observed when the palms were fertilized with N as 100% plant compost. Unfavourable effects on chemical fruit characteristics were observed on the palms that fertilized with N as 100 % inorganic N. The lowest values of nitrate (0.6 & 1.5 ppm) and nitrite (0.40 & 0.50 ppm) were obtained on the palms that fertilized with N completely via plant compost during both seasons, respectively. The palms supplied with N as 100% inorganic N gave the highest values of nitrate (4.1 & 3.8 ppm) and nitrite (2.11 & 2.11 ppm) during both seasons, respectively. The percentage of decrement on nitrate due to application of 100% plant compost over the use of N as 100% inorganic N reached 85.4 and 86.8% during both seasons, respectively. In the case of nitrite, the percentage of decrement reached 81.0 and 76.3% during both seasons, respectively. Similar trend was noticed during both seasons.

Table (3): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on some vegetative growth aspects of Barhy date palms during 2016 and 2017 seasons.

Treatment	Pinnae area (cm)2		Number of pinnae / leaf		Leaf area $(m)^2$		Number of spines/ leaf		Spine length (cm)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	48.3	49.0	226.0	228.0	1.27	1.30	25.0	25.0	13.3	13.5
75 % inorganic N + 25% Compost	50.0	50.8	232.0	235.0	1.33	1.36	28.0	29.0	14.5	14.8
50 % inorganic N + 50% Compost	53.5	54.2	255.0	258.0	1.60	1.62	32.0	33.0	16.7	16.9
25 % inorganic N + 75% Compost	44.6	45.3	216.0	218.0	1.05	1.09	20.0	21.0	11.1	11.3
100% Compost	43.1	43.8	211.0	213.0	0.89	0.92	18.0	18.0	10.0	10.2
75% N+25% Compost + 50 ml EM/ palm	51.9	52.6	244.0	246.0	1.50	1.52	30.0	31.0	17.9	18.0
50% N+50% Compost + 100 ml EM/ palm	55.0	55.8	263.0	265.0	1.72	1.75	35.0	36.0	15.6	15.8
25% N+27% Compost + 200 ml EM/ palm	46.1	46.9	221.0	223.0	1.10	1.12	22.0	22.0	12.2	17.5
New L.S.D. 5%	1.1	1.2	3.0	2.9	0.07	0.08	2.0	2.0	0.9	0.8

Table (4): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on some photosynthetic pigments (mg / g F.W.) of Barhy date palms during 2016 and 2017 seasons.

Treatment	Chlorophyll a (mg/ g F.W.)		Chlorophyll b (mg/ g F.W.)		Total chlorophylls (mg/ g F.W.)		Total carotenoids (mg/ g F.W.)	
	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	3.3	3.0	1.0	1.0	4.3	4.0	1.1	1.2
75 % inorganic N + 25% Compost	3.9	3.9	1.4	1.5	5.3	5.4	1.4	1.5
50 % inorganic N + 50% Compost	4.4	4.5	1.8	1.9	6.2	6.4	1.8	1.8
25 % inorganic N + 75% Compost	4.8	5.0	2.2	2.3	7.0	7.3	2.2	2.1
100% Compost	5.4	5.5	2.5	2.6	7.9	8.1	2.5	2.5
75% N+25% Compost + 50 ml EM/ palm	6.0	5.9	2.8	2.9	8.8	8.8	2.9	2.8
50% N+50% Compost + 100 ml EM/ palm	6.6	6.6	3.0	3.0	9.6	9.6	3.2	3.1
25% N+27% Compost + 200 ml EM/ palm	7.1	7.0	3.3	3.3	10.4	10.3	3.5	3.6
New L.S.D. 5%	0.5	0.4	0.3	0.2	0.5	0.5	0.3	0.3

Table (5): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on the percentages of nitrogen, phosphorus, potassium and magnesium in the leaves of Barhy date palms during 2016 and 2017 seasons.

