

Effect of Spraying Seaweed Extract and Potassium Silicate on Growth and Fruiting Of Al-Saidey Date Palms

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Abstract: This study was conducted during 2013 and 2014 seasons to examine the effect of single and combined applications of seaweed extract and/or potassium silicate each at 0.0-0.4% on leaf area, palm nutritional status, yield and fruit quality of Al-Saidey date palms grown under New Valley environmental conditions. The selected palms received three sprays from each biostimulant. Treating the palms three times with seaweed extract and/or potassium silicate each at 0.05-0.4% was very effective in improving leaf area, total chlorophylls, N, P, and K, yield and fruit quality over the check treatment. The promotion was materially associated with increasing concentrations. Meaningless promotion on these characters was observed with increasing concentrations of both materials from 0.2 to 0.4%. The best results with regard to yield and fruit quality of Al-Saidey date palms grown under New Valley conditions were obtained due to spraying the palms three times with a mixture of seaweed extract and potassium silicate each at 0.2%.

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Introduction

Low yield of Al-Saideydate palms grown under sandy soil is considered a major problem that faces growers. Finding out recent techniques for promoting yield without causing any environmental pollution is an important task for pomologists. Investigation on compounds capable of reducing the sensitivity of fruit crops to all stresses and at the same time to unfavourable conditions are of great importance from the practical point of view.

Silicon plays an important role in increasing and enhancing withstanding of fruit crops to biotic and abiotic stresses, photosynthesis, nutrient and water uptake, plant pigments and all cell division (Epstein, 1999 and Ma, 2004).

Previous studies exhibited that using all sources of silicon was very effective in improving yield and fruit characteristics in various fruit crops (Gad El-Kareem (2012), Al-Wasfy (2014), El-Khawaga (2014), El-Khawaga and Mansour (2014), Gad El-Kareem *et. al* (2014) and Abd El-Wahab (2015)).

The application of seaweed extract which contains most nutrients, organic compounds, enzymes, vitamins antioxidants, amino acids and natural hormones is fast becoming an accepted practice. It increases yield quantitatively and qualitatively in various fruit crops (Soliman *et al.*, 2000 and Khan *et al.*, 2009).

The results of Abdelaal *et al.*, (2012), Mahmoud (2012), Gamal (2013), Abd El-Aaty (2015) and Eshmawy(2015) supported the beneficial

effects of using seaweed extract on fruiting in different fruit crops.

The objective of this study was to test the effect of different concentrations of seaweed extract and potassium silicate on fruiting of Al-Saidey date palms grown under New Valley environmental conditions.

Material and Methods

This study was conducted during 2013 and 2014 seasons in a private date palm orchard situated at Mochia city, El-Dakhla district New Valley Governorate on seventy five 15-years old Al-Saidey date palms (semi-dry date palm cv.). The selected palms are uniform in vigour healthy, good physical conditions, free from insects, diseases and damages. They are planted at 7 x 7 meters apart (86 palms/ feddan). The selected palms were irrigated with well water (600 ppm) through surface irrigation system. The texture of the soil is sandy clay (Table 1).

Hand pollination of all the selected palms was achieved by inserting five fresh male strands into the center of each female spathe using the same source of pollens (Al-Saidey date palms males) to avoid residues of metaxenia. Every bunch was bagged after pollination by white paper bags which were tied at the ends using a piece of cotton for aeration. The bags were shaken lightly to ensure pollens distribution and they were removed after one month. Number of bunches per palm was adjusted to ten bunches and leaf bunch ratio was maintained at 8:1 (Hussein *et al.*, 1989).

Table (1): Analysis of the tested soil.

