

Effect of Spraying Seaweed Extract on Fruiting of Sakkoti Date Palms

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Abstract: This study was carried out during 2017 and 2018 seasons to examine the effect of spraying seaweed extract once, twice, or thrice at 0.05 to 0.2 % on some vegetative growth characteristics, nutritional status of the palms, yield and fruit quality of Sakkoti date palms. Treating the palms once, twice or thrice with seaweed extract at 0.05 to 0.2% was accompanied with enhancing all growth characteristics, total chlorophylls, total carotenoids N, P, K and Mg, initial fruit setting %, fruit retention %, yield, bunch weight as well as physical and chemical characteristics of the fruits over the check treatment. The promotion on these parameters was in proportional to the increase in concentrations and number of sprays. All characteristics were unaffected by increasing concentrations from 0.1 to 0.2% and frequencies from twice to thrice. The best results with regards to yield and fruit quality of Sakkoti date palms grown under Aswan region were obtained due to treating the palms twice with seaweed extract at 0.1%.

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1. Introduction

Recently, many attempts were carried out for using seaweed extract to promote the yield and fruit quality of Sakkoti date palms.

Seaweed extract contains great amounts of nutrients, amino acids, antioxidants, vitamins natural, hormones and plant pigments.

It is also beneficial for increasing the tolerant of plants to all stresses (James, 1994).

Previous studies showed that using seaweed extract at various concentrations and frequencies had an announced promotion on growth and fruiting of all evergreen fruit crops (El- Sawy, 2005; Gamal, 2006; Mouftah, 2007; El- Sayed- Esraa, 2010; Merwad *et al.*, 2011; Abdelaal *et al.*, 2012; Mahmoud, 2012; Ahmed *et al.*, 2013a and 2013b; Mohamed and El- Sehrawy, 2013; Gamal, 2013; Ahmed *et al.*, 2014; Abd El- aaty 2015 and Ahmed *et al.*, 2015).

The target of this study was elucidating the effect of different concentrations and frequencies of seaweed extract on growth characteristics, palm nutritional status, flowering, fruit setting yield and fruit quality of Sakkoti date palms.

2. Material and Methods

This study was conducted during 2017 and 2018 seasons on a private ate palm orchard situated at Edfu district Aswan Governorate on 18- years old Sakkoti date palms (as dry date palm cv.) these palms produced through conventional propagation by offshoots as well as characterized by regular bearing. The selected palms are uniform in vigour,

healthy, good physical conditions, free from insects, diseases and damages. They planted at 7x7 meters apart (86 palms/ feddan). The selected palms were irrigated with Nile water through surface irrigation system. The texture of the soil in sandy loam.

Table (1): Analysis of the tested soil

Characters	Values
Clay %	9.0
Silt %	21.0
Sand %	70.0
Texture	Sandy loam
pH (1: 2.5 extract)	8.50
E.C. (1: 2.5 extract) mmhos/1 cm	0.75
Organic matter %	1.2
Total CaCO ₃ %	10.1
N %	22.0
P%	3.3
K%	80.0
Ca %	71.0
Mg %	5.0
Zn ppm	2.1
Fe ppm	1.8
Mn ppm	0.9
Cu ppm	0.7

Hand pollination was achieved by inserting five male strands into the centre of one female spathe. all the selected Sakkoti date palms received the common and usual horticultural practices that already applied in the orchard except those dealing

with of seaweed extract bunches/ palm was adjusted to ten bunches.

This study included the following ten treatments from different concentrations and frequencies of seaweed extract.

- 1- Control (palm sprayed with water).
- 2- Spraying seaweed extract once at growth start and before hand pollination at 0.05%.
- 3- Spraying seaweed extract twice at growth start and before hand pollination at 0.05%.
- 4- Spraying seaweed extract thrice at growth start and before hand pollination at 0.05%.
- 5- Spraying seaweed extract once at growth start and before hand pollination at 0.1 %.
- 6- Spraying seaweed extract twice at growth start and before hand pollination at 0.1 %.
- 7- Spraying seaweed extract thrice at growth start and before hand pollination at 0.1 %.
- 8- Spraying seaweed extract once at growth start and before hand pollination at 0.2 %.
- 9- Spraying seaweed extract twice at growth start and before hand pollination at 0.2 %.
- 10- Spraying seaweed extract thrice at growth start and before hand pollination at 0.2 %.

Each treatment was replicated three times one date palm per each. Seaweed extract was easily soluble in water and it was dissolved in triton B as a wetting agent at 0.1% before application.

The selected palms received one spray at growth start (last week of Feb.), twice at the same previous date and again just after fruit setting (last week of Mar.) or thrice at the same previous two dates and at one month after fruit setting (last week of Apr).

Randomized complete block design (RCBD) was followed in included three replicates one palm per each.

