

Effect of Organic and Bio-fertilization on Growth and Fruiting of Sakkoty Date Palm

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Abstract

The beneficial effects of organic manure singly or combined with mineral-N (min.) and bio-fertilizers (bio.) on growth, nutritional status, yield and fruit quality of Sakkoty date palm grown in Research farm of Agricultural research station at Kom Ambo, Aswan Governorate, Egypt, were studied during the two successive seasons 2019 and 2020. The experimental palms were arranged in complete randomized design with six treatments and three replications one palm per each.

It is evident from the obtained results that applying organic-N either alone or combined with mineral-N (double form), as well as mineral-N and bio-fertilization (triple form) was very effective in improving growth and nutritional status as well as yield and dates quality compared to fertilization with mineral nitrogen only. Fertilizing with triple form (min., organic and bio.) gave the highest values of the studied traits compared to other fertilization treatments.

So, the study suggested that using triple form (30% mineral-N, 35% organic and 35% bio-fertilization improved the vegetative growth yield and dates quality. In addition, it reduced environmental pollution problems.

Keywords: *Organic, Bio-fertilizers, growth, fruit quality, date palm.*

Introduction

The date palm is one of the most important fruit crops that has been a source of nutrition and shelter against harsh condition. In many desert areas, dates have been used as a staple food for hundreds of years. Dates are a rich source of sugars and numerous minerals that are necessary for life and essentially required for good health (Mertz, 1981 and Wrigley, 1995). Egypt is considered to be one of the major date producing countries in the worlds (FAO, 2014). Date palm is grown in both Nile Valley and desert districts in Egypt. Aswan ranked the fourth position among the Egyptian Governorates. Dry date palm cultivars covered all the acreage

of total cultivated in Aswan governorate.

Sakkoty date palm is the major dry date palm grown under Aswan condition. Poor yield of Sakkoty date palm grown under Aswan region is considered a problem. This is attributed to unbalancing nitrogen nutrition. The main cause of the problem may be due to the use of over mineral-N application that is considered as air, soil and water polluting agents (Devlin and Withdam, 1983 and El-Salhy, 2004). Adjusting inorganic N fertilization partially by using organic manures enriched with bio-fertilization is necessary to overcome this problem (Verna, 1990 and Russa and Berlyn, 1990).

Nitrogen fertilization is one of the important tools to increase the fruiting of yield in fruit trees. The efficiency of nitrogen fertilizer under field conditions and surface irrigated soils rarely exceeds 50% and is usually ranged between 30 and 40% (Sahrawat, 1979). Low efficiency may be due to losses of N from soils as nitrate and nitrite by leaching or going up as nitrogen gases through nitrate reduction by volatilization. So, many problems were caused, such as nitrate pollution of ground water and environment. On the other side, these huge amounts of chemicals depress the activities of both nitrogen fixation bacteria and phosphorus bacteria which only work, actively, at low concentration of these substances (Kannaiyan, 2002). In addition, they can alter the composition of fruits, vegetables and root crops and decrease their contents of vitamins, minerals and other useful compounds. There is a very great danger that harmful residues may remain in food (Bogatyre, 2000).

So, organic fertilization for fruit crops became in the last few decades a good alternative to chemical fertilization to depress pollution in the environment and to produce a safe and nutritive food that is good for health (Nijjar, 1985 and Miller *et al.*, 1990). In addition, the growers apply organic and bio-fertilizer to improve soil physical, chemical and biological properties as well as to increase nutrient availability (Yagodin, 1984; Darwish *et al.*, 1995; El-Salhy 2004 and Subba Rao, 2004). The use of organic materials as N source has been

considered as a best management because organic N is released to the trees more gradually than water soluble inorganic N fertilizers (Nijjar, 1985). Similarly, soil fertility can be managed using organic fertilizers, crop rotation and association along with composting and recycling of the organic matter (Kenny and Hassan, 2006).

Many investigators emphasized the importance of the organic and bio-fertilization to increase the growth and fruiting of date palm trees (Abdel-Hameed and Ragab, 2004; El-Assar, 2005; El-Salhy *et al.*, 2008; Alwasfy and El-Khawaga, 2008; Osman, 2009; Ahmed *et al.*, 2011; Saad *et al.*, 2011; Abou-Baker, 2015; Omar, 2015; El-Sayed *et al.*, 2016; Abdel-Kafy, 2018 and Sayed-Maryam, 2018).