Characters	Values
Practical size distribution	
Clay %	7.5
Silt %	11.0
Sand %	81.5
Texture	Sandy
pH (1: 2.5 extract)	8.80
E.C. (1: 2.5 extract) mmhos / 1 cm / 25°C	0.75
Organic matter %	1.2
Total CaCO ₃ %	20
Available macronutrients (ppm)	
N	22.0
P	3.3
K	80.0
Ca	71.0
Mg	5.0
DPTA extractable available micronutrients (ppm)	
Zn	2.1
Fe	1.8
Mn	0.9
Cu	0.7

Each selected palm received the common horticultural practices that are already applied in the orchard except those dealing with foliar application of seaweed extract and potassium silicate.

This study included two factors (A & B). the first factor (A) comprised from five concentrations of seaweed extract namely a1) 0.0, a2) 0.05 %, a3) 0.1, a4) 0.2 and a5) 0.4%. The second factor (B) contained five concentrations of potassium silicate namely b1) 0.0, b2) 0.05%, b3) 0.1%), b4) 0.2% and b5) 0.4%. Therefore, this experiment included twenty five treatments from single and combined applications of seaweed extract and potassium silicate. Seaweed extract (Aligifert compound form) and potassium silicate (25% Si and 10% K₂O) were sprayed three times during each growing season. The times of application were prior to pollination (1st week of Feb.), just after fruit setting (1st week of May) and at one month later (1st week of June). Triton B as a wetting agent was added to all seaweed extract and potassium silicate solutions at 0.05%. The untreated palms received water containing triton B. All the selected palms received solutions of seaweed extract and potassium silicate till runoff (20 L / palm). Table (2) shows the analysis of seaweed extract according to **James (1994)**.

Randomized complete block design in split plot arrangement was followed. The five concentrations of seaweed extract occupied the main plots. The five

concentrations of potassium silicate ranked the subplots.

Table (2): 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 %	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

During both seasons, the following measurements were recorded:

- 1- Leaf area (m²) according to **Ahmed and Morsy (1999)**.
- 2- Total chlorophylls (mg per 100 g F.W.) according to **von Wettstein, 1957; and Hiscox and Isralstam, 1979**.
- 3- Percentages of N, P, and K according to **Summer (1985) and Wilde et al.,(1985)**.
- 4- Yield per palm (Kg)
- 5- Fruit characteristics namely: fruit weight, percentage of pulp, T.S.S.%, total sugars%, total acidity% as malic acid (**A.O.A.C. 2000**), and total soluble tannins (**Balbaa, 1981**).

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

Results and Discussion

1- Leaf area:

It is clear from the data in Table (3) that the leaf area was remarkably stimulated due to treating the palms with seaweed extract and/or potassium silicate

each at 0.05-0.4% relative to the check treatment. The promotion was materially associated with increasing concentration of each material. Meaningless stimulation was ascribed to increasing the concentration from 0.2 to 0.4%. Using seaweed extract and potassium silicate together at 0.4% gave the highest values. The same trend was observed during 2013 and 2014 seasons.

2- Leaf total chlorophylls and percentages of N, P and K:

Data in Tables (4-7) obviously reveal that carrying out three sprays of seaweed extract and/or potassium silicate each at 0.05-0.4% had significant effects on total chlorophylls and the percentages of N, P, and K over the check treatment. The promotion was obviously related to the increase in concentrations. No significant promotion in these chemical parameters was observed among the higher two concentrations of each material. The maximum values were registered on the palms that were subjected to seaweed extract and potassium silicate combination, each at 0.4%. These results were similar in both seasons.

3- Yield:

A significant promotion on the yield per palm was observed in response to treating the palms with

seaweed extract and/or potassium silicate each at 0.05-0.4% over the check treatment (Table 8). There was a gradual concentration-dependent promotion on these characters. A slight and insignificant promotion on these aspects was noticed among the higher two concentrations of each material. The best results from economical point of view were obtained when the palms received three sprays of seaweed extract plus potassium silicate each at 0.2%. These results were true during both seasons.

4- Fruit Quality:

It is evident from the data in Tables (9-14) that treating the palms three times with seaweed extract and/or potassium silicate, each at 0.05-0.4% succeeded in improving fruit quality in terms of increasing fruit weight, pulp%, T.S.S. %, and total sugars%, and decreasing total acidity % and total soluble tannins relative to the control treatment. The promotion on fruit quality was related to the increase in concentrations. The best results with regard to fruit quality were obtained when the palms were treated three times with a mixture of potassium silicate and seaweed extract each at 0.2%. These results were reproducible in both seasons.