Treatment	Leaf N %		Leaf P %		Leaf K %		Leaf Mg %	
	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	1.51	1.49	0.222	0.194	1.11	1.09	0.55	0.57
75 % inorganic N + 25% Compost	1.59	1.60	0.233	0.206	1.16	1.15	0.64	0.66
50 % inorganic N + 50% Compost	1.67	1.67	0.250	0.218	1.21	1.20	0.73	0.75
25 % inorganic N + 75% Compost	1.72	1.72	0.261	0.230	1.27	1.26	0.82	0.84
100% Compost	1.77	1.78	0.271	0.245	1.32	1.32	0.91	0.93
75% N+25% Compost + 50 ml EM/ palm	1.82	1.83	0.282	0.261	1.36	1.35	1.00	1.02
50% N+50% Compost + 100 ml EM/ palm	1.87	1.88	0.293	0.274	1.40	1.39	1.09	1.11
25% N+27% Compost + 200 ml EM/ palm	1.93	1.94	0.306	0.285	1.44	1.44	1.19	1.21
New L.S.D. 5%	0.05	0.06	0.010	0.009	0.04	0.04	0.09	0.10

Table (6): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on the percentages of initial fruit setting and fruit retention, yield / palm and branch weight of Barhy date palms during 2016 and 2017 seasons.

Treatment	Initial fruit setting %		Fruit retention %		Yield/ palm (kg.)		Av. Bunch weight (kg.)	
	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	32.9	33.0	22.9	23.0	192.0	191.2	24.0	23.9
75 % inorganic N + 25% Compost	34.0	33.9	24.0	23.8	199.2	200.0	24.9	25.0
50 % inorganic N + 50% Compost	36.7	36.6	26.7	26.5	216.0	216.0	27.0	27.0
25 % inorganic N + 75% Compost	30.0	29.9	20.0	19.9	176.8	176.0	22.1	22.0
100% Compost	29.0	28.9	19.0	18.9	168.8	168.0	21.1	21.0
75% N+25% Compost + 50 ml EM/ palm	35.1	35.0	25.1	25.0	207.2	208.0	25.9	26.0
50% N+50% Compost + 100 ml EM/ palm	38.0	38.9	27.0	28.9	223.2	224.0	27.9	28.0
25% N+27% Compost + 200 ml EM/ palm	31.2	31.3	21.1	21.3	184.8	185.6	23.1	23.2
New L.S.D. 5%	1.0	0.9	0.8	0.7	6.9	7.1	0.9	0.8

Table (7): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on some physical characteristics of the fruits of Barhy date palms during 2016 and 2017 seasons.

Treatment	Av. Fruit weight (g.)		Av. Fruit diameter (cm.)		Av. Fruit height (cm.)		Fruit seeds weight %		Fruit flesh weight %	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	15.9	16.0	3.10	3.09	3.50	3.50	7.11	7.20	92.89	92.80
75 % inorganic N + 25% Compost	17.0	16.9	3.20	3.19	3.60	3.60	6.99	7.08	93.01	92.92
50 % inorganic N + 50% Compost	19.0	18.9	3.36	3.35	3.76	3.75	6.80	6.90	93.20	93.10
25 % inorganic N + 75% Compost	14.5	14.6	2.91	2.90	3.31	3.31	7.31	7.40	92.69	92.60
100% Compost	14.0	14.1	2.80	2.75	3.20	3.20	7.40	7.49	92.60	92.51
75% N+25% Compost + 50 ml EM/ palm	17.8	18.0	3.28	3.27	3.68	3.67	6.90	7.00	93.10	93.00
50% N+50% Compost + 100 ml EM/ palm	19.9	20.0	3.45	3.44	3.86	3.84	6.62	6.71	93.38	93.29
25% N+27% Compost + 200 ml EM/ palm	15.0	14.9	2.99	3.00	3.39	3.41	7.21	7.30	72.79	92.70
New L.S.D. 5%	0.5	0.4	0.08	0.07	0.08	0.06	0.07	0.06	0.06	0.05

Table (8): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on some physical and chemical characteristics of the fruits of Barhy date palms during 2016 and 2017 seasons.

