Available online free at www.futurejournals.org

The Future Journal of Horticulture

Print ISSN: 2692-5826 Online ISSN: 2692-5834

Future Science Association

Future J. Hort., 4 (2020) **18-23** **OPEN ACCES**

DOI: 10.37229/fsa.fjh.2020.12.26

EFFECT OF VARIOUS FERTILIZATION METHODS ON FRUIT QUALITY OF ZAGHLOUL DATE PALM

Zagzog, O. A. I.[1, *] and Mohamed I. Mousa[2]

[1]Plant Production Dept., Fac. Technology & Development, Zagazig Univ., **Egypt.**
[2]Tropical fruit Research Dept., Hort. Res. Inst., ARC, Giza, **Egypt.**

[*]**Corresponding author:** zagzog_1000@yahoo.com **Received:** 6 Nov. 2020 **; Accepted:** 26 Dec. 2020

ABSTRACT: The present study was carried out during 2017 and 2018 seasons on Zaghloul date palm cultivar (Phoenix dactylifera L.) grown in El Adlia, Blbas, Sharkia Governorate, Egypt. To evaluate effected of nine different fertilizer treatments1 - control (0.0 N), 2- full nitrogen (N) dose (100%) as mineral fertilizer (recommended rate 1000 g / date). 3- quarter organic fertilizers + 3/4 mineral. 4- half-N dose as organic fertilizers + half as mineral. 5- full N dose as organic fertilizer. 6- quarter organic fertilizers + 3/4 mineral + bio-fertilizers (EM). 7- half-N dose as organic fertilizers + half as mineral+ bio-fertilizers. 8- full N dose as organic fertilizer+ bio-fertilizers. 9- bio-fertilizer on yield and fruit quality Zaghloul date palm cultivar. Results showed that "generally" bio-fertilization treatment registered the highest values of bunch characters, bunch weight and yield/tree. The least values of bunch characters, bunch weight and yield/tree recorded by the control treatment. Fruit physical and chemical quality improved with full N dose as organic fertilizer + bio-fertilizers (EM) fertilizers.

Key words: Date palm, fertilizer, organic, bio-fertilizer, fruit properties

INTRODUCTION

Zaghloul is one of the very important local date cvs. In most Egyptian regions. Date palm needs additional mineral nutrients but also the application of organic matter to enhance water retention. Date palm (*Phoenix dactylifera* L.) was an important crop in arid and semi-arid regions of the world. Date palm is one of the ancient domestic fruit trees in the Middle East countries and their fruits play an important role in the nutrition pattern of many people. It has always played an important turn in the economic and social life of the people of these regions. Owing to date palm can grow and produce under a wide range of soil and climatic conditions, growers have mistakenly believed that it does not require much attention.

The successful orchard management practices directed toward obtaining a suitable yield with good fruit quality. Date fruits are very popular in the Arab and Islamic counties. Zaghloul is one of the very important local date cvs. In most Egyptian regions. It has well known that the nutrient requirements of the date palms could fulfilled through the fertilizers application for inter planted crops.

Inorganic and or organic fertilizers induced promoted the date palm fruit physical and chemical properties (**Hend, 2011; Marzouk and Kassem, 2011; Osman *et al*., 2011; Kahtani and Soliman, 2012; Elkhayat and Elnoam, 2013; Al-Wasfy *et al*., 2014; Amro *et al*., 2014 and Elsadig *et al*., 2017).** In addition, fertilization of evergreen trees with inorganic and or organic fertilizers were very effective in improving fruit physical and chemical properties **(Abd El- Rahman and Mansour, 2015; Ibrahim *et al*., 2015; Ennab, 2016; El-Shamma *et al*., 2017 Mohamed and Massoud, 2017 and Kirankumar *et al*., 2018).**

The present research work aims to provide the best-combined application of mineral, organic, and bio- fertilization that could use to gradually replace regular mineral fertilization

programs and the improve fruit quality of Zaghloul date palm cultivar by bio-organic nitrogen fertilization technique.