During both seasons, the following parameters were recorded:

- 1- Vegetative growth characteristics namely leaflet area (cm)² (Ahmed and Morsy, 1999), length and width of leaf (m) number of leaflet / leaf, leaf area (m)² and spine length (cm).
- 2- Leaf chemical composition namely total chlorophylls and total carotenoids (mg/ 100 g F.W.) (Von- Wettstein, 1957) as well as leaf content of N, P, K and Mg (as %) (Cottenie *et al.*, 1982).
- 3- Percentages of initial fruit setting and fruit retention, bunch weight (kg.) and yield / palm.
- 4- Physical and chemical characteristics of the fruits namely weight, height, diameter of fruit, T.S.S. %, total sugars %, titratable acidity % crude fibre % and total soluble tannins%. (A.O.A.C., 2000)

Statistical analysis was done according to (Mead *et al.*, 1993) using mew L.S.D. at 5% for comparing among the different treatment means.

Table (2): Shows the analysis of seaweed extract according to (James., 1994).

Character	Values
Moisture %	6.0
O.M. %	45- 60
Inorganic matter %	45- 60
Protein %	6-8
Carbohydrates %	5-50
Aliginic acid %	10-20
Mannitol %	4-7
Total N %	1.0-1.5
P ^o	0.02-0.09
K %	1.0- 1.2
Ca %	0.2-1.5
S %	3-9
Mg %	0.5-0.9
Cu ppm	1.0-6.0
Fe ppm	50-200
Mn ppm	5-12
Zn ppm	10-100
B ppm	20-100
Mo ppm	1-5
Cytokinins %	0.02
IAA %	0.03
ABA %	0.01

3. Results

1-Vegetative growth characteristics:

Data in Table (3) clearly show that treating Sakkoti date palms once, twice or thrice with seaweed extract at 0.05 to 0.2% significantly was accompanied with stimulating the eight growth characteristics namely leaflet area, length and width of leaf, number of leaflet/ leaf, leaf area and spine length over the control treatment. There was gradual stimulation on these growth aspects with increasing concentrations form 0.1 to 0.2 % and frequencies from once to thrice. Increasing concentrations from 0.1 to 0.2 % and frequencies from twice to thrice had meaningless promotion on these growth traits.

The maximum values of these characteristics were recorded on the palms that treated three times with seaweed extract at 0.2%. The untreated palms produced the lowest values. These results were true during both seasons.

2- Leaf chemical components:

Data in Table (4) clearly show that varying concentrations and frequencies of seaweed extract had significant differences on the leaf content of N, P, K and Mg as well as total chlorophylls and total carotenoids. Carrying out one, two to three sprays of seaweed extract at 0.05 to 0.2% significantly was responsible for enhancing all chemical components rather than non application.

Table (3): Effect of spraying seaweed extract on some growth characteristics of Sakkoti date palms during 2017 and 2018 seasons.

Treatments	Leaflet area (cm) ²		Leaf length (m)		Leaf width (m)		No. of leaflet per leaf		Leaf area (m) ²		Spine length (cm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	119.1	120.8	4.00	4.15	0.25	0.26	158.1	159.8	1.80	1.85	9.10	9.20
Seaweed extract at 0.05 % once	121.4	123.1	4.14	4.29	0.31	0.34	162.9	164.6	1.88	1.93	9.21	9.31
Seaweed extract at 0.05 % twice	123.8	125.5	4.25	4.40	0.38	0.39	167.0	168.5	1.98	2.02	9.38	9.48
Seaweed extract at 0.05 % thrice	124.1	125.8	4.27	4.42	0.40	0.41	168.0	169.5	1.99	2.04	9.40	9.50
Seaweed extract at 0.1 % once	127.1	128.8	4.65	4.80	0.44	0.45	170.0	171.5	2.07	2.12	9.55	9.59
Seaweed extract at 0.1 % twice	129.8	131.5	4.75	4.92	0.52	0.53	174.0	175.0	2.18	2.23	9.70	9.80
Seaweed extract at 0.1 % thrice	130.1	131.8	4.77	4.94	0.54	0.55	178.0	180.0	2.20	2.26	9.72	9.82
Seaweed extract at 0.2 % once	127.4	129.1	4.76	4.83	0.46	0.43	175.0	175.0	2.10	2.16	9.68	9.79
Seaweed extract at 0.2 % twice	130.1	131.9	4.76	4.94	0.55	0.56	178.0	180.0	2.21	2.27	9.73	9.82
Seaweed extract at 0.2 % thrice	130.4	132.1	4.78	4.95	0.56	0.57	179.0	181.0	2.22	2.29	9.80	9.90
New L.S.D. at 5%	2.1	2.0	0.05	0.06	0.03	0.04	2.0	2.1	0.07	0.09	0.09	0.11

Table (4): Effect of spraying seaweed extract on some growth characteristics and some leaf pigments of Sakkoti date palms during 2017 and 2018 seasons.