Treatment	Flesh / seed		T.S.S. %		Total sugars %		Reducing sugars %		Non – reducing sugars %	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	13.1	12.9	24.1	24.3	20.5	20.4	18.5	18.7	2.0	1.7
75 % inorganic N + 25% Compost	13.3	13.1	24.7	25.0	21.0	21.2	19.0	19.2	2.0	2.0
50 % inorganic N + 50% Compost	13.7	13.5	25.4	25.8	21.6	21.8	19.3	19.5	2.3	2.3
25 % inorganic N + 75% Compost	12.7	12.5	26.0	26.5	22.3	22.4	19.7	19.9	2.6	2.5
100% Compost	12.5	12.6	29.5	29.9	25.5	25.6	21.7	22.0	3.8	3.6
75% N+25% Compost + 50 ml EM/ palm	13.5	13.3	28.0	27.8	23.6	23.7	20.5	20.6	3.1	3.1
50% N+50% Compost + 100 ml EM/ palm	14.1	13.9	28.5	28.9	24.3	24.4	20.9	21.0	3.4	3.4
25% N+27% Compost + 200 ml EM/ palm	12.9	12.7	29.0	29.4	25.0	25.1	21.3	21.6	3.7	3.5
New L.S.D. 5%	0.3	0.3	0.5	0.6	0.5	0.4	0.3	0.3	0.3	0.3

Table (9): Effect of using plant compost and effective microorganisms (EM) as partial replacement of inorganic N on some chemical characteristics of the fruits of Barhy date palms during 2016 and 2017 seasons.

Treatment	Titratable acidity %		Total crude fibre %		Total soluble tannins %		Furit content of nitrate (ppm)		Fruit content of nitrite (ppm)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
100% inorganic N	0.321	0.322	0.93	0.89	0.52	0.55	4.1	3.8	2.11	2.11
75 % inorganic N + 25% Compost	0.302	0.301	0.89	0.90	0.49	0.50	3.5	3.4	2.07	2.05
50 % inorganic N + 50% Compost	0.281	0.279	0.85	0.84	0.45	045	3.0	2.9	2.04	2.01
25 % inorganic N + 75% Compost	0.261	0.260	0.81	0.80	0.40	0.41	2.5	2.4	2.01	1.97
100% Compost	0.199	0.196	0.59	0.60	0.25	0.23	0.6	0.5	0.40	0.50
75% N+25% Compost + 50 ml EM/ palm	0.241	0.239	0.78	0.79	0.37	0.37	1.7	1.8	1.98	1.96
50% N+50% Compost + 100 ml EM/ palm	0.225	0.224	0.74	0.73	0.33	0.33	1.3	1.4	1.90	1.89
25% N+27% Compost + 200 ml EM/ palm	0.212	0.210	0.69	0.70	0.30	0.30	0.9	1.0	1.80	1.79
New L.S.D. 5%	0.013	0.012	0.02	0.02	0.2	0.2	0.4	0.4	8.02	0.03

4. Discussion

The beneficial effects of using plant compost on growth and fruiting of Barhy date palms might be attributed to its essential roles on enhancing both physical and chemical characteristics of the soil, N fixation, organic matter, biosynthesis of natural hormones such as IAA, cytokinins and GA_3, B vitamins and antibiotics, root development, availability of most nutrients, water retention, soil aggregation, soil exchange capacity and root development. Its action in reducing soil pH, salinity and different soil pathogens did not neglect in this respect (**Devlin and Withdam, 1983, Mengel, 1984; Nijjar, 1985; Mengel and Kirkby, 1987; Yagodin, 1990; Miller *et al.,* 1990; El- Haddad *et al.,* 1993; Chowdhury *et al.*, 1994; Wani and Lee, 1995; Marshner, 1995; Dahama, 1999,. Taiz and Zeigler 2002; Srivastava *et al.,* 2002, Irizar- Garza *et al.,* 2003 and Cabrera *et al.,* 2003**).