MATERIALS AND METHODS

This investigation carried out on the Zaghloul date palm cultivar in 2017 and 2018 seasons grown in loamy sandy soil under drip irrigation, at a private orchard in El Adlia Blbas, Sharkia Governorate, Egypt.

Soil samples were collected at (30 - 60 cm) depth from the experimental orchard. Soil analysis results shown in Table 1.

Table 1. Soil and compost analyses

Analyses	O.M. %	pH	EC ds/m	Soluble cations (meq/L)				Soluble anions (meq/L)			Elements (mg/kg)			
				Ca^{+2}	Mg^{+2}	Na^{+1}	k^{+1}	co^{-}_{3}	HCO_3^{-2}	SO_4^{-2}	N	P	K	Zn
Soil	**1.83**	**8.95**	**2.75**	**12.00**	**10.17**	**45.89**	**38.60**	**0.04**	**3.22**	**35.83**	**20.14**	**8.56**	**22.11**	**0.12**
Compost	**44.68**	**7.51**	**1.36**	**30.11**	**11.20**	**40.65**	**40.32**	**0.8**	**2.1**	**30.41**	**1500 ppm**	**50 ppm**	**8000 ppm**	**8.20 ppm**

Twenty- seven palms, as uniform as possible, randomly selected for the study, planted at 10 x 10 meters apart for this experiment. The experimental design in a randomized complete block design (RCBD) experiment divide to nine treatments with three replicates (one palm/replicate) for each treatment.

The tested treatments will be as follows:

1- Control (0.0 N).

2- Full N dose (100%) as mineral fertilizer (recommended rate = 1000 g).

3- Quarter organic fertilizers (17 kg compost) + 3/4 mineral.

4- Half-N dose as organic fertilizers (34 kg compost) + half as mineral.

5- Full N dose as organic fertilizer (68 kg compost).

6- Quarter organic fertilizers + 3/4 mineral + bio-fertilizers (EM).

7- Half-N dose as organic fertilizers + half as mineral+ bio-fertilizers (EM).

8- Full N dose as organic fertilizer+ bio-fertilizers (EM).

9- Bio-fertilizers (EM).

Soil application of EM bio-fertilizer 150 ml/palm (It has been obtained from Agricultural fertilizer unit, Ministry of Agriculture). Nitrogen fertilizers Amonium Sulphate (NH4) SO4 20.5 % N are divide into three doses apply on February 1st (before flowering, 50 ml EM and 1/2 nitrogen fertilizer), May, 1st (Cell division, 50 ml EM and 1/4 nitrogen fertilizer) and July, 1st (Cell elongation, 50 ml EM and 1/4 nitrogen fertilizer) in each season. The experimental palms immediately irrigated after treatments. Organic fertilizer as compost (mixture of rice straw and animal manure) was added before irrigation by scattering around the tree trunk during the first week of March (early spring). Organic fertilizer as compost (mixture of rice straw and animal manure) was added before irrigation by scattering around the tree trunk and stirring in soil during the first week of March (early spring).

Eight spathes on each palm pollinated and removed the other bunch during April in the two experimental seasons. The same pollen source used to pollinate the experimental palms during the two seasons of study.

Fruit physical characters

At harvest time, a sample of thirty fruits were taken at random from each replicate for determination of physical characteristics of date fruits including: fruits weight, pulp fresh weight and pulp flesh percentage was determined. In addition, fruit length (L) and diameter (D) (cm), fruit shape index (L/D) and pulp thickness (mm). In addition, seed weight (g), seed length (cm) and diameter (cm) were measured.

Fruit chemical characters

Chemical characteristics of date fruits including total soluble percentage (TSS %), titratable acidity percentage (TA %) and pH Also, TSS/acid ratio was calculated. The fruits

of each sample were washed with distilled water and the flesh was cut into small pieces by clean knife after peeling, then weight of 1 g from these pieces to determine total tannins (as fresh weight percentage). Total sugars of each fruit sample were extracted from 0.05 g dried material by 95% ethanol, then determined by phenol sulfuric method total sugars according to **Stewart (1974)** and soluble tannins were determined in each sample by **(A. O. A. C., 2006).**

Statistical analysis

Data was subject to the analysis of variance and the complete randomized design was used (**Steel and Torrie, 1980**). Mean separation was done using Duncan multiple range test at 0.05 % level.