So, the objective of this investigation was to study the possibility of using organic or bio-fertilization partially instead of completed mineral fertilization on growth and fruiting of Sakkoty date palm.

Materials and Methods

The experiment was carried out during two successive growing seasons 2019 and 2020 on 35 years old Sakkoty date palms. The selected palms were grown in Research farm in Agricultural research station that located at Kom Ambo, Aswan Governorate, Egypt. The laboratory work was conducted in Regional Agricultural Research Station of Aswan. The texture of the soil is silty clay. Analysis of the soil was done according to Wilde *et al.* (1985) and the obtained data are given in Table (1).

Table 1. Mechanical, physical and chemical analysis of the tested orchard soil.

Characters	Values	Characters	Values
Particle size distribution		P (ppm Olsen method)	20.00
Sand %	10.60	K (ppm ammonium acetate)	419.00
Silt %	58.00	Mg (ppm)	79.00
Clay %	31.40	S (ppm)	6.90
Texture grade	Silty clay	B (ppm hot water extractable)	0.27
pH (1:2.5 extract)	8.00	EDTA extractable micronutrients (ppm)	
E.c (1:2.5 extract) mmhos/1cm/25°C	0.91	Zn	1.31
Organic matter %	2.09	Fe	11.00
CaCO ₃ %	1.22	Mn	10.18
Macronutrients values		Cu	1.60
Total N%	0.11		

Eighteen healthy palms nearly similar in growth vigour were selected. Regular agricultural practices except nitrogen fertilization were carried out as usual. The leaf/bunch ratio was adjusted at the end of the blooming season to meet their value of 8:1. Artificial pollination was uniformly performed in respect of source, date and method.

The experiment involved six treatments representing various levels of nitrogen fertilization (inorganic and bio-organic). Each treatment except the checked treatment was under the same recommended N level of 1000 g N/palm/year, as shown in Table (2).

Table 2. The amount of nitrogen in organic, bio-mineral-form applied in the studied treatments.

Treatment (F)		The amount of fertilization					Total N/palm (g)
		Inorganic fertilizer		Organic fertilizer		Bio-	
		Amount/palm (kg)	Net N/palm (g)	Amount/Palm (kg)	Net N/palm (g)	Net N/palm (g)	
1- 0.0% min. +100% org.	T ₁	0.0	0.0	240	1000	--	1000
2- 50% min. +50% org.	T ₂	2.330	500	120	500	--	1000
3- 25% min. +25% org. + 50% bio.	T ₃	1.165	250	60	250	500 g	1000
4- 30% min. + 35% org. + 35% bio.	T ₄	1.400	300	84	350	350 g	1000
5- (100% min-N)	T ₅	4.660	1000	0.0	0.0	--	1000
6- 50% min. (farm treatment, control)	T ₆	2.330	500	0.0	0.0	-	500

Nitrogen in mineral source is used as ammonium sulphate form (21.5% N) while organic-N was added as farmyard manure (0.42% N). Farmyard manure was added in one dose in two exchangeable holes, 1 m apart from palm trunk in December. Ammonium sulphate was applied

at three equal batches in March, May and July of each season.

Nitrobien is a commercial bio-fertilizer was mixed with moist sand and added in soil holes around the trunk of palm, then irrigated immediately. Nitrobien was applied at two

equal batches on the middle of February and May.

The design of the experiment was completely randomized with three replicates, one palm per each.

The following parameters were determined to evaluate the effects of different fertilization treatments on growth, nutrient status and fruiting.

1- Vegetative growth:

Average number of newly grown leaves was counted at the end of growing season. In addition, four mature leaves (fronds) around fruiting zone (each embracing a bunch) were chosen on each palm to determine, leaf length (m). Four pinnae were taken from the middle part of each leaf to determine pinnae area (cm²) as follows:

leaflet area = (length x maximum width x 0.84) according to Shabana and Antoun (1980). Then, the whole leaf area (m²) was determined from multiplying the leaflet area by the number of leaflets/leaf.