Table (3): Effect of different concentrations of seaweed extract and potassium silicate on the leaf area (m²) of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	2.33	2.47	2.6	2.72	2.73	2.57	2.39	2.5	2.61	2.71	2.73	2.59
A ₂ 0.05% Seaweed	2.44	2.61	2.76	2.86	2.9	2.71	2.5	2.61	2.71	2.82	2.84	2.70
A ₃ 0.1% Seaweed	2.53	2.76	2.88	3	3.01	2.84	2.63	2.76	2.88	3	3.01	2.86
A ₄ 0.2% Seaweed	2.64	2.92	3.02	3.14	3.16	2.98	2.75	2.9	3.01	3.13	3.16	2.99
A ₅ 0.4% Seaweed	2.68	2.95	3.05	3.16	3.19	3.01	2.76	2.9	3.01	3.14	3.16	2.99
Mean (B)	2.52	2.74	2.86	2.98	3.00		2.61	2.73	2.84	2.96	2.98	
New L.S.D. at 5%	A 0.09		B 0.08		AB 0.18		A 0.08		B 0.08		AB 0.18	

Table (4): Effect of different concentrations of seaweed extract and potassium silicate on total chlorophylls (mg/100 g F.W.) in the leaves of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	8.0	10.1	12.2	14.4	14.6	11.9	7.8	10.2	12.3	14.5	14.7	11.9
A ₂ 0.05% Seaweed	9.8	12.2	14.3	16.4	16.6	13.9	9.9	12.3	14.6	16.7	16.9	14.1
A ₃ 0.1% Seaweed	11.6	14.3	16.4	18.4	18.6	15.9	11.8	14.7	16.8	18.9	19.1	16.3
A ₄ 0.2% Seaweed	13.3	16.4	17.4	19.5	20.7	17.5	13.4	16.8	18.9	20.9	21.0	18.2
A ₅ 0.4% Seaweed	13.5	16.5	18.6	20.7	20.8	18.0	13.6	16.9	19.0	21.0	21.0	18.3
Mean (B)	11.2	13.9	15.8	17.9	18.3		11.3	14.2	16.3	18.4	18.5	
New L.S.D. at 5%	A 1.1		B 1.0		AB 2.2		A 1.0		B 1.0		AB 2.2	

Table (5): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of N in the leaves of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	16	1.49	1.58	1.69	1.70	1.57	1.49	1.55	1.66	1.70	1.71	1.62
A ₂ 0.05% Seaweed	1.47	1.59	1.70	1.77	1.78	1.66	1.55	1.66	1.76	1.86	1.87	1.74
A ₃ 0.1% Seaweed	1.58	1.71	1.80	1.91	1.91	1.78	1.65	1.76	1.90	1.95	1.96	1.84
A ₄ 0.2% Seaweed	1.69	1.89	1.91	1.99	2.00	1.90	1.73	1.90	1.96	2.03	2.04	1.93
A ₅ 0.4% Seaweed	1.70	1.89	1.91	1.99	2.00	1.90	1.74	1.90	1.97	2.04	2.05	1.94
Mean (B)	1.57	1.71	1.78	1.87	1.88		1.63	1.75	1.85	1.92	1.93	
New L.S.D. at 5%	A 0.05		B 0.06		AB 0.13		A 0.06		B 0.06		AB 0.13	