RESULTS AND DISCUSSION

Fruit physical characters

Physical fruit characteristics of fruit weight (g), fruit length (cm), and fruit width (cm) increased in both years by different fertilizers treatments (Table 2). Highest values of fruit weight were recorded with bio-fertilizers (EM) treatment (29.2 g) in the first season and with full N dose as organic fertilizer+ bio-fertilizers treatment (30.0 g) and bio-fertilizers treatment (29.2 g) without significant them in the second season. Also, fruit length came from with full N dose as organic fertilizer+ bio-fertilizers treatment in the first season (6.17 cm) and with bio-fertilizers treatment (6.14 cm) in the second season without significant them. In addition, fruit width obtained with full N dose as organic fertilizer+ bio-fertilizers treatment (2.97 and 2.98 cm) in the two seasons. While, the least values of fruit weight, fruit length, and fruit width recorded by the control treatment (17.0 & 17.2 g, 3.34 & 3.34 cm and 1.18 & 1.13 cm in the two seasons, respectively).

Further, the results on the effect fertilizers treatments on seed weight (g), pulp thickness (cm) and TSS percentage presented in Table 3. Full N dose as organic fertilizer+ bio-fertilizers treatment recorded the highest values of seed weight (1.74 and 2.10 g) compared with control treatment recorded the least values (1.15 g in the two seasons). Where, half N dose as organic fertilizers + half as mineral+ bio-fertilizers registered the highest values of pulp thickness (0.98 and 0.99 cm in the two seasons) compared with control treatment (0.46 cm in the two seasons) recorded the least values. Bio-fertilizers (EM) treatment in the first season and full N dose as organic fertilizer+ bio-fertilizers treatment in the second season gave the highest TSS % in fruit (29.0 and 35.3 % respectively) compared with control treatment recorded the least values (19.7 % in the two seasons).

Table 2. Impact of mineral, organic and bio-fertilizers on fruit characters of Zaghloul date palm during 2017 and 2018 seasons

Characters / Treatments	Fruit weight (g)		Fruit length (cm)		Fruit width (cm)	
	2017	2018	2017	2018	2017	2018
Control	**17.0**	**17.2**	**3.34**	**3.34**	**1.18**	**1.13**
Full N Min.	**18.2**	**18.4**	**4.68**	**4.98**	**1.28**	**1.96**
1/4 Ora. + 3/4 Min.	**18.3**	**18.9**	**4.63**	**4.67**	**1.73**	**2.16**
1/2 Ora. + 1/2 Min.	**19.5**	**19.3**	**4.58**	**4.67**	**1.69**	**2.17**
Full Ora.	**22.6**	**23.3**	**4.58**	**5.67**	**2.56**	**2.94**
1/4 Ora. + 3/4 Min. + EM	**24.1**	**26.8**	**5.48**	**5.67**	**2.77**	**2.97**
1/2 Ora. + 1/2 Min. + EM	**24.4**	**26.2**	**5.92**	**5.60**	**2.96**	**2.93**
Full Ora. + EM	**26.2**	**30.0**	**6.17**	**5.36**	**2.97**	**2.98**
EM	**29.2**	**29.2**	**5.25**	**6.14**	**2.52**	**2.57**
LSD at 5%	**0.9**	**1.5**	**0.38**	**0.25**	**0.28**	**0.13**

Min. = mineral fertilizer (Sulphate Amonum 20.5 % N), Ora. = organic fertilizer 1.5 %N, EM = bio-fertilizers

Table 3. Impact of mineral, organic and bio-fertilizers on seed weight, pulp thickness and TSS of Zaghloul date palm during 2017 and 2018 seasons