2- Percentage of N, P and K in leaf:

Samples of pinnae from each replicate were collected at mid of November. The pinnae were washed with tap water, distilled water, air-dried, oven-dried at 70°C to constant weight. The dry material was ground in a stainless well and 0.2 g of each sample was digested using concentrated sulphuric acid and 30% hydrogen peroxide for overnight, percentage of N, P and K (on dry weight basis) were determined in the digested solution according to Wilde *et al.* (1985).

3- Yield and its components:

A- The spathe number of each date palm was recorded at the end of blooming season.

B- Fruit retention:

It was calculated at harvest from number of fruits harvested divided by total number of fruits set and multiplied by hundred using the following equations:

$$\text{Fruit retention (\%)} = \frac{\text{Number of retained fruits on the strand}}{\text{Number of retained fruit} + \text{Number of flowers scars}} \times 100$$

C- Bunch weight and yield/palm:

At the harvest time, bunches of each palm were picked and weighed, then the yield/palm (kg) was recorded.

4- Fruit characteristics:

Sample of 50 fruits were taken randomly from each replicate to determine some physical and chemical properties.

A- Physical characteristics:

These characteristics included the determination of fruit weight, fruit dimension, flesh percentage, flesh thickness and fruit moisture percentage.

B – Chemical characteristics:

These characteristics included, total soluble solids (TSS), sugar contents and total acidity of fruit juice as outlined in A.O.A.C. (1995).

All the obtained data were tabulated and analyzed to the proper statistical analysis according to Gomez and Gomez (1984) and Snedecor and Cochran (1990). The differences between treatment means were compared by Duncan's multiple range test at 5% level of probability to Duncan (1955).

Results

1 - Vegetative growth:

It is evident from the data in Tables (3 and 4) that organic-N form either alone or combined with mineral-N and bio-forms significantly increased the growth traits, i.e. leaf length and area of leaflet and leaf, then significantly increased the total

leaf surface area per palm. Moreover, all combined forms as well as organic fertilization significantly increased the leaf N, P and K percentage compared to fertilization with 100 or 50% of nitrogen doses as mineral-N only.

The highest values of leaf area and leaf mineral contents were recorded on the palms that were fertilized with triple form (25-30 mineral, 25-35% organic and 35-50 bio-form, T₃, T₄). On other hand, the least values of these studied traits were recorded on palm that fertilized with 50% mineral-N (farm treatment, T₆). The highest leaf area was 2.44 & 2.33 m² and leaf-N was 1.84 & 2.08% due to the triple form use (25% m, 25% organic and 50% bio-form, T₃) during the two studied seasons, respectively. Contrarily, the least values for leaf area were 1.88 & 1.77 m², 2.16 & 2.03 m² and leaf N were 1.36 & 1.48% and 1.53 & 1.75% on the

palms treated with 50% mineral-N (T₆) and 100% mineral N (T₅) during the two studied seasons, respectively. Hence the increment percentage of leaf area were 29.79 & 31.64%, 12.96 & 14.78% and leaf N % were 35.29 & 40.54% and 20.26 & 18.86% due to fertilization with triple form (25% m, 25% org. and 50 bio-form) compared to fertilization with 50% or 100% mineral-N during the two studied seasons, respectively. No significant differences were found due to fertilization with either organic alone, double (50% m and 50 organic) or triple forms, whereas, there is a significant difference between using 100% or 50% mineral-N. The best results with regard to growth and nutritional leaf of Sakkoty date palm were obtained due to its fertilization with the triple form either 25 m + 24 org + 50% bio (T₃) or 30 m, 35% org. and 35% bio-form (T₄).

Table 3. Effect of different nitrogen fertilization sources on vegetative growth of Sakkoty date palm during 2019 and 2020 seasons.