These results regarding the promoting effect of organic manures namely compost on growth, palm nutritional status, yield and fruit quality are in agreement with those obtained by **Abd El- Hameed and Ragab (2004); Mohamed and Ragab (2004); Gobara and Ahmed (2004); El- Salhy *et al.,* (2008); Morsi (2009); Saied (2011) and (2015); Saad *et al.,* 2011; Omar (2015); Abd El- Wahab (2017); Boghdady (2018) and Abd El- Kafy (2018).**

The promoting effect of EM on growth, palm nutritional status, yield and fruit quality of Barhy date palms might be attributed to its positive effect

on fixation of N and increasing the availability of most nutrients and soil organic matter, building of natural hormones, B vitamins and different antibiotics (**Subba- Rao, 1984; Higa, 1989; Higa and Wididana 1991 and 1991b, Higa and Konjo, 1991 and Kannaiyan, 2002**).

The beneficial effects of the biofertilizer effective microorganism on growth, palm nutrition status, yield and fruit quality of Barhy date palms are in concordance with those of **Pashoal *et al.*, (1999); Badran and Mohamed (2009); Roshdy *et al.*, (2011), Faraag (2013); Ibrahim and Gad El-Kareem (2014); Hassan – Huda (2014); Saied (2015); Abd El- Haleem – Sahar (2015) and Abdel Wahab (2017).**

Conclusion

For improving yield and fruit physical characteristics, it is suggested to fertilize Barhy date palms with N via 50% inorganic N plus 50% plant compost and 100 ml EM/ palm/ year. However, supplying the palms with N via 100% plant compost gave the better fruit chemical properties.