Treatments	Total chlorophylls (mg/ 100 g F.W.)		Total carotenoids (mg/ 100 g F.W.)		Leaf N %		Leaf P %		Leaf K %		Leaf Mg %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	8.2	8.0	1.9	2.1	1.68	1.71	0.14	0.14	1.15	1.21	0.44	0.46
Seaweed extract at 0.05 % once	8.4	8.1	2.3	2.5	1.75	1.80	0.20	0.21	1.21	1.28	0.50	0.51
Seaweed extract at 0.05 % twice	8.7	8.9	2.7	2.8	1.83	1.89	0.22	0.26	1.24	1.33	0.54	0.55
Seaweed extract at 0.05 % thrice	8.9	9.1	2.8	2.9	1.84	1.91	0.23	0.28	1.30	1.34	0.56	0.57
Seaweed extract at 0.1 % once	9.3	9.7	2.9	3.0	1.92	1.97	0.25	0.29	1.32	1.39	0.59	0.60
Seaweed extract at 0.1 % twice	9.9	10.4	3.3	3.4	2.00	2.07	0.28	0.30	1.33	1.41	0.63	0.64
Seaweed extract at 0.1 % thrice	10.3	10.7	3.4	3.5	2.02	2.09	0.29	0.30	1.31	1.42	0.64	0.65
Seaweed extract at 0.2 % once	9.9	10.3	3.1	3.2	1.96	2.02	0.27	0.29	1.35	1.45	0.61	0.62
Seaweed extract at 0.2 % twice	10.5	10.8	3.5	3.6	2.03	2.09	0.30	0.31	1.37	1.46	0.66	0.68
Seaweed extract at 0.2 % thrice	10.7	10.9	3.6	3.7	2.06	2.10	0.31	0.32	1.38	1.47	0.68	0.69
New L.S.D. at 5%	0.3	0.4	0.3	0.3	0.06	0.05	0.02	0.03	0.03	0.04	0.03	0.03

The promotion on these chemical components was in proportional to the increase in concentrations and frequencies of seaweed extract application.

Increasing concentrations of seaweed extract from 0.1 to 0.2% and frequencies from twice to thrice

failed to show significant promotion on these chemical traits.

The highest values were recorded on the palms that treated with seaweed extract thrice at 0.2% the untreated palms produced the lowest values. These results were true during both seasons.

3- Percentages of initial fruit setting and fruit retention, yield / palm and bunch weight.

It is evident from the data in Table (5) that treating Sakkoti date palms once, twice or thrice with seaweed extract at 0.05 to 0.2% significantly was followed by improving the percentages of initial fruit setting and fruit retention, yield / palm and bunch weight relative to the control treatment.

There was a gradual promotion on such parameters with increasing concentrations and frequencies of seaweed extract. Meaningless promotion was observed on the percentages of initial fruit setting and fruit retention, yield/ palm and bunch weight among the higher two concentrations namely 0.1 to 0.2% and frequencies from twice to thrice. Therefore, it is suggested to use two sprays of seaweed extract at 0.1 % for promoting the yield. Under such promised treatment, yield/ palm reached 109 and 110 kg while the untreated palms produced 95 and 96 kg during both seasons respectively. The

percentage of increment on the yield due to using the previous promised treatment over the check treatment reached 14.7 and 14.6% during both seasons, respectively.

4- Physical and chemical characteristics:

Data in Table (5, 6) obviously reveal that treating Sakkoti date palms once, twice or thrice with seaweed extract at 0.05 to 0.2% significantly was very effective in improving fruit quality in terms of increasing weight, height and diameter of fruit, T.S.S. % and total sugars % and decreasing the percentages of titratable acidity, crude fibre and total soluble tannins relative to the check treatment. The promotion on both physical and chemical characteristics of the fruits was related to the increase in concentrations and frequencies of application. Negligible promotion on all fruit quality parameters were observed among the higher two concentrations (0.1 and 0.2%) and frequencies (twice or thrice). Therefore, from economical point of view, the best results on these quality parameters were observed on the palms that received two sprays of seaweed extract at 0.1% unfavorable effects on fruit quality were detected on the untreated trees. Similar results were recorded during both seasons.

Table (5): Effect of spraying seaweed extract on the percentages of initial fruit setting and fruit relation, bunch weight and yield, fruit weight and height of Sakkoti date palms during 2017 and 2018 seasons.