		No. of New leaves		Leaf length (m)		No. of leaf-let/leaf		Leaflet area (cm ²)	
		2019	2020	2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T₁)	32.0 A	30.0 A	3.46 A	3.33 A	206 A	205 A	118.4 A	113 A
2- 50% min. +50% org.	(T₂)	32.4 A	31.6 A	3.58 A	3.40 A	210 A	205 A	114.8 A	110.2 A
3- 25% min. +25% org. + 50% bio.	(T₃)	31.6 B	29.8 A	3.32 A	3.15 B	206 A	204 A	113.9 A	114.7 A
4- 30% min. + 35% org. + 35% bio.	(T₄)	33.0 B	30.9 A	3.48 A	3.32 A	202 A	199 A	116.5 A	112.6 A
5- (100% min-N)	(T₅)	31.2 A	29.8AB	3.46 A	3.28 A	205 A	201 A	105.3 B	100.8 B
6- 50% min. (farm treatment, control)	(T₆)	25.43 B	24.67 B	3.12 B	2.88 C	190 B	191 B	97.9 C	92.44 C
L.S.D.		2.25	2.18	0.18	0.15	11.7	10.25	6.8	7.5

Means with different letters are significantly different at P<0.05.

Table 4. Effect of different nitrogen fertilization sources on leaf area, N%, P% and K% of Sakkoty date palm during 2019 and 2020 seasons.

		Leaf area (m ²)		N%		P%		K%	
		2019	2020	2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T ₁)	2.39 A	2.29 A	1.67B	1.88B	0.210 A	0.227AB	1.13 A	1.20 A
2- 50% min. +50% org.	(T ₂)	2.41 A	2.26 A	1.87 A	2.04 A	0.213 A	0.234AB	1.16 A	1.22 A
3- 25% min. +25% org. + 50% bio.	(T ₃)	2.35 A	2.33 A	1.84 A	2.08 A	0.220 A	0.239A	1.16 A	1.23 A
4- 30% min. + 35% org. + 35% bio.	(T ₄)	2.44 A	2.21 A	1.82 A	2.03 A	0.218 A	0.241 A	1.18 A	1.22 A
5- (100% min-N)	(T ₅)	2.16 B	2.03 B	1.53 C	1.75 C	0.189 B	0.216 B	1.03 B	1.12 B
6- 50% min. (farm treatment, control)	(T ₆)	1.88C	1.77 C	1.36 D	1.48 D	0.146 C	0.165 C	0.88 C	1.02 C
L.S.D.		0.14	0.15	0.08	0.09	0.013	0.018	0.06	0.07

Means with different letters are significantly different at P<0.05.

2- Yield and its components:

As shown in Table (5) fertilizing Sakkoty date palm with organic N form either alone or combined with bio and mineral-N form significantly increased the number of inflorescences born/palm, fruit set and the heavy bunch weight and consequently the yield/palm. The significantly higher values of bunch weight and yield/palm were obtained from the palms that received all amounts of N in triple form (organic plus bio and mineral sources). Whereas, the minimum values of bunch weight and yield/palm were related to the palms that were supplied by 100% mineral (N) (T₅) or 50% mineral-N (checked treatment, T₆).

Also, data in the prementioned table indicated that the fertilization with triple form significantly increased the bunch weight and yield/palm compared to the use of organic only or double form (organic and mineral-N). Fertilization with 100% mineral-N significantly increased the bunch weight and yield/palm compared to using 50% mineral-N (checked treatment).

The recorded heaviest yield were 171.50 & 176.30 kg/palm and 172.80 & 176.20 kg/palm due to fertilization by any triple form (T₃ or T₄) during the two studied seasons, respectively. Contrarily these values on palm that fertilized with 100% mineral were 152.5 & 100.66 kg/palm and 111.65 & 64.66 kg/palm on checked palm that fertilized with 50% mineral-N during the two studied seasons. Then, the corresponding increment percentage due to the use of triple form over 100% mineral-N were 12.46 & 75.14 and 13.31 & 85.04% and checked ones attained 53.61 & 172.66 and 54.77 & 172.50% during the two studied seasons, respectively.

In general terms, it seems that the fertilization in either the organic, double or triple forms leads to an increase in the yield and its regularity. In addition, these treatments induce a reduction of the difference between the number of inflorescences and yield in the two studied seasons compared to fertilization via mineral-N only that causes decrease of the yield and high variation in production between the two studied seasons.

Table 5. Effect of different nitrogen fertilization sources on yield components of Sakkoty date palm during 2019 and 2020 seasons.