Characters / Treatments	Seed weight (g)		Pulp thickness (cm)		TSS (%)	
	2017	2018	2017	2018	2017	2018
Control	1.15	1.15	0.46	0.46	19.7	19.7
Full N Min.	1.35	1.78	0.77	0.72	23.5	26.3
1/4 Ora. + 3/4 Min.	1.57	2.02	0.76	0.87	22.2	35.8
1/2 Ora. + 1/2 Min.	1.54	1.93	0.83	0.96	24.3	28.2
Full Ora.	1.61	1.64	0.92	0.97	27.0	25.7
1/4 Ora. + 3/4 Min. + EM	1.61	1.95	0.87	0.88	24.8	28.5
1/2 Ora. + 1/2 Min. + EM	1.54	1.91	0.98	0.99	28.8	31.7
Full Ora. + EM	1.74	2.10	0.92	0.94	27.7	35.3
EM	1.59	1.59	0.88	0.94	29.0	30.0
LSD at 5%	0.92	0.28	0.12	0.04	1.8	2.3

Min. = mineral fertilizer (Sulphate Amonum 20.5 % N), Ora. = organic fertilizer 1.5 %N, EM = bio-fertilizers

These results agreed with those reported on date palm by **Marzouk and Kassem (2011), Osman *et al.* (2011), Kahtani and Soliman (2012), Elkhayat and Elnoam (2013) and Amro *et al.* (2014)**, Also, on evergreen fruit trees by **Abd El- Rahman and Mansour (2015), Ennab (2016), El-Shamma *et al.* (2017) and Mohamed and Massoud (2017).**

Fruit chemical characters

Data of the fruit contents of tannins (mg/kg) and anthocyanin (mg/100g) of both years presented in Table 4. They showed highest values of tannins (mg/kg) was recorded with quarter organic fertilizers + 3/4 mineral + bio-fertilizers treatment (196.8 and 199.4 mg/kg) compared with bio-fertilizers treatment recorded the least values (180.5 and 178.8 mg/kg) in the two seasons. Quarter organic fertilizers + 3/4 mineral + bio-fertilizers treatment came from the highest values of anthocyanin (62.9 and 64.9 mg/100g) compared with control treatment recorded the least values (53.1 and 55.0 mg/100g) in the two seasons.

Table 4. Impact of mineral, organic and bio-fertilizers on fruit content of tannins and anthocyanin of Zaghloul date palm during 2017 and 2018 seasons

Characters / Treatments	Tannins (mg/kg)		Anthocyanin (mg/100g)	
	2017	2018	2017	2018
Control	184.1	183.1	53.1	55.0
Full N Min.	183.0	182.7	60.1	61.5
1/4 Ora. + 3/4 Min.	183.2	184.8	61.6	62.7
1/2 Ora. + 1/2 Min.	181.8	182.7	60.5	59.2
Full Ora.	193.2	193.6	56.7	59.8
1/4 Ora. + 3/4 Min. + EM	196.8	199.4	62.9	64.9
1/2 Ora. + 1/2 Min. + EM	192.6	190.4	60.0	61.5
Full Ora. + EM	182.8	184.6	57.3	59.3
EM	180.5	178.8	57.2	58.1
LSD at 5%	2.1	2.7	3.3	4.1

Min. = mineral fertilizer (Sulphate Amonum 20.5 % N), Ora. = organic fertilizer 1.5 %N, EM = bio-fertilizers

Data presented in Table 5 showed that test treatments of fertilizers were improvement fruit sugars content of Zaghloul date palm during 2017 and 2018 seasons. Especially, quarter organic fertilizers + 3/4 mineral + bio-fertilizers treatment resulted the highest values of reducing, non- reducing total sugar (24.3 & 26.2, 10.3 & 5.5 and 34.6 & 31.7 % in the two seasons, respectively) compared with half N dose as organic fertilizers + half as mineral treatment recorded the least values of reducing sugar (15.1 and 13.3 % in the two seasons). While, control treatment recorded the least values of non-reducing and total sugar (3.9 & 3.8 and 21.2 & 19.2 % in the two seasons, respectively).