Treatments	Initial fruit setting %		Fruit retention %		Bunch weight (kg.)		Yield/ palm (kg)		Fruit weight (g.)		Fruit height (cm)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	50.5	51.0	28.2	29.0	9.5	9.6	95.0	96.0	9.0	9.0	4.01	4.03
Seaweed extract at 0.05 % once	51.8	52.0	30.0	30.6	9.8	9.9	98.0	99.0	9.13	9.17	4.15	4.17
Seaweed extract at 0.05 % twice	52.9	53.1	31.5	32.0	10.2	10.4	102.0	104.0	9.27	9.31	4.22	4.32
Seaweed extract at 0.05 % thrice	54.0	55.0	31.7	32.3	10.5	10.6	105.0	106.0	9.28	9.32	4.31	4.35
Seaweed extract at 0.1 % once	54.2	55.5	35.0	35.9	10.6	10.8	106.0	108.0	9.41	9.45	4.45	4.45
Seaweed extract at 0.1 % twice	56.3	56.9	36.3	37.9	10.9	11.0	109.0	110.0	9.56	9.60	4.50	4.61
Seaweed extract at 0.1 % thrice	58.5	59.5	36.6	38.0	11.2	11.4	112.0	114.0	9.58	9.62	4.62	4.71
Seaweed extract at 0.2 % once	57.5	57.9	35.5	37.5	10.7	11.0	107.0	110.0	9.42	9.45	4.48	4.50
Seaweed extract at 0.2 % twice	59.0	60.0	36.7	38.0	11.5	11.6	115.0	116.0	9.58	9.63	4.60	4.70
Seaweed extract at 0.2 % thrice	60.1	61.1	36.9	38.3	11.8	12.0	118.0	120.0	9.60	9.66	4.68	4.75
New L.S.D. at 5%	1.3	1.2	1.1	1.2	0.5	0.5	4.5	4.7	0.11	0.12	0.11	0.11

Table (6): Effect of spraying seaweed extract on some chemical characteristics of Sakkoti date palms during 2017 and 2018 seasons.

Treatments	Fruit diameter (cm)		T.S.S. %		Total sugars %		Titratable acidity %		Crude fibre %		Total soluble tannins %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Control	1.88	1.89	68.2	69.0	60.6	61.2	0.390	0.380	1.94	1.93	0.68	0.65
Seaweed extract at 0.05 % once	1.95	1.97	68.8	70.0	61.1	61.7	0.370	0.350	1.74	1.72	0.61	0.59
Seaweed extract at 0.05 % twice	2.01	2.03	69.0	71.0	61.8	62.5	0.350	0.340	1.63	1.61	0.58	0.56
Seaweed extract at 0.05 % thrice	2.03	2.05	71.0	71.5	62.0	62.7	0.345	0.330	1.61	1.59	0.53	0.52
Seaweed extract at 0.1 % once	2.11	2.12	71.5	71.9	62.2	63.1	0.320	0.315	1.50	1.48	0.51	0.49
Seaweed extract at 0.1 % twice	2.20	2.22	72.4	72.6	62.8	63.5	0.295	0.290	1.38	1.37	0.48	0.46
Seaweed extract at 0.1 % thrice	2.21	2.24	72.0	72.3	63.0	63.7	0.291	0.288	1.37	1.35	0.46	0.44
Seaweed extract at 0.2 % once	2.12	2.13	71.6	72.0	62.9	63.6	0.290	0.285	1.47	1.45	0.49	0.50
Seaweed extract at 0.2 % twice	2.25	2.26	71.8	72.2	63.5	63.9	0.280	0.278	1.36	1.34	0.44	0.41
Seaweed extract at 0.2 % thrice	2.30	2.31	72.0	72.5	64.0	64.5	0.275	0.270	1.35	1.31	0.41	0.39
New L.S.D. at 5%	0.05	0.06	0.5	0.5	0.3	0.4	0.018	0.016	0.04	0.03	0.04	0.03

4. Discussion

The previous promotive effect of seaweed extract on growth characters, palm nutritional status, yield and fruit quality might be attributed to its higher own content from natural plant hormones namely IAA, GA₃ and cytokinins that are responsible for enhancing cell division, glutathione, lecithin, vitamins, 60 nutrients and 21 amino acids, also, seaweed extract plays an important role in enhancing the biosynthesis of all organic foods, plant pigments and antioxidants seaweed extract is also responsible for enhancing the resistance of palms to all stresses (James, 1994; and Spinelli *et al.*, 2009).

These results are in harmony with those obtained by (El- Sawy, 2005; Gamal, 2008; Mouftah, 2007; El- Sayed- Esraa, 2010; Merwad *et al.* 2011; Abdelaal *et al.*, 2012 Mahmoud 2012; Ahmed *et al.*, 2013a and 2013b; Mohamed and El-Sehrawy, 2013; Gamal, 2013; Ahmed *et al.*, 2014; And El- aaty 2015 and Ahmed *et al.*, 2015).

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