		No. of bunches		Fruit set %		Bunch weight (kg)		Yield/palm (kg)	
		2019	2020	2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T ₁)	23.6A	17.8 B	28.6B	25.3B	6.80 B	8.15B	165.50A	145.0 B
2- 50% min. +50% org.	(T ₂)	24.5A	18.6AB	28.9B	24.8B	6.90 B	7.93B	169.00A	147.50B
3- 25% min. +25% org. + 50% bio.	(T ₃)	23.5A	19.0A	32.1A	27.4 A	7.30AB	9.28A	171.50A	176.30A
4- 30% min. + 35% org. + 35% bio.	(T ₄)	23.2A	19.8A	31.4A	25.92A	7.45 A	8.86A	172.8 A	176.20A
5- (100% min-N)	(T ₅)	24.6A	14.0 C	26.8C	20.3C	6.20 C	7.19C	152.50B	100.66C
6- 50% min. (farm treatment, control)	(T ₆)	20.3A	10.6D	25.6C	18.95C	5.50 D	6.10D	111.65C	64.66 D
L.S.D.		N.S.	1.32	1.68	1.56	0.53	0.63	9.81	8.92

Means with different letters are significantly different at P<0.05.

3 - Fruit quality:

Data presented in Tables (6, 7 and 8) declared that using all amounts of nitrogen dose in either organic source or combined with bio and mineral source was accompanied with improving fruit weight, dimension and flesh percentage. Their effects produce the heaviest fruit weight with no effect on seed weight and consequently increasing its thickness and flesh percentage. The heaviest fruit weights were recorded on palms that received the fertilization via triple form, T₃ (8.28 & 11.85 g) and T₄ (8.53 & 12.25 g), whereas, the lightest fruit weights were found on palms that received the fertilization via 100% mineral T₅ (7.40 & 9.83 g) and 50% mineral, T₆ (6.70 & 7.20 g) during the two studied seasons. Hence, the increment percentage of fruit weight due to the use of triple form with 100% mineral was 11.89 & 20.55 and 15.27 & 24.62% and over 50% mineral was 23.58 & 64.58 & 27.31 & 70.14% during the two studied seasons, respectively. There is no significant differences in such traits due to any triple form, or-

ganic alone or double form. Whereas, using 100% mineral significantly increased these traits compared to 50% mineral (check treatment).

Moreover, fertilization with either organic, double or triple forms was accompanied with improving the quality of dates in terms of raising total soluble solids and sugars contents and in reducing the moisture and total acidity percentage. The highest improvement of these traits of fruit quality was associated with using the triple form. The highest total soluble solids (85.0 & 82.8%) and total sugars (67.23 & 64.15%) were recorded in dates of the palm that received the fertilization via triple form (25% min, 25% organic and 50% bio-form, T₃, against the least ones (65.8 & 66.9%) and (54.11 & 52.24%) on 50% mineral (checked treatment) during the two studied seasons, respectively. Then, the increment percentage of TSS were 29.18 & 23.77% and total sugars were 24.25 & 22.80% due to using triple form compared to the checked ones during the two studied seasons, respectively.

The best results with regard to yield and fruit quality were obtained as a result of supplying the palms with 25% mineral 35% organic and 35% bio-form nitrogen dose/palm.

Table 6. Effect of different nitrogen fertilization sources on some physical properties of Sakkoty dates during 2019 and 2020 seasons.

		Fruit weight (g)		Flesh (%)		Fruit length (cm)		Fruit diameter (cm)	
		2019	2020	2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T ₁)	7.78B	10.85B	87.83A	88.60AB	4.88 B	5.47 B	1.86 B	1.90B
2- 50% min. +50% org.	(T ₂)	7.92B	11.69A	88.22A	89.34 A	4.91 B	5.54AB	1.98 A	1.88B
3- 25% min. +25% org. + 50% bio.	(T ₃)	8.28A	11.85A	88.39A	89.89 A	5.12AB	5.76 A	1.89 B	1.85B
4- 30% min. + 35% org. + 35% bio.	(T ₄)	8.53A	12.25A	87.80A	89.25 A	5.26 A	5.82 A	1.90 B	1.96A
5- (100% min-N)	(T ₅)	7.40C	9.83 C	85.28B	86.15 B	4.65 C	5.14 C	1.78 C	1.76C
6- 50% min. (farm treatment, control)	(T ₆)	6.70D	7.20D	83.68B	85.22 B	4.31 D	4.62 D	1.64 D	1.68D
L.S.D.		0.32	0.59	2.31	2.48	0.21	0.28	0.06	0.05

Means with different letters are significantly different at P<0.05.