Table 5. Impact of mineral, organic and bio-fertilizers on sugars content of Zaghloul date palm during 2017 and 2018 seasons

Characters / Treatments	Reducing sugar (%)		Non-reducing sugar (%)		Total sugar (%)	
	2017	2018	2017	2018	2017	2018
Control	**17.3**	**15.4**	**3.9**	**3.8**	**21.2**	**19.2**
Full N Min.	**17.5**	**16.0**	**4.7**	**4.2**	**22.2**	**20.2**
1/4 Ora. + 3/4 Min.	**18.1**	**17.6**	**7.3**	**4.8**	**25.4**	**2 2.4**
1/2 Ora. + 1/2 Min.	**15.1**	**13.3**	**6.6**	**5.3**	**21.7**	**18.6**
Full Ora.	**19.8**	**21.6**	**10.3**	**4.5**	**30.1**	**26.1**
1/4 Ora. + 3/4 Min. + EM	**24.3**	**26.2**	**10.3**	**5.5**	**34.6**	**31.7**
1/2 Ora. + 1/2 Min. + EM	**18.3**	**21.6**	**8.8**	**4.0**	**27.1**	**25.6**
Full Ora. + EM	**23.1**	**24.6**	**9.0**	**5.0**	**32.1**	**29.6**
EM	**20.6**	**23.9**	**10.1**	**4.7**	**30.7**	**28.6**
LSD at 5%	**3.5**	**5.1**	**2.0**	**1.4**	**2.9**	**4.2**

Min. = mineral fertilizer (Sulphate Amonum 20.5 % N), Ora. = organic fertilizer 1.5 %N, EM = bio-fertilizers

These findings were in line on date palm trees with **Marzouk and Kassem (2011), Osman *et al*. (2011), Hend (2011), Kahtani and Soliman (2012), Elkhayat and Elnoam (2013), Al-Wasfy *et al*., (2014) and Elsadig *et al*., (2017),** further, on evergreen and deciduous fruit trees by **Abd El- Rahman and Mansour (2015), Ibrahim *et al*., (2015), Ennab (2016), El-Shamma *et al*. (2017), Mohamed and Massoud (2017) and Kirankumar *et al.* (2018).**

Biofertilizers are biological preparations containing primary potent strains of microorganisms in sufficient numbers to increase the plant dry weight, leaf chlorophyll and net assimilation rate **(El- Gamal, 1996).** These microorganisms have a definite beneficial role in the fertility of rhizosphere soil. Application of mineral fertilizers with organic or bio-fertilizers proved to be highly effective in improving nutritional status, fruiting and fruit quality of various fruit trees (**Abd El-Migeed *et al*., 2006; Hegazi *et al*., 2007).** Supplying sufficient nutrition and using sound irrigation scheduling techniques should be high-priority management practices for every grower for expected yield and fruit quality. The most important management practices include irrigation, in addition to nitrogen, phosphorus, potassium, and magnesium nutrition. Some micronutrients, like zinc, boron and copper, can also affect fruit quality, but only if they are deficient in the soil and tree. In general, when any nutrient element is severely deficient, fruit yield and quality will be negatively affected **(Zekri *et al*., 2003**).

REFERENCES

A.O.A.C. (2006) Official Methods of Analysis of the Association of Official Agricultural Chemists. 12th ed, Washington, DC, USA.

Abd El- Rahman, M.M.A. and Mansour, A.E.M. (2015). mesponse of williams banana Plants to Application of EM1 and Yeast extract. Middle East J. Agric., 4 (2): 277-282.

Abd El-Migeed, M.M. M.; El-Ashry, S. and Gomaa, A. M. (2006). The integrated

fertilization of Thompson seedless grapevines with organic, bio-fertilizers, manures and low dose of mineral nitrogen. Rese. J. Agric. & Biol. Sci., 2(6): 460-466.

Al-Wasfy, M.M.M. and Abd El- Rahman, M.M.A. (2014). Reducing Inorganic N Fertilizer Partially in Hayany Date Palm Orchards by Using Animal and Chicken Manures. World Rural Observations, 6(1): 94-98.

Amro, S.M.S.; Omima, M.S. and Osama, H.M.G. (2014). Effect of Effective Microorganisms (EM) and Potassium Sulphate on Productivity and Fruit Quality of "Hayany" Date Palm Grown Under Salinity Stress. IOSR J. Agric. and Veterinary Sci., 7(6): 90-99.