References

1. Abd El- Hameed, M. A. and Ragab, M. A. (2004): Response of Sewy date palm to application of some organic fertilizers. Abstract of the Second Inter. Conf, on Date Palm. Fac. of Agric., El- Arish Suez Canal Univ. Egypt. pp 100 - 120.
2. Abd El- Haleem- Sahar, A. (2015): Trials for improving productivity of the trees and reducing nitrite pollution in the fruits of Sukkary mango trees. M. Sc. thesis Fac. of Agric. Minia Univ. Egypt.
3. Abd El- Kafy, A.A.B. (2018): Effect of replacing inorganic N fertilizers partially using slow release N fertilizers as well as humic and fulvic acids on fruiting of Bartemuda date palms. Ph. D. Thesis Fgac. of Agric,. Minia Univ. Egypt.
4. Abd El-Wahab, A.Kh.M. (2017): Influence of replacement apart of inorganic nitrogen acid fertilizers by using humic acid and E.M. on fruiting of Sewy date palms. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
5. Ahmed, F. F and Morsy, M. H. (1999): A new method for measuring leaf area in different fruit species. Minia. J. of Agric.Res. & Dev.19: 97-105.
6. Association of Official Agricultural - Chemists (2000): Official Methods of Analysis 14th ed. (A. O. A. C.) Benjamin Franklin Station, Washington D. E. U.S.A., pp. 490-510.
7. Badran, M. A.F. and Mohamed, Y. A. (2009): Response of Williams banana plants to application of EM and yeast. Egypt. J. Agric. Res. 87 (1): 129- 140.
8. Black, C.V.; Evans, D.D.; Ersminger, L.E.; White, J.L. and Clark, F.E. (1965): Methods of Soil Analysis. Amer. Soc. Agron. Inc. Bull. Medison, Wisconsin, U.S.A. pp. 891- 1400.
9. Boghdady, H.A.A. (2018): Effect of using poultry manure enriched with *Spirulina platensis* algae as a partial replacement of mineral N fertilization on fruiting of Barhy date palms M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
10. Cabrera, O.; Valera- Garza, J. and Aguirre-Medina, J. F. (2003): Use of bio-fertilizers in agricultural crops in the central region of Mexico. Agricultural Tecnica en Mexico Institutro Nacional de Investigaciones Forestales, Agricolas pecuarias (INIFAP). 2: 213 - 225.
11. Chapman, H.D. and Pratt, P.F. (1975): Methods of Analysis for Soil, Plant and Water. Univ. of Calif. Division of Agric. Sci. 172 – 173.
12. Chowdhury, A. R.; Hossam, M. M.; Mia, M. S.; Karim, A. J.; Haider, J.; Bhuiyan, N. I. and Saifuddin. Kh. (1994): Effect of organic amendments on productivity of different crops in Bangladesh. p:155- 163. In J. F. Parr, S. B. Hornick, and M.E. Simpson (eds.). Proceeding of the Second International Conference on Kyusei Nature Farming. U.S. Department of Agriculture, Washington, DC. p.155-163.
13. Dahama, A. K. (1999): Organic Farming for Sustainable Agriculture. Agro, Botanica, Daryagun, New Delhi, India, P. 258.
14. Dammas, M. O. (1998): Fruit growth and receptivity of pistillate flowers pollination in two date palm cultivars (*Phoenix dactylifera* L.). M. Sc. Thesis, Fac. of Meteorology, Environment and Arid land Agri. King Abdel Aziz Univ., pp. 50 - 57.
15. Devlin, R. M. and Withdam, F. H. (1983): Plant Physiology. Renolds Book Corporation, New York (Chapter V).
16. El- Haddad, M. E; Ishae, Y. Z. and Mostafa, M. L. (1993): The role of biofertilizers in reducing agricultural costs, decreasing environment pollution and raising crops yield.Arab Univ. J. of Agric. Sci. Ain Shams Univ., Cairo, 1(1): 147-195.
17. El-Salhy, A. M.; Abdel-Galil, H.A.; El-Akkad, M.M. and Diab, Y.M. (2008): Effect of mineral and organic nitrogen fertilization on vegetative growth, yield and fruit characteristics of Sewy date palms. 3rd Inter. Conf. for Date palms Agric. Sci. and Environ. Fac. Suez Canal Univ.