Table 7. Effect of different nitrogen fertilization sources on flesh thickness, fruit moisture and TSS of Sakkoty dates during 2019 and 2020 seasons.

		Fruit thickness (cm)		Fruit moisture %		TSS %	
		2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T ₁)	0.32 A	0.44 C	5.67 C	7.27 C	83.8 AB	80.7 A
2- 50% min. +50% org.	(T ₂)	0.32 A	0.47 B	5.15 D	6.83 D	86.0 A	81.0 A
3- 25% min. +25% org. + 50% bio.	(T ₃)	0.31 B	0.44 C	4.83 D	6.75 D	85.0 A	82.8 A
4- 30% min. + 35% org. + 35% bio.	(T ₄)	0.33 A	0.49 A	5.44 C	7.22 C	85.5 A	79.5 A
5- (100% min-N)	(T ₅)	0.29 C	0.38 D	6.63 B	8.95 B	81.5 B	75.9 B
6- 50% min. (farm treatment, control)	(T ₆)	0.28 C	0.35 E	8.35 A	9.85 A	65.8 C	66.9 C
L.S.D.		0.02	0.02	0.28	0.32	2.86	3.13

Means with different letters are significantly different at P<0.05.

Table 8. Effect of nitrogen fertilization source on sugar contents, acidity of Sakkoty dates during 2019 and 2020 seasons.

		Total		Reducing %		Non reducing`		Acidity	
		2019	2020	2019	2020	2019	2020	2019	2020
1- 0.0% min. +100% org.	(T ₁)	66.88A	63.18A	32.83A	30.86A	34.05 B	32.32AB	0.26 C	0.23 C
2- 50% min. +50% org.	(T ₂)	68.93A	63.85A	33.48A	30.65A	35.45 A	33.20 A	0.25CD	0.23 C
3- 25% min. +25% org. + 50% bio.	(T ₃)	67.23A	64.15A	32.93A	31.27A	34.30AB	32.86AB	0.24 D	0.21DE
4- 30% min. + 35% org. + 35% bio.	(T ₄)	68.21A	62.84A	33.29A	30.68A	34.92AB	32.17 B	0.23 D	0.20 E
5- (100% min-N)	(T ₅)	64.63B	60.20B	31.54B	29.45B	33.13 B	30.75 C	0.28 B	0.26 B
6- 50% min. (farm treatment, control)	(T ₆)	54.11C	52.24C	27.18C	27.57C	26.93 C	24.67 D	0.30 A	0.27A
L.S.D.		2.15	2.08	1.25	1.11	1.19	0.98	0.01	0.01

Means with different letters are significantly different at P<0.05.

Discussion

Nitrogen fertilization is one of the important tools to increase fruit trees yield. It plays a key role in nutrition of fruit trees that is a necessary element for chlorophyll, protoplasm and nucleic acids (Nijjar, 1985). The promotion on growth and nutritional status in response to application of organic-N and bio-fertilizers mainly may be attributed to their positive action on increasing the activity of micro flora, water holding capacity, soil structure, soil aggregation, organic matter, soil humus content and the availability of most nutrients. Also, such findings might be attributed to the effect of organic manure and bio-fertilizers on increasing the soil acidity, reducing the loss of nutrients with drainage water and enhancing the availability of nutrients in the soil. As well as, it can provide most nutrients to palm along the whole growth season. Such stimulation on the uptake of nutrients leads to enhancing the biosynthesis of organic foods and cell division (Yagodin, 1984; Miller *et al.*, 1990; Kannainyan, 2002 and Yang *et al.*, 2019).

It could be concluded that organic-N either alone or accompanied with inorganic and bio-N forms is beneficial to improve the growth and nutritional status of palms.

So, one can say that amending either by organic N only treatment or organic combined with bio plus mineral increased the yield components and regulated the annual yield. These results emphasized the vital importance of using organic manure as well as bio-fertilization in order to improve the bunch born, fruit set per-

centage and bunch weight. Increasing the yield might be due improving the flower bud formation and fruit retention as well as decreasing the fruit drop as a response of organic manure and bio-form application.