Table (6): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of phosphorus (P) in the leaves of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	0.15	0.18	0.21	0.23	0.23	0.20	0.15	0.17	0.19	0.21	0.21	0.19
A ₂ 0.05% Seaweed	0.17	0.19	0.23	0.25	0.25	0.22	0.18	0.21	0.24	0.26	0.26	0.23
A ₃ 0.1% Seaweed	0.20	0.23	0.25	0.27	0.27	0.24	0.21	0.24	0.27	0.30	0.30	0.26
A ₄ 0.2% Seaweed	0.22	0.25	0.27	0.30	0.30	0.27	0.23	0.27	0.30	0.32	0.33	0.29
A ₅ 0.4% Seaweed	0.22	0.25	0.27	0.30	0.30	0.27	0.23	0.27	0.30	0.32	0.33	0.29
Mean (B)	0.19	0.22	0.25	0.27	0.27		0.20	0.23	0.26	0.28	0.29	
New L.S.D. at 5%	A 0.02		B 0.02		AB 0.04		A 0.02		B 0.02		AB 0.04	

Table (7): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of potassium in the leaves of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	1.16	1.25	1.32	1.40	1.41	1.31	1.18	1.24	1.31	1.41	1.41	1.31
A ₂ 0.05% Seaweed	1.22	1.32	1.40	1.47	1.47	1.38	1.25	1.31	1.40	1.47	1.48	1.38
A ₃ 0.1% Seaweed	1.27	1.41	1.50	1.59	1.60	1.47	1.32	1.40	1.47	1.55	1.56	1.46
A ₄ 0.2% Seaweed	1.34	1.52	1.61	1.70	1.71	1.58	1.37	1.48	1.56	1.62	1.62	1.53
A ₅ 0.4% Seaweed	1.34	1.53	1.62	1.71	1.72	1.58	1.38	1.48	1.56	1.63	1.63	1.54
Mean (B)	1.27	1.41	1.49	1.57	1.58		1.30	1.38	1.46	1.54	1.54	
New L.S.D. at 5%	A 0.04		B 0.05		AB 0.11		A 0.05		B 0.05		AB 0.11	

Table (8): Effect of different concentrations of seaweed extract and potassium silicate on the yield per palm (Kg.) of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	63.0	90.0	94.0	106.0	107.0	92.0	60.0	90.0	95.0	106.0	106.0	91.4
A ₂ 0.05% Seaweed	75.0	94.0	107.0	118.0	119.0	102.6	76.0	94.0	107.0	118.0	118.0	102.6
A ₃ 0.1% Seaweed	89.0	110.0	122.0	133.0	134.0	117.6	90.0	110.0	122.0	133.0	133.0	117.6
A ₄ 0.2% Seaweed	100.0	122.0	133.0	155.0	155.0	133.0	100.0	123.0	134.0	156.0	156.0	133.8
A ₅ 0.4% Seaweed	101.0	122.0	133.0	156.0	156.0	133.6	101.0	124.0	134.0	156.0	156.0	134.2
Mean (B)	85.6	107.6	117.8	133.6	134.2		85.4	108.2	118.4	133.8	133.8	
New L.S.D. at 5%	A 1.5		B 1.2		AB 2.7		A 1.0		B 1.0		AB 2.2	

Table (9): Effect of different concentrations of seaweed extract and potassium silicate on the fruit weight (g.) of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	9.67	9.90	10.11	10.32	10.33	10.07	10.70	9.93	10.14	10.35	10.35	10.29
A ₂ 0.05% Seaweed	9.88	10.11	10.33	10.55	10.56	10.29	9.91	10.14	10.36	10.55	10.59	10.31
A ₃ 0.1% Seaweed	10.10	10.33	10.56	10.76	10.77	10.50	10.13	10.36	10.60	10.80	10.81	10.54
A ₄ 0.2% Seaweed	10.30	10.56	10.76	10.96	10.96	10.71	10.33	10.60	10.80	11.00	11.00	10.75
A ₅ 0.4% Seaweed	10.31	10.56	10.76	10.97	10.97	10.71	10.33	10.61	10.81	11.00	11.00	10.75
Mean (B)	10.05	10.29	10.50	10.71	10.72		10.28	10.33	10.54	10.74	10.75	
New L.S.D. at 5%	A 0.14		B 0.13		AB 0.29		A 0.13		B 0.13		AB 0.29	