El-Gamal, A.M. (1996). Response of tomato in new reclaimed areas to mineral nitrogen fertilizer levels and nitrogen fixing biofertilizer. Assuit J. Agric. Sci., 27: 89–99.

ElKhayat, H.M. and Elnoam, S.M. (2013). The use of bio-fertilizer to enhance fruit quality and productivity Zaghloul and Samani date palms. Alex. J. Agric. Res., 58(2): 131-140.

Elsadig, E.H.; Aljuburi, H. J.; Elamin, A.H.B. and Gafar, M.O. (2017). Impact of organic manure and combination of NPKS, on yield, fruit quality and fruit mineral content of Khenazi date palm (*Phoenix dactylifera* L.) cultivar. J. of Scientific Agric., 335-346.

El-Shamma, M.S.; Mona, E. M. Helal; Maksoud, M.A.; Fekria H. Khalil and Mansour, A.E.M. (2017). Effect of some bio - stimulants on nutritional status, yield and fruit quality of avocados. Middle East J. Agric. Res., 6 (3): 692-699.

Ennab, H.A. (2016). Effect of humic acid on growth and productivity of egyptian lime trees (*citrus aurantifolia* swingle) under salt stress conditions. J. Agric. Res. Kafr El-Sheikh Univ., A. Plant Production, 42(4): 494-505.

Hegazi E.S.; El-Sonbaty, M.R.; Eissa, M.A.; Ahmed, D.M. and El-Sharony, T.F. (2007). Effect of Organic and Bio-Fertilization on Vegetative Growth and Flowering of Picual olive Trees. World of Agri. Sci., 3(2):210 – 217.

Hend, A.M. (2011). Soil Fertilization Study on Zaghloul Date Palm Grown in Calcareous Soil and Irrigated with Drainage Water. American-Eurasian J. Agric. & Environ. Sci., 10(5): 728-736.

Ibrahim, H.I.M.; Mansour, A.E.M. and Merwad, M.A. (2015). Impact of Spraying Some Organic Manure Tea, Seaweed Extract and Royal Jelly on Fruiting of Keitt Mango Trees. Intern. J. Chem. Tech. Res., 8(4): 2131-2141.

Kahtani, S.H. and Soliman, S.S. (2012). Effects of organic manures on yield, fruit quality, nutrients and heavy metals content of Barhy date palm cultivar. African J. of Bio., 11(65): 12818-12824.

Kirankumar, K.H.; Shivakumara, B.S.; Ekabote, S.D. and Salimath, S.B. (2018). Effect of integrated nutrient management on quality and biochemical parameters of pomegranate cv. Bhagwa under central dry zone of Karnataka. Intern. J. Chem. Studies, 6(1): 05-06.

Marzouk, H.A. and Kassem, H. A. (2011). Improving fruit quality, nutritional value and yield of Zaghloul dates by the application of organic and/or mineral fertilizers. Scientia Hort., 127: 249-254.

Mohamed, Shaimaa A. and Massoud, O.N. (2017). Impact of Inoculation with Mycorrhiza and Azotobacter under Different N and P Rates on Growth, Nutrient status, Yield and Some Soil Characteristics of Washington Navel Orange Trees. Middle East J. Agric. Res., 6(3): 617-638.

Osman, S.O.; Moustafa, F.M. A.; Abd El-Galil, H.A. and Ahmed, A.Y.M. (2011). Effect of yeast and Effective Microorganisms (Em1) application on the yield and fruit characteristics of Bartamuda date palm under Aswan conditions. Assiut J. of Agric. Sci., 42(5): 332-349.

Steel, R.G. and Torrie, J.H. (1980). Principles and Procedures of Statistics McGraw-Hill Book Co. Inc., New York, 481.

Stewart, G.R. (1974). The role of proline accumulation in halophytes. Planta, 120(3): 279-289.

Zekri, M.; Obreza, T.A. and Koo, R. (2003). Irrigation, Nutrition and Citrus Fruit Quality. SL 207, Series of the Soil and Water Science Department, UF/IFAS Extension, University of Florida, Gainesville, Florida, USA. J. Fruit Sci., 34(2): 936- 1101.