25 – 27 April.
18. Faraag, M.H.A. (2013): Reducing the amount of chemical fertilization partially by using organic and biofertilization in Balady mandarin orchards. M. Sc. Fac. of Agric. Minia Univ. Egypt.
19. Gobara, A.A. and Ahmed, F.F. (2004): Response of Zaghloul date palms to application of some biofertilizers. 2nd Inter. Conf. on Date palm Suez Canal Univ., El- Arish 6-8 Oct. 2004.
20. Hassan- Huda, M.I. (2014): Impact of effective microorganisms and amino acids enriched with some nutrients on growth and fruiting of Valencia orange nutrients on growth and trees. Ph. D. Thesis Fac. of Agric. Minia Univ. Egypt.
21. Higa, T. (1989): Studies on the application of microorganisms in nature farming II. The practical application of effective microorganisms. 7th I.F.O.A.M. Conf., Quagadogou, Brkinafaso, West Africa.
22. Higa, Y. and Kinjo, S. (1991): Effect of lactic fermentation Higa, Y. and Kinjo, bacteria on plant growth and humus formation. p. 140-147. In J. F. Parr; S. B. Hornick aild C. E. Whitman (ed.) Proc. of the Ist Inter. Conf. on Kyusei Nature Farming U. S. Dept. of Agric., Washington, D. C. U.S.A.
23. Higa, Y. and Wididana, G. N. (1991a): The concept and theories of effective microorganisms. pp. 118 - 124 & In J. F. Parr; S.B. Hornick and C. E. Whitman (ed.)
24. Higa. Y. and Wididana, G. N. (1991b): Changes in the soil Microlr ora induced by effective microorganisms. pp.153- 163. J. FPan; S. B. Hornick and C. E. Whitman (ed.) Proc. of the I't Inter. Conf. on Kyusei Nature Farming, U. S. Dept. of Agric., Washington, D.C. U.S.A.
25. Hiscox, A. and Isralstam, B. (1979): A method for the extraction of chlorophyll from leaf tissue without maceration Ca. J. Bot. 57: 1332-1334.
26. Kannaiyan, S. (2002): Biotechnology of Biofertilizers Alpha Sci. Inter Ltd. P.O. Box 4067 Pang Bourne R. 68. M. K, pp.1- 275.
27. Ibrahim, W. M. A. (2012): Behavior of Taimour mango trees to inorganic and organic fertilization and application of EM. Ph. D. Thesis, Fac. of Agric. Minia Univ., Egypt.
28. Ibrahim, H.I.M. and Gad El- Kareem (2014): Response of Williams banana plants to organic and biofertilization of nitrogen versus inorganic fertilization. J. Bio. Chem. Environ. Sci. 9(1): 71-83.
29. Rrizar Garza, M.B.; Vargaqzuez, P.; Gaza Garcia, D.; Tuty. Cough, C.; Rojas Martinez, L; Trujillo compus, A.; Garcia Silva; Aguirre V Montoya D.; Martinez Gonzalez, J.C.; Alvarado Mendoza; S., Grageda Cabrera, O.; Valero Garza, J.; Aguirre and Medina, J.F. (2003): Use of biofertilizes in Agricultural crop in the central region of Mexico. Agric.,Tee. En Mexico, Instit. National de Investigations Mexico, 29 (2): 213 - 225.
30. Lane, J. H. and Eynon, L. (1965): Determination of reducing sugars by means of Fehlings solution with methylene blue as indicator A. O.A. C Washington D.C., U.S.A.
31. Marschner H. (1995): Mineral Nutrition of Higher Plants. Academic Press. (London).
32. Mead, R.; Currnow, R. N. and Harted, A. M. (1993): Methods in Agricultural and Experimental and Biology 2nd Ed Hall, London pp. 10-44.
33. Mengel, K. E. (1984): Nutrition and Metabolism of Plants. Fisher Verlage Stutgart and New York. pp. 110-115.
34. Mengel, K.E. and Kirkby, E. A. (1987): Principles of Plant Mengel, K. E. and Kirkby, Nutrition. Worblaufen- Bern Switzerland, international Potash Institute. p 10-20.
35. Miller, E. W.; Donahue, R. L. and Miller, J. U. (1990): Soils "An Introduction to Soils and Plant Growth. 5 ed. Prenticeo Hall International Inc. Engle word Cliffs, New Jersy, 303- 339.
36. Mohamed, A.Y. and Ragab, A. M. (2004): Response of Sewy date alms to application of some organic fertilizers. 2nd Inter. Conf. on Date palm, Suez Canal Univ., El- Arish 68 Oct. 2004.
37. Moreira, S. and Gurgel, J. A. (1941): Pollen fertility and its correlation with number of seeds in species and forms of the genus,citrus. Brogarntia, Saopaulo, 1: 669-711.
38. Morsi, M. E. (2009): Response of date palm Sewy cv. grown in new reclaimed land to organic and inorganic nitrogen sources Fayoum J. Agric. Res. & Dev. Vol. 33 No. (1):106-172.
39. Nijjar, G. S. (1985): Nutrition of Fruit Trees. Mrs. Usha Raj. Kumar for Kalyani Publishers, New Delhi, India, p. 10-52.
40. Omar, M.G.G. (2015): Response of Saidy date palms growing under New Valley conditions to some inorganic, organic and biofertilization as well as some antioxidant treatments. Ph.D. Thesis Fac. of Agric. Minia Univ. Egypt.
41. Paschoal-AD.; Senanayake- YDA; and Samuakkara- UR. (1999): Improved soil chemical and physical conditions and their relation to yield and fruit quality of oranges in a field under kyusei nature fanning and EM technology in Brazil. Fifth Inter. Con. on