Table (10): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of pulp of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	81.00	82.20	84.00	68.00	86.70	80.38	81.00	82.00	83.80	85.80	85.90	83.70
A ₂ 0.05% Seaweed	82.20	84.00	85.60	87.60	88.00	85.48	82.00	83.80	85.40	87.40	87.50	85.22
A ₃ 0.1% Seaweed	84.00	86.00	88.00	89.00	89.00	87.20	83.90	85.90	87.80	87.90	88.00	86.70
A ₄ 0.2% Seaweed	85.30	88.00	89.00	90.20	90.20	88.54	85.10	87.80	88.80	89.90	90.00	88.32
A ₅ 0.4% Seaweed	85.40	88.00	89.00	90.30	90.30	88.60	85.10	87.80	88.90	90.00	90.00	88.36
Mean (B)	83.58	85.64	87.12	85.02	88.84		83.42	85.46	86.94	88.20	88.28	
New L.S.D. at 5%	A 1.0		B 1.0		AB 2.2		A 0.9		B 1.0		AB 2.2	

Table (11): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of total soluble solids in the fruits of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	68.00	69.30	70.50	71.70	71.50	70.20	68.40	69.70	71.00	72.00	72.00	70.62
A ₂ 0.05% Seaweed	69.00	70.50	72.00	73.30	73.40	71.64	69.40	71.00	72.10	73.20	73.30	71.80
A ₃ 0.1% Seaweed	70.20	72.20	73.30	74.40	74.50	72.92	70.60	72.10	73.30	74.30	74.40	72.94
A ₄ 0.2% Seaweed	71.20	73.40	74.60	75.70	76.00	74.18	71.60	73.30	74.30	75.30	75.40	73.98
A ₅ 0.4% Seaweed	71.30	73.50	74.70	75.70	76.10	74.26	71.70	73.30	74.30	75.30	75.40	74.00
Mean (B)	69.94	71.78	73.02	74.16	74.30		70.34	71.88	73.00	74.02	74.10	
New L.S.D. at 5%	A 1.0		B 1.0		AB 2.2		A 1.0		B 1.0		AB 2.2	

Table (12): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of total sugars in the fruits of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	59.00	60.50	61.60	64.00	64.10	61.84	59.30	60.80	61.90	64.30	64.40	62.14
A ₂ 0.05% Seaweed	60.20	62.00	64.00	65.50	65.60	63.46	60.60	62.30	64.30	65.80	66.00	63.80
A ₃ 0.1% Seaweed	61.50	64.00	66.00	68.00	68.60	65.62	61.80	64.30	66.30	68.20	68.30	65.78
A ₄ 0.2% Seaweed	62.90	66.00	68.50	70.90	71.00	67.86	63.20	66.40	69.00	71.20	71.30	68.22
A ₅ 0.4% Seaweed	63.00	66.10	68.60	71.00	71.00	67.94	63.30	66.50	69.10	71.30	71.40	68.32
Mean (B)	61.32	63.72	65.74	67.88	68.06		61.64	64.06	66.12	68.16	68.28	
New L.S.D. at 5%	A 1.0		B 1.0		AB 2.2		A 1.0		B 1.0		AB 2.2	

Table (13): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of total acidity in the fruits of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	0.391	0.370	0.350	0.330	0.328	0.354	0.390	0.369	0.349	0.329	0.328	0.353
A ₂ 0.05% Seaweed	0.370	0.350	0.330	0.310	0.308	0.334	0.369	0.349	0.328	0.310	0.309	0.333
A ₃ 0.1% Seaweed	0.350	0.330	0.310	0.282	0.280	0.310	0.349	0.329	0.309	0.281	0.279	0.309
A ₄ 0.2% Seaweed	0.330	0.310	0.282	0.260	0.260	0.288	0.330	0.309	0.281	0.259	0.259	0.288
A ₅ 0.4% Seaweed	0.328	0.310	0.282	0.260	0.280	0.292	0.330	0.308	0.280	0.259	0.259	0.287
Mean (B)	0.354	0.334	0.311	0.288	0.291	0.310	0.354	0.333	0.309	0.288	0.287	0.310
New L.S.D. at 5%	A 0.019		B 0.020		AB 0.040		A 0.020		B 0.020		AB 0.040	

Table (14): Effect of different concentrations of seaweed extract and potassium silicate on the percentage of total soluble tannins in the fruits of Al-Saidey date palms during 2013 & 2014 seasons.