There more, improvement of dates in terms of increasing total soluble solids and decreasing the moisture contents and total acidity due to organic nitrogen application either alone or combined with bio plus mineral nitrogen sources could be ascribed to a good balance between growth and fruiting and could be a result of accumulating more carbohydrates that makes them very available for enhancing ripening of dates.

These effects are very important in dates production since the improvement on dates quality is the most important target that induce an increase in packable yield and price.

Current study showed that fertilization with organic and bio-fertilizers significantly increased the leaf area for about 30% of leaf nitrogen for 37%. Moreover, these fertilization applications significantly increased yield/palm for about 50% and fruit weight for 26% as well as significantly improved total soluble solids for about 26% and total sugars about for 23%. Thus these treatments lead to increase the yield with good fruit quality which lead to the increase in packable yield.

These results are in agreement with those obtained by Abdel-Hameed and Ragab (2004), El-Assar (2005), El-Salhy *et al.* (2008), Alwasfy and El-Khawaga (2008), Ahmed *et al.* (2011), Saad *et al.* (2011),

Abou Baker (2015), Omar (2015), El-Sayed *et al.* (2016), Sayed-Maryam (2018) and Abdel-Kafy (2018). They reported that using organic and bio-fertilizers could improve the growth aspects followed by a gradual increase of the yield and improving the fruit quality of different palm date cultivars.

Conclusion

On the account of the present results, it could be concluded that fertilization the palms with triple form via 25-30 mineral-N and 25-35 organic along with 50-35% bio-form was very effective in improving the growth and nutritional status, as well as yield and fruit quality of Sakkoty date palm under the circumstance of this study. Additionally, it improves soil properties and reduces environmental pollution which could be occurred by excess of chemical fertilizers.

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تأثير التسميد العضوي والحيوي علي نمو وإثمار نخيل البلح السكوتي

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الملخص

أجريت هذه الدراسة خلال موسمين متتاليين هي ٢٠١٩ ، ٢٠٢٠ علي نخيل البلح السكوتي المنزرعة بالمرزعة البحثية لمركز البحوث الزراعية - كوم أمبو - أسوان، حيث التربة الطينية الطميية. ويهدف البحث إلي إلقاء المزيد من الضوء علي تأثير التسميد العضوي والحيوي علي النمو الخضري والحالة الغذائية وكذلك المحصول وخصائص الثمار حيث تم إحلال السماد العضوي بنسبة ١٠٠-٢٥% بالإضافة للأسمدة الحيوية بنسبة ٣٥-٥٠% من الجرعة السمادية المضافة للأشجار المقدره ١٠٠٠ جم نيتروجين/نخلة. بينما كانت معاملة المقارنة هي ٥٠٠ جم/نخلة وهي المعاملة التي تجري بالمرزعة. وقد أوضحت النتائج:

- تسبب استخدام التسميد العضوي فردياً أو خلطياً مع السماد المعدني أو مع السماد المعدني والأسمدة الحيوية زيادة معنوية في مساحة الأوراق ومحتواها من عناصر النيتروجين والفوسفور والبوتاسيوم مقارنة باستخدام الأسمدة المعدنية سواء ١٠٠٠ أو ٥٠٠ جرام/نخلة.
- أدي استخدام ١٠٠٠ جم معدني/نخلة زيادة معنوية في الصفات الخضرية والثمارية مقارنة باستخدام ٥٠٠ جرام معدني فقط.
- أدي التسميد في الصورة العضوية (فردياً) أو الثنائية (عضوي + معدني) أو الثلاثية (عضوي + معدني + حيوي) إلي زيادة معنوية في وزن السباطات والمحصول/نخلة مع تحسين خصائص الثمار من حيث وزن الثمرة - نسبة اللحم - وسمك اللحم - وكذلك الصفات الكيميائية من حيث المواد الصلبة الكلية ومحتواها من السكريات مقارنة بالتسميد المعدني فقط.
- أوضحت النتائج أن استخدام الصورة الثلاثية (معدني + عضوي + حيوي) لتسميد نخيل البلح السكوتي سببت تحسين النمو الخضري وزيادة المحصول وخصائص الثمار مع تقليل التلوث البيئي الناشئ عن استخدام الأسمدة الكيميائية.