Kyusei Nature fanning, Bangkok, Thailand, 23-26 October, 175-18 1.
42. Peach, K and Tracey, I.M.V. (1968): Modern Methods of Plant Analysis, Vol. 11 p. 37-38.
43. Piper, C. S. (1950): Soil and Plant Analysis. Inter Science- New York pp 48- 110.
44. Refaai, M.M.; Ahmed, F.F. and AI- Wasfy, M.M. (2012): Using of compost enriched with some microorganism strains as a partial replacement of mineral N fertilizers In Ewaise mango orchards. World Academy of Sci. Engineering and Technology 69-1647-1666.
45. Ridnour- Lisa, A.; Sim- Juliu, E.; Michael, A.H. David, A.W.; Sean, M.M.; Carry, R.B. and Douglas, R.S. (2000): A spectrophotometric methods for the direct detection and Quantitation of nitrite oxide, nitrite and nitrate in cell culture Media. Analytical Biochemistry, 281, 233-229.
46. Roshdy, Kk. A. Abdalla, B. M. and El-Kafrawy, A. A. (2011): Effect of EM on productivity of Taimour mango trees. Egypt J. of Appl. Sci. 26 (3): pp 128 - 139.
47. Saad. R.I.; Roshdy, Kh, A. and Abd El- Mgeed-Nagwa, A. (2011): Response of Zaghloul date palms grown in new reclaimed lands to application of organic and bio-nitrogen fertilizers. Alex. Sci. Exch. J. 31 (2): 121-129.
48. Saied, H.H.M. (2011): Effect of inorganic, organic and bio fertilization on growth, nutritional status, yield and fruit quality of Sakkoti date palms. M. Sc. Thesis Fac. of Agric. Minia Univ. Egypt.
49. Saied, H.H.M. (2015): Influence of replacing inorganic N fertilizer partial in Sakkoti date palm orchards by using some natural organic and bio stimulants. Ph.D. Thesis Fac. of Agric. Minia Univ, Egypt.
50. Snedecor GAV, and Cochran, G.W. (1980): Statistical Methods.7th Ed. Iowa State Univ. Press. Ames, Iowa, U.S.A 507.
51. Srivastava, A. K.; Shyam,S. and Marathe, R. A. (2002): Organic citrus soil fertility and plant nutrition. Sustainable Agric. Food Products Press., Binghamton USA, 19 (3): 5-29.
52. Steel, R. G. D. and Torrie, J. H. (1982): Principles and Procedures of Statistics. Mc Grow- Hill Inter. Book Company, 3rd Ed. London p. 633.
53. Subba-Rao, N. S. (1984): Biofertilizers in Agriculture. Oxford, IBH. Company, New Delhi, p 1-186.
54. Summer, M.E. (1985): Diagnosis and recommendation Integrated system (DRIB) as a guide to orchard fertilization. Hort. Abst. 55(8): 7502.
55. Taiz, A. and Zeiger, M. (2002): Plant Physiology, third Ed. 306 p. Academic press, London.
56. Von- Wettstein, D.V. (1957): Chlorophyll-Ithale under submikrosphpische formiuechrel der plastiden celi, Drp. Trop. Res. Amer. Soc. Hort. Sci., 20 pp. 427-433.
57. Wani, S. P. and Lee, K. K. (1995): Microorganisms as biological for sustainable agriculture In organic agriculture, theory and practices- (ed) P.K. Thamplan, Peekay Tree Crops Development Foundation, Gandhi Nagar Cochin 682 - 220, p. 36- 67.
58. Wilde, S. A.; Corey, R. B.; Layer, J. G. and Voigt, G. K. (1985): Soils and Plant Analysis for Tree Culture. Oxford, and 1131-1, publishing Co., New Delhi, pp. 96-106.
59. Yagodin, B. A. (1990): Agricultural Chemistry. Mir Publishers Moscow pp. 278-281.

2/16/2019