Seaweed extract Conc. (A)	2013						2014					
	Potassium silicate Conc. (B)											
	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)	B ₁ 0.0%	B ₂ 0.05%	B ₃ 0.1%	B ₄ 0.2%	B ₅ 0.4%	Mean (A)
A ₁ 0.0% Seaweed	1.00	0.93	0.86	0.80	0.79	0.88	1.01	0.92	0.85	0.79	0.78	0.87
A ₂ 0.05% Seaweed	0.94	0.86	0.80	0.75	0.74	0.82	0.93	0.85	0.79	0.74	0.74	0.81
A ₃ 0.1% Seaweed	0.88	0.80	0.70	0.65	0.64	0.73	0.87	0.79	0.69	0.64	0.64	0.73
A ₄ 0.2% Seaweed	0.80	0.74	0.68	0.62	0.61	0.69	0.79	0.73	0.67	0.61	0.60	0.68
A ₅ 0.4% Seaweed	0.79	0.73	0.68	0.62	0.60	0.68	0.78	0.72	0.66	0.60	0.59	0.67
Mean (B)	0.88	0.81	0.74	0.69	0.68	0.73	0.88	0.80	0.73	0.68	0.67	0.73
New L.S.D. at 5%	A 0.05		B 0.05		AB 0.11		A 0.05		B 0.05		AB 0.11	

Discussion

The previous positive action of seaweed extract on growth characters and fruiting of fruit crops might be attributed to its higher content of organic matter, proteins, alginic acid, N, P, K, Mg, Ca, S, Fe, Mn, Zn, Cu, B, cytokinins and IAA, in addition to its content of enzymes, vitamins, antioxidants and amino acids. These are responsible for enhancing cell division, photosynthesis, and building of plant pigments and increasing the tolerance of plant to all stresses (James, 1994; Soliman *et al.*, 2008 and Khan *et al.*, (2009)).

These results regarding the enhancing effect of seaweed extract on the leaf area, yield and fruit quality are in harmony with those obtained by Abdelalet *al.* (2012), Mahmoud (2012), Gamal (2013), Abd El-Aaty (2015) and Eshmawy (2015).

Previous studies showed that the favourable effects of silicon on growth, nutritional status of the trees and fruiting seem to originate from its positive action on enhancing the tolerance of plants to biotic and abiotic stresses and drought tolerance. This is attributed to its essential role in maintaining plant water balance, photosynthetic activity erecting the structure of xylem vessels. Previous studies explained these benefits to the formation of silica cuticle double layers formed on leaf epidermal tissue. Silicon also is responsible for water transport and root development

as well as increasing the tolerance of plants to reduce powdery mildew. The mechanical strength provided by silicon to the plant tissues increases their resistance to diseases and insects and is responsible for reducing the adverse effects of heavy metal toxicity (Epstein, 1999 and Ma, 2004).

The findings regarding the promoting effect of silicon on growth and fruiting of fruit crops are in harmony with those obtained by Gad El-Kareem (2012), Al-Wasfy (2014), El-Khawaga (2014), El-Khawaga and Mansour (2014), Gad El-Kareem *et al.* (2014) and Abd El-Wahab (2015).

Conclusion:

Under the present and resembling conditions, it is suggested to spray Al-Saidey date palms with a mixture of seaweed extract and potassium silicate each at 0.2% three times; prior to hand pollination (1st week of Feb.), just after fruit setting (1st week of May) and at one month later (1st week of June) for improving yield and fruit quality.

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